Natural Resources Working Party

Tuesday 4 December 2018 at 1.00pm

AGENDA

Northland
REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

Natural Resources Working Party Agenda

Meeting to be held in the Kaipara Room
on Tuesday 4 December 2018, commencing at 1.00pm

Please note: working parties and working groups carry NO formal decision-making delegations from council. The purpose of the working party/group is to carry out preparatory work and discussions prior to taking matters to the full council for formal consideration and decision-making. Working party/group meetings are open to the public to attend (unless there are specific grounds under LGOIMA for the public to be excluded).

MEMBERSHIP OF THE NATURAL RESOURCES WORKING PARTY
Chairman, Councillor Justin Blaikie

Councillor David Sinclair	Councillor Rick Stolwerk	Councillor Joce Yeoman
Councillor Bill Shepherd (Ex-Officio)	Non Elected Member from TTMAC	

RECORD OF ACTIONS

NORTHLAND REGIONAL COUNCIL
Natural Resources Working Party

Discussion held in the Council Chambers, Northland Regional Council on Tuesday 4 September 2018 commencing at 1.00 pm

Present: Justin Blaikie (Chair), Rick Stolwerk, Joce Yeoman, Juliane Chetham, Penny Smart, Bruce Howse, Malcolm Nicolson, Colin Dall, Duncan Kervell, Lorna Douglas, Joe Camuso, Lisa Forester, Ricky Eyre, Suzanne Takiwa, Ben Tait, Imogen Field, Rachel Ropiha, James Griffin, Leane Makey, Nola Sooner (Minute Taker)

Apologies: Bill Shepherd

Additional matters to be discussed: Nil.

MATTERS DISCUSSED

1. **Record of Actions from Previous Meeting & Matters Arising**

   Agreed action points
   - Deferred from previous meeting - Staff to provide a high level analysis of the need and work required for Section 128 reviews of consents for farm dairy effluent discharges to water. **Action: Colin Dall**
   - Final draft of Environment Fund Criteria Review to be presented at the next Natural Resources Working Party Meeting. **Action: Duncan Kervell**

   ***** Juliane Chetham arrived

2. **Water Strategy & Communications/Engagement Plan**

   Presented by:
   Suzanne Takiwa

   Agreed action points
   - Request for a brief update on the Water Strategy & Communications/ Engagement Plan to be shown to TTMAC. **Action: Suzanne Takiwa**
   - A further update on the Water Strategy & Communications/Engagement Plan to be presented at the next Natural Resources Working Party meeting. **Action: Suzanne Takiwa**

3. MPI Hill Country Erosion Fund

Presented by:
Duncan Kervell

4. Update FIF Projects – Northern Wairoa and Dune Lakes

Presented by:
Imogen Field and Will Trusewich

5. Ecosystem Prioritisation Project Update

Presented by:
Lisa Forester

Agreed action point

- Staff to provide maps that separate out high value areas administered by Department of Conservation from that owned privately to distinguish NRC's areas where regulatory mechanisms could be provided to protect these ecosystems. **Action: Lisa Forester**
- Staff to provide the final report once the project is completed. **Action: Lisa Forester**

6. Update on Long Term Plan River Management Works Progress

Presented by:
Joseph Camuso

7. Juvenile Fish and Sub Title Habitat

Presented by:
Ricky Eyre

Agreed action point

- Staff to provide a report on options and preliminary costs to obtain subtidal data for Northland's coastal environment. **Action: Ricky Eyre**

Meeting closed: 3.05 pm

INDIGENOUS BIODIVERSITY RANKINGS FOR THE NORTHLAND REGION

J. R. Leathwick

EXECUTIVE SUMMARY

1. Evidence based, landscape-scale assessments of biodiversity priority can play a valuable role in assisting management agencies make informed decisions on which sites to protect or manage, particularly when resources and funding are constrained. Such priorities have been identified for the Northland Region, using spatial conservation prioritization software to analyse high resolution data describing the distributions of indigenous-dominated terrestrial ecosystems, rivers, and lakes.
2. Input data used in the ranking analysis comprised: a layer predicting the potential distribution of terrestrial ecosystems across the entire Northland Region, including for sites no longer supporting indigenous-dominated cover; the most recent version (4.1) of the New Zealand Landcover Database (LCDB4.1); and, spatial data extracted from the Department of Conservation's Freshwater Ecosystems of New Zealand (FENZ) data compilation, describing a variety of attributes for Northland's lakes and for its river and stream network. Additional data layers were constructed to describe the estimated condition of terrestrial sites, lakes and rivers and streams.
3. The ranking procedure starts by assuming that the entire landscape can be protected/managed; it calculates rankings using a stepwise backwards removal process, at each step removing those sites making the lowest contribution to the representation of a full range of ecosystems. This process continues until all sites have been removed, with the removal order indicating the biodiversity ranking. For this analysis, connectivity constraints encouraged the identification of high priority sites with strong connectivity both across the landscape (terrestrial and lake ecosystems) and up and down river catchments (lakes, rivers and streams). Weightings applied to terrestrial ecosystems during ranking resulted in higher priority being given to ecosystems that have suffered greater losses in extent since human settlement of the Region.
4. The top 30% of terrestrial sites identified from the analysis cover a total area of 133,545 ha, equivalent to 10.6% of Northland's pre-human indigenous terrestrial cover. This provides representation of 83% for all primary ecosystems, on average; representation is inversely proportional to ecosystem extent, with less extensive ecosystems having higher levels of representation than those that are extensive. Kauri, podocarp, broadleaved forest, which is currently the most extensive ecosystem, occupying 167,813 ha, has the lowest representation within the top 30% of sites at 13.5% or 23,000 ha.
5. The top 30% of terrestrial ecosystems are distributed across 1293 locations, varying in size between one and c. 25,500 ha; thirty-two exceed 500 ha in extent. Using a geographic breakdown of the Region based on the New Zealand Ecological Regions, the largest number of large priority sites, i.e., fourteen, are located in western Northland; six each occur in Te Paki and Aupouri, while four occur in eastern Northland, and two in Kaipara.
6. Similar rankings are provided for rivers and streams, with the top 30% of the river network providing representation of 19% or more for all river and stream ecosystems occurring within the Region. Because of their discrete nature, a total of 88 individual lakes are identified as priorities, these comprising 59% of all lakes by area.
7. Guidelines are provided to assist in the robust use of results to inform decision making.

INTRODUCTION

Project goals

Over the last several years a number of New Zealand's Regional Councils have begun to implement more strategic approaches to their management of indigenous biodiversity (Willis 2017). As part of this, several councils have implemented processes designed to identify biodiversity priorities within their regions, including Auckland (Auckland Council 2012), Waikato (Leathwick 2016), Bay of Plenty, Taranaki, Greater Wellington, and Hawkes Bay. This report describes a prioritisation of the surviving indigenous biodiversity of the Northland Region, implemented using conservation planning software to analyse spatial data describing its indigenous-dominated ecosystems. Results from this analysis rank all indigenous-dominated terrestrial sites (including mangroves) and all freshwater sites, based on their ability to contribute to the representation of a full range of regional terrestrial and freshwater ecosystems.

By way of context, the need to carry out such regional analyses has increased over the last decade, reflecting wider changes that have occurred in the management of New Zealand's biodiversity. While the Department of Conservation has traditionally been viewed as the main agency with responsibility for managing our nation's biodiversity, other players, including regional councils, NGOs, philanthropists, community groups and private individuals, are now playing an increasingly important role (Parkes et al. 2017). Although this broadening of conservation management responsibilities has the potential to improve the overall status of New Zealand's biodiversity, there are questions about the effectiveness of this work in contributing to national biodiversity goals such as those set out in the New Zealand Biodiversity Strategy (Department of Conservation & Ministry for the Environment 2000). In particular, its effectiveness depends at least in part on the degree to which individual agencies can coordinate their actions around a common understanding of priorities for action (Parkes et al. 2017, Willis 2017, Brown 2018).

METHODS

The methods used to implement the ranking analysis described in this document draw heavily on conceptual and technical developments in the field of systematic conservation planning (Margules & Pressey 2000). This relatively new discipline focuses on how to most efficiently and effectively apply limited funding to the achievement of some set of biodiversity conservation goals defined at landscape scales. These goals are generally specified in terms of the need to provide long-term, systematic protection for a representative range of ecosystems and their component species (e.g., Ferrier & Drielsma 2010). Technical tools developed in support of the achievement of these goals mostly consist of evidence-based, spatial analysis software designed to identify those sites that provide the most efficient protection of a full range of biodiversity features (e.g., Moilanen et al. 2009).

In this analysis, spatial prioritisation software (Zonation – Moilanen et al. 2005, Moilanen et al. 2012), was used to analyse data describing the distribution of all indigenous dominated terrestrial ecosystems in the Northland Region, these extending across just over 445,000 ha or around 35.6% of the Region, including sites both on private and public conservation land. Also included, were spatial data describing all freshwater lakes, rivers and streams in the Region, recognising the parallel importance of freshwater ecosystems, both for their inherent values, and for their two-way linkages with terrestrial ecosystems. Outputs from the ranking analyses include maps showing the

biodiversity priority or ranking of all sites, and tabular data describing the protection provided to each terrestrial and freshwater ecosystem as a function of site priority.

Input data

Terrestrial data

Terrestrial data used to construct the conservation rankings were drawn from two existing primary sources, a reconstruction of the potential terrestrial ecosystem cover for the entire Northland Region (Singers & Lawrence 2018) and satellite based mapping of contemporary land cover (LCDB 4.1[1]).

The potential ecosystem layer was compiled using both published and unpublished descriptions of New Zealand's terrestrial ecosystems in conjunction with climate and soils data, to identify the most likely ecosystem cover for the entire Northland Region, including for sites where the original indigenous ecosystem cover has been removed (Singers & Lawrence 2018); ecosystems are categorised according to the national ecosystem classification of Singers and Rogers (2014).

The contemporary land-cover layer used in the ranking analysis was derived from national land-cover mapping based on satellite imagery collected during the summer of 2012/13. This uses a more generalised set of cover classes than used for the potential ecosystem mapping, with 33 classes used to map the vegetation cover across all of New Zealand; eighteen of these refer to indigenous-dominated terrestrial cover types (Cieraad. et al. 2015), ten of which occur within the Northland Region (Appendix I); a further three classes were included that describe bare ground ('Gravel or Rock', 'Landslide', 'Sand or Gravel'). Occurrences of one class that is often dominated by exotic species, i.e. 'Low Producing Grassland', were also included in the analysis, but only where they coincided with sites identified by the potential ecosystem layer as likely to have once supported a non-forest ecosystem class, i.e., dunes, coastal ecosystems, and wetlands. Finally, a number of polygons mapped in the LCDB layer as 'Deciduous Hardwoods' that were located on sites likely to support wetland vegetation, e.g., on sites with a potential ecosystem cover consisting of wetlands, or in close proximity to lakes, were included in the analysis to allow consideration of their wetland values in the ranking process.

These two spatial data layers were intersected using a standard GIS procedure to create a set of polygons describing spatial combinations of potential ecosystem and current vegetation cover class on all indigenous-dominated sites. Each individual polygon in the intersected layer was then assigned a broad categorisation for summary purposes according to its potential ecosystem and current vegetation cover class assignments as follows:

- Polygons identified by the LCDB4 layer as 'Indigenous forest' and as one of the forest ecosystems in the potential ecosystems layer were assigned to a broad category of 'primary forest';
- polygons identified by the LCDB coverage as 'Fernland', 'Manuka and/or Kanuka', 'Broadleaved Indigenous Hardwoods', 'Matagouri or Grey Scrub', or 'Flaxland', and as one of the forest ecosystems in the potential ecosystems layer were assigned to a broad category of 'secondary'; exceptions were a small number of polygons mapped as 'Broadleaved

[1] Available for download at https://lris.scinfo.org.nz/layer/423-lcdb-v41-land-cover-database-version-41-mainland-new-zealand/

Indigenous Hardwoods' in higher elevation forests with low canopies, which were categorised as 'primary';

- polygons identified by the LCDB coverage as 'Fernland', 'Manuka and/or Kanuka', 'Broadleaved Indigenous Hardwoods', 'Matagouri or Grey Scrub', or 'Flaxland' and as one of the non-forest ecosystems (dunes, cliffs, ultramafic) in the potential ecosystems layer were classified as 'non-forest';
- polygons identified by the LCDB coverage as 'Herbaceous Freshwater Wetland', 'Herbaceous Saline Vegetation' or Mangrove were all assigned to the broad category of 'wetland';
- polygons identified by the LCDB coverage as 'Gravel or Rock', 'Landslide', or 'Sand or Gravel', were assigned to the broad category of 'bare', except for areas of 'Sand or Gravel' on sites mapped within the potential ecosystems layer as a duneland, cliff or ultramafic ecosystem, in which case they were assigned to the broad category of 'non-forest';
- polygons identified by the LCDB coverage as 'Deciduous hardwoods' and by the potential ecosystem coverage as a wetland ecosystem were assigned to the broad category of 'exotic'.

New data fields were added to this intersected ecosystems layer to allow the creation of gridded or raster data layers describing the current distribution of all terrestrial ecosystems; this included both the primary ecosystem classes contained in the potential ecosystem layer, and the secondary and general wetland cover classes from the LCDB4 layer. Values were assigned to these fields as follows:

- for all polygons identified as supporting primary cover, the ecosystem field matching the potential ecosystem mapped in that polygon was given a value of 100; values for all other fields were set to zero; where a polygon had been mapped as a mixture of two primary ecosystems, values of 50 were allocated to the two relevant ecosystem fields;

- For all polygons identified as supporting secondary cover, the field corresponding to its LCDB4 secondary cover class was assigned a value of 95 and the relevant potential ecosystem field was assigned a value of 5. Use of two values in this way allowed polygons now supporting secondary cover to be differentiated in the Zonation analysis according to the potential ecosystem cover that is likely to develop in each in the absence of further disturbance;

- For polygons mapped in both the potential ecosystems and LCDB4 layers as supporting a wetland class, the corresponding potential ecosystems field was assigned a value of 100. Where the LCDB coverage indicated a general wetland type ('Herbaceous Freshwater Vegetation', 'Herbaceous Saline Vegetation'), but the potential ecosystems layer indicated a non-wetland ecosystem (e.g., 'Indigenous Forest'), the corresponding LCDB4 general wetland field was given a value of 100. This generally occurred because the LCDB4 mapping contains many small polygons derived from satellite imagery that are below the minimum size threshold discriminated in the potential ecosystems layer;

- For polygons mapped as a dune ecosystem in the potential ecosystems layer and 'Sand or Gravel' in the LCDB coverage, a value of 100 was assigned to the corresponding dune ecosystem field. Similarly, for polygons mapped as a cliff ecosystem in the potential ecosystems layer and 'Landslide' or 'Rock or Gravel' in the LCDB layer, a value of 100 was allocated to the cliff ecosystem field;

- For polygons mapped in the potential ecosystems layer as a dune ecosystem and in the LCDB coverage as 'Low Producing Grassland', a value of 100 was assigned to the corresponding dune ecosystem field. By contrast, for polygons indicated as supporting wetland or cliff

ecosystems in the potential ecosystem layer but 'Low Producing Grassland' in the LCDB coverage a value of 50 was assigned to the 'Low Producing Grassland' field and a value of 50 was assigned to the corresponding ecosystem field;

- Where the LCDB4 classification field for a polygon indicated that it contained 'Deciduous Hardwoods', and other information including the potential ecosystems layer, indicated a likely occurrence of indigenous wetland elements, a value of 80 was assigned to the 'Deciduous Hardwoods' field and a value of 20 was assigned to the corresponding wetland ecosystem field.

Once the final intersected layer describing the distributions of terrestrial ecosystems had been checked carefully for the consistency of application of these rules, it was used to create gridded data layers (30m by 30m cells) covering the entire region, one layer for each of the 29 terrestrial ecosystems from the potential ecosystem layer, and one for each of the 10 general wetland, secondary, induced, and bare ground classes from the LCDB4 classification.

River and stream data

Spatial data describing the distributions of river and stream ecosystems in the Northland Region were derived from the Department of Conservation's Freshwater Environments of New Zealand database (FENZ – Department of Conservation 2010). The river component of this database is constructed around a fully linked, digital network topology describing New Zealand's rivers and streams (REC – Snelder & Biggs 2002), in which individual reaches (a section of river or stream between two adjacent junctions) are represented by line segments (polylines); environmental and ecological attributes for each segment are stored in an associated database. FENZ includes a hierarchical ecosystem classification for all New Zealand rivers and streams that was specifically tuned to discriminate variation in biodiversity character, using extensive compilations of data describing the distributions of freshwater fish and macro-invertebrates (Leathwick et al. 2011). This classification is hierarchical in nature and can be used at varying levels of classification detail, i.e., 20, 100, 200 or 400 groups nationally. The 100 group classification was chosen as providing an appropriate level of detail for this regional-scale analysis; 14 of these river ecosystems occur within the Northland Region, nine of which are widespread, i.e., occurring in river and stream segments totalling 100 km or more in length.

For this analysis, the FENZ classification was coupled with the updated digital description of New Zealand's river and stream network contained in REC2[2], developed by the National Institute of Water and Atmospheric Research. A very small number of coastal stream segments occurring in the REC2 network but not in the original REC network used in the FENZ compilation, were allocated classification memberships based on the FENZ classification allocated to their closest neighbour of similar environmental character.

As for the terrestrial ecosystems, a separate field was created for each of the 14 river ecosystems occurring within the Region. Values were allocated to these fields so that for any river segment, the field corresponding to its allocated ecosystem type was given a value of 1, and fields for all other ecosystems were given a value of 0. Gridded data layers were then created with the same spatial resolution and extent as for the terrestrial ecosystem layers, one per river ecosystem, with '1's identifying the locations of river and stream segments where each ecosystem occurred.

[2] Available for download at https://www.niwa.co.nz/freshwater-and-estuaries/management-tools/river-environment-classification-0.

Lake data

Digital information describing the locations and attributes of lakes greater than 1 ha in extent for the Northland Region were extracted from the Department of Conservation's Freshwater Ecosystems of New Zealand database (Department of Conservation 2010). These data describe a number of key environmental features of all New Zealand lakes, along with both a numerical classification and a broad grouping of lakes into geomorphic types following the classification of Lowe & Green (1987); of these, the geomorphic classification provides arguably the more useful basis for prioritisation.

A total of 295 lakes greater than 1 ha were mapped within the Northland Region by the FENZ database; the classification of these was checked for consistency, with simplification down to five natural lake groups, as follows (sorted in order of decreasing frequency): 'dune' lakes (183); 'riverine' lakes (31); 'volcanic' lakes (7), 'shoreline' lakes (5), and 'geothermal' lakes (3); a further large group comprised artificial reservoirs (66). As with the terrestrial and river data, a data field was created for each lake geomorphic type, and these were populated with zeros or ones as described above. Gridded data layers were then created with the same resolution and coverage as for the terrestrial and river ecosystems, and indicating the distributions of lakes in each lake geomorphic type.

Estimating biodiversity condition

Three gridded or raster data layers were used in the ranking analysis to describe the estimated ecological integrity or condition of terrestrial, river and stream, and lake ecosystems respectively. Values within these layers are expressed in relative terms on a scale from zero to one; a value of one indicates a very high level of naturalness while values approaching zero indicate increasingly complete loss of ecological values or integrity.

While these estimates might appear somewhat arbitrary, they are used in the ranking analysis only in a relative sense, contributing to the assessment of the potential value of different sites containing the same ecosystem. This enables good condition examples of a particular ecosystem to be ranked ahead of other examples that have lower condition, all other things being equal. Used in this way, the condition estimates have no influence on the balancing of ranks *between* different ecosystems, which is controlled instead by weights that are assigned to the different ecosystems, as described below.

Terrestrial condition

Estimates of the condition or integrity of terrestrial ecosystems were constructed in two stages. In the first stage estimates were constructed of the likely intrinsic condition of surviving indigenous-dominated sites, i.e., in the absence of management interventions; these estimates were constructed using a scoring-based approach to combine separate estimates of the effects of fragmentation, risks of weed invasion, logging (in forest ecosystems), and introduced browsers. In the second stage an estimate of the overall current condition was created by combining these estimates of intrinsic condition with estimates of the likely gains made through recent conservation management actions, particularly those aimed at controlling populations of vertebrate browsers and predators.

The effects of fragmentation on terrestrial ecosystems are diverse (e.g., Young & Mitchell 1994, Burns et al. 2011), and include loss of the microclimate typical of extensive natural communities, increased access for predators and domestic stock, increased vulnerability to invasion by weeds, and

greater susceptibility to the effects of adjacent land uses including impacts such as hydrological alteration and drift of fertiliser and/or sprays. These effects were estimated by creating from the LCDB coverage, a high–resolution (10 m) gridded data layer that mapped the distribution of all surviving, indigenous-dominated ecosystem patches, regardless of their composition; these habitat patches varied in size from 0.01 ha to nearly 37,581 ha, with a mean of 27.6 ha.

The amount of 'core' habitat contained in each of these patches, i.e., that which is located more than 50 m inside the boundary, was then calculated, expressed as a percentage of the total size of each patch. This averaged 8.6% across all the patches, but is highly skewed, reflecting the manner in which small patches greatly outnumber large patches. At one extreme, for the 320 patches that exceed 100 ha in extent it averaged 66% with a maximum of 94%, while for the 10,974 patches that are between 1 and 100 ha in extent it averaged only 9.8%; the 4815 patches of one ha or less contain no core habitat, regardless of their shape.

The threats of weed invasion to indigenous ecosystems are influenced not only by fragmentation but also by variation in human population densities, with pressures from weed invasion generally increasing in close proximity to human settlements (e.g., Timmins & Williams 1991). To estimate this effect, human population data, captured during New Zealand's 2013 national census[3], was converted into spatial population density estimates (people per ha) for each of the Region's 2016 census sample units (mesh blocks). Because of their highly skewed distribution (mean = 5.7, range = 0–50), these density estimates were subject to a fifth root transformation ($X^{0.2}$) and converted into a gridded or raster data layer. This layer was then processed with a spatial filter that calculated for each grid cell the highest values (90th percentile) occurring within a circular neighbourhood with a radius of 250 m, allowing the effects of local high population densities to be spread out across the surrounding landscape.

Logging primarily results in loss of key structural elements of forests, occurring both through the clearance of forests to enable land uses, and through selective removal of some species, particularly kauri, but also emergent podocarps that were valued because of their generally large size and timber qualities. These impacts were assessed by combining information from the LCDB coverage that identifies once forested sites that were cleared but have since reverted to secondary cover, and from broad scale mapping of indigenous forest composition produced by the former New Zealand Forest Service (FSMS6[4]) that differentiates between unlogged and partially logged forests.

Partially logged forests identified in Northland by the FSMS6 mapping include former podocarp-tawa forests now dominated by tawa (type 'N'), former rimu-taraire-tawa forests now dominated by taraire and tawa (type 'S') forest, and forests mapped as general hardwoods (type 'P'). Given the relatively coarse spatial scale of this mapping (1:250,000), it captures logging impacts only in larger blocks of forest (> c. 25 ha); many smaller forest remnants are likely to have also been modified by logging, but capturing information describing these impacts was beyond the scope of this project. Forested sites identified in the LCDB coverage as now supporting secondary cover, along with sites identified in the FSMS6 layer as selectively logged were allocated a score of 0.5, while all other sites were allocated a score of 1.0

While introduced vertebrate predator species (principally rodents and mustelids) are likely to occur throughout the Northland Region, except on some offshore islands, the distributions of vertebrate

[3] Available for download from http://www.stats.govt.nz/Census/2013-census.aspx.
[4] Available for download from https://koordinates.com/layer/300-nz-fsms6-north-island/.

browsers are more varied. Possums are known to have very wide distributions, but the remaining two introduced terrestrial browsers, i.e., goats and pigs, are more patchily distributed. This patchiness was accounted for using maps compiled in 2007 and stored on the Department of Conservation's spatial data server[5], but were subsequently updated by Northland District Council staff to reflect contemporary information. For each browser, sites within its known range were allocated a score of 0.794, and sites outside the known range were allocated a value of one. When these three browser score layers are cross multiplied, sites with only one browser present received a score of 0.794, those with two browsers a score of 0.630, and those with all three browsers present received a score of 0.5.

These estimates of core habitat proportion, mean human population density, logging impact, and browser impact were combined to estimate the intrinsic condition. Prior to this calculation, estimates of core habitat were rescaled into a range from 0.2–1, and the transformed and smoothed population estimates were inverted and rescaled into a range from 0.2–1, i.e., so that low values correspond to high population densities and vice versa; values describing browser and logging impacts were used directly in the form described above, i.e., with values in the range from 0.5–1.0.

These four standardised pressure layers were combined to estimate the intrinsic condition calculated as:

$$\textit{Intrinsic condition} = EI_{\text{fragmentation}} * EI_{\text{weed}} * EI_{\text{logging}} * EI_{\text{browser}}$$

where $EI_{fragmentation}$ is the estimated ecological impact of fragmentation, EI_{weed} is the estimated impact of human mediated weed invasion, EI_{logging} is the estimated impact of logging, and EI_{browser} is the estimated impact of introduced browsers. Multiplying these estimates together rather than averaging them recognises that the effects of different biodiversity pressures generally interact with each other, with lowest condition occurring when a site is affected by all four pressures. For example, weed impacts can be expected to be most intense in sites that are not only close to human settlement, but also suffer from fragmentation, logging modification and browsing. Lowest values for the intrinsic condition estimates (c. 0.025) occurred in very small, logged or secondary ecosystem patches (< 1 ha) with no core habitat and in areas of high human population density; at the other extreme, values approach one on several offshore islands that retain their natural ecosystem cover, have no resident human population, and lack browsers and predators. Extensive ecosystem patches with minimal human population pressure in their surrounds, and no logging impacts, but under pressure from all three browsers have values of around 0.5, while extensive areas of logged primary forest or secondary ecosystems mostly have values of around 0.2–0.25, depending on their extent and number of browsers present.

Estimates of **recent management gain** were constructed using data supplied by Regional Council staff that identified locations receiving control of browsers and/or predators by public agencies over the last five years; additional sites managed by community groups were identified from the Predator Free New Zealand website[6]. For each site, information describing management action were used to estimate the approximate intensity of control using a simple scoring approach with values ranging between zero and one. Sites receiving no management were allocated scores of zero; managed sites

[5] E.g., http://geoportal.doc.govt.nz/ArcGIS/rest/services/GeoportalServices/DOC_BDIPEST_FeralGoat_2007/MapServer.

[6] https://predatorfreenz.org/get-started/find-a-group/.

received scores that reflected the degree to which control of both browsers and predators has been sustained over the last five years. Values of 1.00 were allocated to offshore islands from which browsers and predators have been eradicated, while values of 0.9–0.95 were allocated to islands receiving control but subject to periodic reinvasion by predators. Values of 0.45 were generally used for mainland sites where possums have been reduced to a residual trap catch of less than 5%, but where other ground browsers have not been systematically controlled, e.g., through aerial application of 1080 or through sustained ground operations. The final management gain layer has values of zero where no recent control has been applied, through to a maximum value of one on several offshore islands; several mainland sites intensively managed either by the Department of Conservation (Trounson Kauri Park, Whangaruru North Head) or by community groups (Whangarei Heads) had values in the range 0.5–0.65.

The **overall biodiversity condition** was then calculated by combining the separate estimates of intrinsic condition and recent management gain, i.e.

$$\textit{Overall condition} = \textit{intrinsic condition}/2 * (1 + \textit{management gain}).$$

For sites that have not received recent management the current condition is simply the intrinsic condition, with spatial variation in values driven solely by variation in logging effects, patch size, human population densities, and the mix of browsers present; values at these non-managed sites range between 0.02–0.5. By contrast, condition estimates for sites where sustained control has been applied to both predators and browsers increase to a maximum value of one as the management becomes more intensive and comprehensive in its scope. The final condition estimates for all terrestrial polygons were converted into a gridded data layer with the same extent and spatial resolution as the terrestrial ecosystem layers described above.

Freshwater condition

Condition estimates for rivers and lakes were both derived from the FENZ database (Department of Conservation 2010). Estimates for rivers take account of the indigenous cover in the upstream catchment, modelled estimates of instream nitrogen concentrations, the alteration of river flows and impeding of fish passage by dams and other control structures, introduced fish, discharges from mines and industrial sites, and the creation of impervious surfaces in urban areas. In this analysis, a modified form of the FENZ condition estimates was used that better captures the reduced ecological integrity of catchments that have low indigenous cover, particularly where it leads to both high sediment yield and high instream nitrogen concentrations. In particular, estimates of instream condition were calculated as:

$$\textit{Condition} = \text{Minimum}(EI_{\text{impervious}}, EI_{\text{native}}^{0.8} * EI_{\text{nitrogen}}^{0.8}, EI_{\text{mines}}) * EI_{\text{dam}} * EI_{\text{fish}},$$

where $EI_{\text{impervious}}$ is the estimated impact of impervious surfaces in urban areas, EI_{native} is the estimated impact of the clearance of natural cover in the upstream catchment, EI_{nitrogen} is the estimated impact of instream nitrogen, EI_{dam} is the estimated impact of dams, and EI_{fish} is the estimated impact of introduced fish species. Further details of the background and rationale for these calculations can be found in Leathwick & Julian (2007).

A similar set of factors contribute to the FENZ estimates of lake condition, i.e., catchment cover, nitrogen inputs, flow alteration from dams, urbanisation and introduced fish (de Winton et al. 2008);

including information about the distributions of introduced aquatic weeds would have been highly desirable, but was precluded by a lack of sufficient data.

Calculating biodiversity priorities

Accounting for connectivity

Connectivity is an important consideration when planning conservation protection or management, given the tendency for small and/or isolated ecosystem fragments to decline more rapidly over time than large ecosystem patches. These declines in smaller patches occur not only because of the edge effects described above, but also because small ecosystem patches often lack sufficient habitat to support sustainable populations of a full range of species, or because they are too distant from other natural ecosystem patches for the maintenance of the broader landscape processes (e.g., seasonal movements of mobile species) required for the long term maintenance of their ecological integrity. For this reason, there is a long-standing consensus in the conservation science literature that ecosystem conservation is generally most effective when sequences of related ecosystems can be protected/managed together, preferably in large, contiguous patches (e.g., Thompson & Nicholls 1973, Christenson et al. 1996).

Two types of connectivity constraints were applied in the ranking analyses for the Northland Region. For **terrestrial and lake** ecosystems, connectivity constraints were applied through the use of a procedure within Zonation that allows the identification of locations where ecosystems occur in close proximity to each other (Lehtomäki et al. 2009), e.g., as when they form a sequence along an elevation gradient. This procedure was implemented in the ranking analysis for Northland over distances of up to 500 m for forest ecosystems, and 250 m for other terrestrial and lake ecosystems.

This connectivity routine requires the specification of a matrix of values in the range 0–1 that define the degree of interaction expected between different combinations of ecosystems (see Lehtomäki et al. 2009). Higher values indicate more important interactions, and zero values indicate that the interaction between a particular pair of ecosystems should be ignored. These interactions can also be asymmetric, for example, as when a particular type of ecosystem provides a strong beneficial effect for other ecosystem(s) in its neighbourhood, but receives little benefit in return. A relatively conservative approach was taken when defining interactions between ecosystems for this analysis (Table 1). In particular, the analysis assumes that all ecosystems will benefit most strongly from proximity to other ecosystems of the same broad structural type, i.e. forests with forests, wetlands with wetlands, etc.; this is indicated by the values of 1 occurring diagonally from top left to bottom right in Table 1.

Interactions specified *between* different ecosystem groups were more complex. First, it is assumed that proximity to a forest ecosystem will generally benefit all other ecosystem groups, these benefits arising, for example, from the physical buffering that forests provide, the provision of seed sources required for successional development in secondary ecosystems, or the maintenance of good water quality in lakes. Non-forest ecosystems, wetlands and saline ecosystems are assumed to have a moderate positive interaction with each other, with values varied to reflect their degree of ecological similarity and expected geographical proximity. For example, coastal dunes are assumed to have a somewhat stronger interaction with coastal cliffs than with ultramafic ecosystems. Secondary ecosystems are assumed to provide weaker benefits for other ecosystems, with the exception of lakes, for which they can play a valuable riparian function.

Table 1. Interactions between broad ecosystem groups as used in Zonation analyses for the Northland region. Table entries indicate the relative magnitude of beneficial interactions of ecosystems (in broad groups – columns) on all other ecosystems (by group – rows).

		AFFECTING ECOSYSTEM					
		Forest	Non-forest	F/w wetland	Saline	Secondary	Lakes
AFFECTED ECOSYSTEM	Forest	1.0	0.25–0.75	0.25	0.25	0.25–0.5	0.25
	Non-forest	0.25–0.75	0.5–1.0	0.25–0.75	0.25–0.75	0.25–0.5	0.25
	F/w wetland	0.5	0.25–0.75	1.0	0.75	0.25–0.5	0.5
	Saline	0.5	0.25–0.75	0.75	1.0	0.25–0.5	0.5
	Secondary	0.5	0.5	0.5	0.5	1.0	0.25
	Lakes	0.5	0.5	0.5	0.5	0.5	1.00

Setting ecosystem weights

One of the most important steps when carrying out a Zonation analysis is the setting of weights for biodiversity features, in this case ecosystems; these control the relative priority given to the different ecosystem when calculating rankings across the landscape. Using equal weights for all biodiversity features might be appropriate where they are all equally important. However, weights are generally varied across the different features to give greater emphasis to those that are considered more important, e.g., endemic species in a ranking analysis that is based on species distribution data. Alternatively, higher weights might be used for biodiversity features whose geographic ranges have been most reduced through human activity.

This latter aspect is particularly important when prioritising surviving indigenous remnants in New Zealand's lowland landscapes to maintain a representative range of native ecosystems, given the frequently high degree of loss of the former indigenous-dominated cover that has often occurred there. This requires an understanding of the specific patterns of loss that have occurred in a landscape, and the use of analysis settings that allow surviving examples of those ecosystems that have been most diminished in extent to receive a greater emphasis when identifying priorities.

Calculating such losses for the Northland Region was straightforward, given the availability of spatial data describing both estimated historic ecosystem patterns and estimates of their current extent. For each ecosystem, its estimated historic extent as indicated by the potential ecosystem layer was compared with its estimated current extent as identified from the intersection of the potential ecosystems layer with the layer describing the current extent of primary and secondary vegetation cover (LCDB4). The resulting estimates of ecosystem survival in primary remnants (Table 2 below) were then used to set weights for each of the terrestrial ecosystem layers in the ranking analysis. Ecosystems whose primary cover has been reduced to between 25% and 50% of their former extent were given a weight of two, while those with primary cover reduced to 25% or less were given a weight of three; all other primary terrestrial ecosystems were given a weight of one, indigenous-dominated secondary ecosystems were given a weight of 0.1, and the deciduous hardwood layer was given a weight of 0.05. These weights can be broadly viewed as an indicator of rarity induced by human activity, as opposed to natural rarity, which is a consequence of having a very limited natural extent.

The lake and river ecosystem layers were initially given a weights of one, but these were progressively adjusted downwards during a series of initial analyses that were used to tune the

balance between terrestrial and freshwater ecosystems. For each of these analyses, the broad balance between the representation of terrestrial, river and lake ecosystems was assessed, and the weights adjusted accordingly; the final analysis used the terrestrial weights described above and weights of 0.5 both for lake and riverine ecosystems.

Post-processing

While the simultaneous ranking of terrestrial, river and lake ecosystems contributed to better recognition of linkages between these different broad ecosystem groupings, it required care in the subsequent identification of separate biodiversity rankings for terrestrial, lake and riverine ecosystems from the raw ranking outputs.

The first step in this process involved the extraction from the final ranking layer of separate layers describing rankings for the terrestrial, lake and river ecosystems. However, examination of these extracted layers indicated subtle differences in their overall *mean* rankings, reflecting the difficulty of setting weights that result in them being removed at exactly the same rate throughout the analysis process. To place rankings for all three groups of ecosystems (terrestrial, lakes, and rivers and stream) onto a common scale, the three extracted ranking layers were each sorted into a strict rank order, with these ordered ranks then converted back onto a 0-1 scale. These transformed ranking layers preserve exactly the same ranking *order* as in the underlying raw ranking layer, but importantly, the rescaled rankings values are entirely consistent *across* terrestrial, lake and river ecosystems. That is a top-ranked subset of sites for each of these ecosystem groups (e.g., the top 30%) can be selected from their respective rescaled priority layer using the same threshold value (0.3); similarly, these layers can be shown without ambiguity on a map using the same colour ranges.

These rescaled priorities were then used to create spatial layers designed to facilitate the ready identification of high priority sites for each of the three broad groups of ecosystems, and in particular recognising the greater ease that most land managers have in working with polygon layers rather than gridded or raster data layers.

For the terrestrial ecosystems, a polygon layer was created that encompasses the top 30% of sites. This polygon layer was simplified by grouping together polygons lying within 250 m of each other, assuming that they are likely to require coordinated management actions; any groups of polygons with a total area of less than 1 ha were eliminated because of their likely low ecological viability. In a small number of cases, large sites were manually split where they crossed significant ecological or geographic boundaries. Similarly, several pairs of adjacent sites sharing closely similar environmental and ecological characteristics, but separated by slightly greater than 250 m, were each amalgamated with their immediate neighbour, reflecting a strong likelihood that any management actions applied to one would need to be applied to the other.

Finally, to better understand the contribution of different ecosystems within each of the polygons delineating the top 30% of terrestrial sites, a supplementary hierarchical Zonation ranking was calculated using just the terrestrial ecosystem layers with all connectivity settings turned off. This supplementary ranking used a feature in Zonation in which the backwards removal ranking process is constrained so that sites outside the top 30% are ranked first (and assigned ranks in the range 30–100%), and then sites falling within the top 30% are ranked (with their ranks constrained to fall within the range 0-30%). In practical terms, this achieves two important outcomes;

- first, individual ecosystem patches occurring within the top 30% polygons are ranked to reflect their standalone contribution to biodiversity representation, independent of their landscape connectivity as applied in the main ranking analysis – this allows the most important ecosystem components to be identified within each polygon, while also identifying other ecosystems that are included in the top 30% because of their strong connections with high priority terrestrial (or freshwater) ecosystems, and hence play more of a supporting role;
- second, ecosystem patches that fall outside the top 30% are ranked according to their ability to complement ecosystem patches contained within the top 30% of sites, but again without any consideration of connectivity. This enables, in particular, the identification of any small indigenous fragments that, while not well connected in a landscape sense, have high value because of their strong marginal contribution to biodiversity representation.

River priorities were treated differently to the terrestrial priorities, given their discrete nature, with the mean rank calculated for each river segment contained in the REC2 river network. A different approach was also taken to the post processing of the lake rankings, given that they are comprised of discrete sites that vary widely in size, with individual lakes only able to be managed in their entirety; their priorities are indicated by integer ranks, i.e., 1–295, that sorts them according to their area-based rankings. Additional data fields have been added that describe the accumulated extent of lakes along this rank order, both in hectares and as a percentage of the total lake area.

RESULTS

Given the size of the Northland Region and the wide diversity of its environments, results in this report are presented using a spatial subdivision of the Region comprising five geographic units (Fig. 1), based on New Zealand's Ecological Regions framework (McEwen 1987). This classification subdivides New Zealand's land area into geographic areas having similar recurring patterns of climate, landform and biodiversity. For this analysis, the Ecological Regions classification was adopted largely unchanged (Fig. 1, Table 2), except for a small area in the south-east around Mangawhai that falls within the Auckland Ecological Region (an Ecological Region occurring predominantly to the south), which was merged with the adjacent Eastern Northland Ecological Region.

The smallest of these units, **Te Paki** (c. 39,000 ha), is also the most northern, and stretches from Cape Maria van Diemen in the west to North Cape in the east; it extends southwards to include the western shores of Parengarenga Harbour. It consists predominantly of low elevation (maximum = 310 m), dissected hill-country on a mix of older basalts (Tangihua Complex), and younger sandstones, mudstones and conglomerates; dunes of varying age occur along the west coast and intrusive gabbro and peridotite (ultramafic) occur in the far northeast at North Cape.

The elongated, low elevation (maximum = 236 m), **Aupouri** unit (c. 100,000 ha) connects the Te Paki unit in the north and the main Northland land mass to the south. It consists almost entirely of dunes of varying age (Karioitahi and Awhitu Groups), with younger dunes predominating in the west; small areas of basalt occur in the far north (Tangihua Complex), in the east around Houhora and on the Karikari Peninsula (Houhora Complex); it also contains small areas of granitoid (Coromandel Group) on the Karikari Peninsula.

The Ecological Regions classification divides the main land mass of the Northland Region broadly in two, forming the two largest geographic units. The larger **Western Northland** unit (c. 619,000 ha) broadly comprises catchments draining westwards into the Tasman Sea south to Maunganui Bluff; its geological substrates are predominantly older basalts (Waipoua Basalt, Tangihua Complex), with often rounded landforms on these reaching elevations of 600-700 m towards the west coast, with a maximum elevation of 770 m on Tutamoe. Generally younger sandstones and some mudstones (Mangakahi Complex) underlie dissected hill country at lower elevations; young dunes are locally extensive along the west coast, and recent alluvium occurs along the floors of major river valleys; peats occur in an extensive basin west of Hikurangi in the headwaters of the Wairua River.

The smaller **Eastern Northland** unit (c. 380,000 ha) broadly comprises catchments on the main Northland land mass that drain eastwards into the Pacific Ocean; its geological substrates are predominantly old sandstones (greywacke) of the Waipapa Group, with smaller areas of younger basalts (Kerikeri Volcanic Group), sandstone (Whangai Formation) and localised breccia (Coromandel Group) and melange; an area of dacite occurs between Brynderwyn and Mangawhai. Steep, dissected landforms are general on greywacke, but gentler landforms predominate on younger sandstones and basalts; elevations reach a maximum of 575 m.

The elongated **Kaipara** unit (c. 144,000 ha) is located in the south-west of the Region, extending south along the west coast from Maunganui Bluff to Kaipara Head, and inland to include low hill country along the convoluted eastern shoreline of the Kaipara Harbour. It contains three main components: extensive dunes of varying age (Karioitahi and Awhitu Groups) occur along the west coast forming the Poutu Peninsula which encloses the Kaipara Harbour; extensive recent alluvium (Tauranga Group) occurs on the flood plain of the Wairoa River and its tributaries about and south of Dargaville; further east, dissected low-elevation hill-country is formed on a diverse mix of sedimentary and volcanic substrates including sandstone, mudstone, limestone, conglomerate, melange, andesite and basalt; these are most extensive in the south where they form a series of peninsulas that extend into the Kaipara harbour. Elevations throughout this unit rarely exceed 200 m.

The potential ecosystem pattern

Terrestrial ecosystems

The reconstructed potential ecosystem layer for Northland (Singers & Lawrence 2018) highlights the dominance of tall forests, which once extended across nearly 90% of the Region (Table 2); palynological studies indicate that this dominance is long established, extending back for at least 100,000 years (Newnham 1992, Elliott 1997). Although the composition of these forests has varied over this period, kauri has been a prominent and widespread species over the last c. 40,000 years. While this species sometimes grew in dense stands in the pre-human forests (WF10 – 1.1% of the potential cover of the Region), particularly at middle elevations, over most of its range it occurred in mixture with podocarp and broadleaved trees (WF11 – 58.9%), occasionally also with hard beech (WF12 – 0.03%).

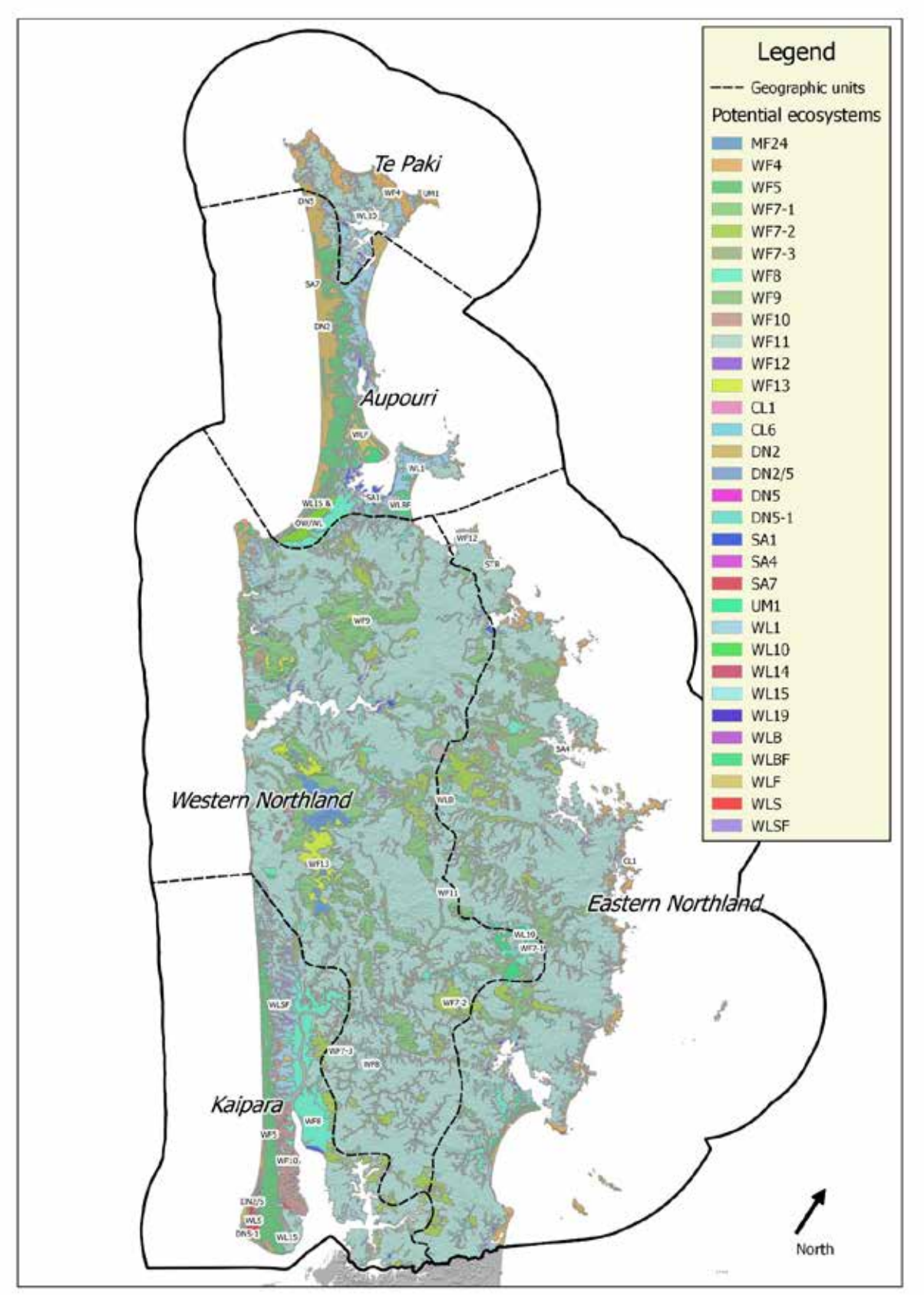


Figure 1. Potential ecosystem pattern of the Northland Region. Broad geographic subdivisions of the region, based on New Zealand's Ecological Regions framework, are delineated by dashed lines. Full names for ecosystems are listed along with their codes in Table 2.

Table 2. Estimated historic and current extents of terrestrial ecosystems in the Northland Region.

Ecosystem	Potential	Primary	Secondary	Wetland	Non-forest	Bare	Exotic	Total	Percent
MF24, Rimu, towai forest	9,542	9,255	-	-	-	-	-	9,255	97.0
WF4, Pohutukawa, puriri, broadleaved forest	28,201	4,060	14,438	66.4	-	749	-	19,313	68.5
WF5, Totara, kanuka, broadleaved forest [Dune forest]	47,406	119	7,994	257	-	466	-	8,836	18.6
WF7-1, Puriri, totara forest	35,776	2,141	1,485	379	-	10.1	-	4,015	11.2
WF7-2, Puriri, taraire forest	44,381	3,378	2,102	75.8	-	12.2	-	5,567	12.5
WF7-3, Kahikatea, puriri forest	26,122	1,521	801	350	-	14.4	-	2,687	10.3
WF8, Kahikatea, pukatea forest	55,435	1,636	1,923	1,821	-	42.1	223	5,645	10.2
WF9, Taraire, tawa podocarp forest	108,528	58,544	8,008	62.7	-	29.5	-	66,645	61.4
WF10, Kauri forest	13,346	3,410	1,230	101	-	9.8	-	4,751	35.6
WF11, Kauri, podocarp, broadleaved forest	743,467	164,510	94,881	1,424	-	216	-	261,030	35.1
WF12, Kauri, podocarp, broadleaved beech forest	346	25.2	320	-	-	-	-	345	99.8
WF13, Tawa, kohekohe, rewarewa, hinau, podocarp forest	10,254	7,863	298	-	-	-	-	8,160	79.6
CL1, Pohutukawa treeland/flaxland/rockland	2,119	-	218	28.2	897	554	-	1,698	80.1
CL6, Hebe, whararikí flaxland/ rockland	41.2	-	-	-	32.3	-	-	32.3	78.4
UM1, Pohutukawa, tanekaha forest/scrub/rockland	175	-	-	-	169	-	-	169	96.9
DN2, Spinifex, pingao grassland/sedgeland	31,932	30.9	-	210	16,669	-	-	16,910	53.0
DN2/5 Coastal Sand Dunes Mosaic	258	-	-	74.5	183	-	-	258	100.0
DN5, Oioi, knobby clubrush sedgeland	391	-	-	66.4	298	-	-	365	93.3
DN5-1, Sand sedge sand flats [Dune slack]	81.3	-	-	18.6	60.7	-	-	79.3	97.5
WL1, Manuka, Gumland grass tree, Machaerina scrub/sedgeland [gumland]	40,539	119	-	7,970	-	123	38	8,249	20.3
Open Water & WL2/WL3 Bog Mosaic	3,643	3.0	-	455	-	-	3.5	461	12.7
WL10, Oioi restiad rushland/reedland	59.7	-	-	58.9	-	-	-	58.9	98.7
WL14, Ephemeral Wetland	14.1	-	-	3.7	-	-	-	3.7	26.0
WL15, Herbland [Lakeshore turf]	4.8	-	-	3.4	-	-	-	3.4	69.9
WL15 & Open Water	47.0	-	-	3.8	-	-	-	3.8	8.1
WL19, Raupo reedland	7.5	-	-	0.6	-	-	-	0.6	8.1
WL, Bog mosaic	125	-	-	120	-	0.0	-	120	96.4
WL, Bog/Fen mosaic	14,744	-	-	3,919	24.3	92	15	4,050	27.5
WL, Fen mosaic	4,776	-	-	2,647	-	-	3.1	2,651	55.5
WL, Swamp mosaic	5,720	-	-	3,602	-	63	2.7	3,668	64.1
WL, Swamp/Fen mosaic	4,181	1.7	-	1,843	-	8.6	0.2	1,854	44.3
SA1, Mangrove forest and scrub	18,183	-	-	16,626	103	6.0	0.2	16,736	92.0
SA4, Shore bindweed, knobby clubrush gravelfield/stonefield	6.1	-	-	-	3.1	1.2	-	4.3	70.7
SA7, Ice plant, glasswort herbfield/loamfield	132	-	-	-	102	-	-	102	77.1
Overall	**1,240,439**	**247,360**	**133,698**	**42,187**	**18,542**	**2,397**	**286**	**444,471**	**35.8**

The remaining forest ecosystems were much less extensive in terms of their proportional cover; pohutukawa-dominant forests (WF4 – 2.2%) occurred mostly on steep coastal sites, while forests dominated by taraire, with tawa and podocarps (WF9 – 9.7%) generally occurred on lower elevation hill-country on more inland sites, particularly those with basalt substrates; taraire also grew in association with puriri (WF7-2 – 3.5%) on fertile soils formed generally on basalt and limestone. With increasing elevation, these ecosystems gave way to diverse forests dominated by tawa, kohekohe, rewarewa and hinau with emergent podocarps (WF13 – 0.8%), these in turn giving way with further increase in elevation to rimu, towai forest (MF24 – 0.8%). Forests on poorly drained alluvial surfaces were generally dominated by kahikatea growing in mixture with puriri on more fertile soils (WF7-3 – 2.1%) or pukatea on less fertile, gley soils (WF8 – 4.4%); by contrast, well drained alluvial soils were dominated by totara and puriri (WF7-1 – 2.8%); forests dominated by totara and kanuka (WF5) occupied more stable dunes, accounting for a further 3.8% of the region.

The remaining ten percent of the region supported ecosystems dominated by lower stature vegetation, including tussock- and tussock-shrubland on dunes (DN2 and DN5 – 2.6%), 'gumland' on older, infertile, poorly-drained dunes (WL1 – 3.2%), and a range of freshwater wetlands, which occurred both on older dunes and on alluvium (2.7%), and coastal mangroves (SA1 – 1.5%). Smaller areas of low stature vegetation occurred on cliffs (CL1,CL6 – 0.2%), and on ultramafic substrates (UM1 – 0.01%).

Turning in more detail to the geographic units, the historic cover of the **Te Paki** unit was dominated by kauri, podocarp, broadleaved forest (WF11) on more inland sites, and by pohutukawa, puriri, broadleaved forest (WF4) on more coastal sites. Spinifex, pingao grassland/sedgeland (DN2) occupied more recent dunes, totara, kanuka, broadleaved forest (WF5) occurred on older, more stable dunes, and gumland (WL1) occupied extensive areas of depleted soils. Moderately drained alluvial sites on valley floors supported puriri, totara forest (WF7-1), while more poorly drained alluvium supported wetlands of varying fertility. Coastal cliffs (CL1) occurred at a number of locations around the coast, and a small area of ultramafic pohutukawa, tanekaha forest/scrub/rockland (UM1) occurred at North Cape. Coastal mangroves (SA1) were a prominent feature of Parengarenga Harbour.

Dune ecosystems predominated in the **Aupouri** unit, with their distributions strongly determined by dune age and soil conditions. Spinifex, pingao grassland/sedgeland (DN2) was widespread on recent dunes, particularly in the west, although narrow fringes also occurred along the majority of the eastern coasts. Totara, kanuka, broadleaved forest (WF5) occurred on more stable dunes of intermediate age along the centre of the peninsula, while manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1) occupied the depleted soils of older dunes towards the east coast and on the Karikari Peninsula; small areas of kauri, podocarp, broadleaved forest (WF11) occurred locally, mostly on older dune soils, and those formed on volcanic substrates. Towards the base of the main peninsula, kahikatea, pukatea forest (WF8) occupied an extensive area of alluvial and estuarine sediments around Kaitaia; extensive areas of wetland of varying nutrient status occurred at Kaimaumau, between Kaitaia and Ahipara, and at the base of the Karikari Peninsula – smaller areas of wetland also occurred in basins and depressions along central parts of the main peninsula. Mangroves (SA1) were a prominent feature of Rangaunu Harbour.

Kauri, conifer, broadleaved forest (WF11) formed the dominant historic ecosystem cover throughout the **Western Northland** unit, with more local occurrences of kauri-dominant forest (WF10), mostly at

Waipoua and Warawara. Taraire, tawa, podocarp forest (WF9) was locally common mostly at intermediate elevations and on basalt substrates; with increasing elevation these two ecosystems gave way to tawa, kohekohe, rewarewa, hinau, podocarp forest (WF13). Smaller areas of rimu, towai forest (MF4) occupied the highest elevation sites, mostly in the west on the Parataiko and Tutamoe Ranges. Less extensive, lowland ecosystems included: spinifex, pingao grassland/sedgeland (DN2) on recent dunes along the west coast; totara, kanuka, broadleaved dune forest (WF5) on more stable dunes, mostly at the mouths of the Hokianga and Herekino Harbours; *Machaerina* scrub/sedgeland (WL1) on depleted soils near Ahipara and near the coast at Waipoua; kahikatea, puriri forest (WF7) and kahikatea, pukatea forest (WF8) on moderately drained alluvium; and puriri, totara forest (WF7-1) on more freely draining recent soils along the flood plains of larger rivers and streams. Wetlands were generally restricted to narrow sites on valley floors, the one exception being an extensive basin west of Hikurangi, which supported a mosaic of intermediate to low fertility wetlands interspersed with kahikatea, pukatea forest (WF8) and puriri, totara forest (WF7-1). Coastal mangroves (SA1) were a prominent feature of the western harbours, most notably the Hokianga, but also at Whangape and Herekino; mangroves also occurred in the upper reaches of harbours on the northern coast that fall within the Western Northland unit (Mangonui, Whangaroa).

Although the **Eastern Northland** unit was also dominated by kauri, conifer, broadleaved forest (WF11), along with a mix of less extensive lowland forest ecosystems dominated by mixtures of taraire, puriri, totara, and/or kahikatea (WF7-1, WF7-2, WF7-3, WF8, WF9), it shows several important differences compared to the Western Northland unit. First, higher elevation forests (WF13, MF4) were completely lacking, reflecting the lower maximum elevations reached within the Eastern Northland unit. Second, coastal pohutukawa, puriri, broadleaved forest (WF4) was more extensive in the Eastern Northland unit, reflecting the greater dominance of rocky coasts in the east compared to the Western Northland unit, where dunes instead dominated along much of the coast. Third, as a consequence of this difference in coastal environments, dune ecosystems (DN2, DN5, WF5, WL1) were less extensive in Eastern Northland, with small areas occurring on sandy beaches at scattered locations around the coast, and extensive dune ecosystems occurring only at Bream Bay. Fourth, offshore islands are more numerous around the Eastern Northland coast than in all the other geographic units; major islands (or island groups) include Stephenson Island off Whangaroa Harbour, the Cavalli Islands at Matauri Bay, an extensive group of islands in the Bay of Islands, the Poor Knights Islands, and Taranga Island and the Marotere Islands, collectively known as the Hen and Chickens Islands. In addition, the most extensive stand of kauri, podocarp, broadleaved, beech forest (WF12) in the Northland Region was located in the Eastern Northland unit, occupying the summit of Whakaangi, a high point on the northern coast near Mangonui. The most extensive wetlands in the Eastern Northland unit occurred on flat basalt terrain east of Kerikeri and on poorly drained alluvium in Bream Bay; smaller wetlands were scattered throughout on poorly drained alluvium along valley floors. Mangroves were a prominent feature in the many harbours and embayments scattered around the Eastern Northland coast.

The **Kaipara** unit is arguably the most heterogeneous of the five geographic units, reflecting its complex mix of aeolian, alluvial, sedimentary and volcanic substrates. The reconstructed historic ecosystem cover of the extensive dunes that stretched along the Poutu Peninsula was dominated by a sequence in which younger coastal dunes were occupied by spinifex, pingao grassland/sedgeland (DN2), sometimes in mixture with oioi, knobby clubrush sedgeland (DN5) and sand sedge sand flats (DN5-1) on more stable sites; dunes of intermediate age further back from the coast were occupied by extensive totara, kanuka, broadleaved forest (WF5); and, older more weathered and infertile dunes in the centre and east were occupied either by low stature manuka, gumland grass tree,

Machaerina scrub (WL1 – northern parts of the Poutu Peninsula) or tall kauri forest (WF10 – southern half of the Poutu Peninsula, with some WF11 throughout). Numerous depressions and basins scatted among the older dune landforms along the eastern side of the Poutu Peninsula supported fertile wetlands (swamps), as did an extensive area of flatter topography on younger dunes in the southwest.

A dramatic change occurred in the reconstructed ecosystem pattern with transition to the extensive alluvium that forms the floodplain of the Wairoa River. Kahikatea, pukatea forest (WF8) formed the dominant cover here, sometimes in mixture with fertile wetlands; small, inland areas of more recent alluvium supported kahikatea, puriri forest (WF7-3), while mangroves increased in prominence on coastal sites with saline influence. The surrounding hills were dominated by kauri, podocarp, broadleaved forest (WF11), with smaller areas of puriri, taraire forest (WF7-2) on more fertile soils, particularly on limestone, this general pattern extending to the south-east onto the several peninsulas that extend into the Kaipara Harbour. Exceptions to this general pattern include small areas of gumland (WL1) near Tinopai, of kahikatea, pukatea forest (WF8) and swamp on the Puketotara Peninsula, and of taraire, tawa, podocarp forest (WF9) south of Topunui.

River and stream ecosystems

Fourteen river and stream ecosystems from the FENZ Level Two (100 group) classification are distributed across the 18,536 km of rivers and streams mapped within the Northland Region. However, there are marked differences in the river lengths occupied by these different ecosystems (Table 3); only nine individually occupy 100 km or more of the river network, and together these account for 99.5% of the entire river network (Figure 2); the remaining five ecosystems together occupy less than 100 km of the river network, with two occurring in just a single river or stream segment.

The following brief account describes the environmental characteristics and geographic distribution of the nine widespread river and stream ecosystems; descriptions for the five less common river and stream ecosystems can be found in the FENZ documentation (Department of Conservation 2010).

- A1 – 5605 km – consists of small, gentle gradient streams on sandy substrates, occurring mostly in moderately inland locations; this is the most widespread river ecosystem in Northland, occurring on gentle terrain mostly in the southern half of the Region, but also around Kaikohe, south of Broadwood, around Otoroa, and at Te Paki;
- A2 – 1548 km – consists of small, very gentle gradient streams on silty substrates occurring in moderately coastal locations, mostly in the Kaipara geographic unit, and in the extensive basin west of Hikurangi in the Western Northland unit;
- A3 – 3581 km – consists of very small, gentle gradient streams on sandy substrates occurring in coastal locations; it is widespread in coastal parts of the Eastern Northland unit, in the upper reaches of the Hokianga Harbour, around Awaroa, and from Kaitaia north to North Cape;
- A4 – 261 km – consists of very small, gentle gradient streams with sandy to fine gravelly beds occurring in moderately coastal locations; this stream ecosystem is relatively restricted in its distribution occurring mostly on sites east of Maunganui Bluff, at Ahipara, and west of Kerikeri;
- C1 – 141 km – consists of very small, very steep gradient, coastal streams with coarse gravel substrates; it occurs mostly in steep parts of Waima and Warawara Forests, and along the coast north to Ahipara;

- C4 – 3456 km – consists of small, moderate gradient rivers with gravelly beds occurring in coastal to moderately inland locations; this group occurs throughout Northland, generally on gentler terrain where streams of steeper uplands, transition into the lowlands;
- C5 – 1645 km – consists of very small, moderate gradient streams with coarse gravelly substrates, occurring in coastal locations, particularly in moderately steep low-elevation hill country, including the lower slopes of the Waipoua and Warawara massifs, on the Maungataniwha Range, and in Puketi-Omahuta and Russell Forests;
- C6 – 1484 km – consists of small, moderate gradient streams with fine to coarse gravelly substrates, occurring in moderately inland locations; it occurs at low to intermediate elevations in central parts of the main Northland landmass, including on the Maungataniwha Range, and from the Tutamoe Range eastwards to the hill-country that lies south of Russell Forest; and,
- C8 – 816 km – consists of small, moderate gradient streams with coarse gravelly substrates in inland locations; it is largely restricted to high elevation sites, mostly on the Tutamoe, Parataiko and Maungataniwha Ranges.

- **Table 3**. River ecosystems occurring within the Northland region, their environmental characteristics, and their estimated current condition. Table values are as follows: Mean flow – the estimated mean annual flow; Summer temp – the estimated January air temperature; Sediment – the predominant bed sediment size where 1 = mud, 2 = sand, 3 = fine gravel, 4 = coarse gravel, 5 = cobble, 6 = boulder, 7 = bedrock; Segment slope – the average slope within the segment; Down slope – the average downstream slope between the segment and the coast; Distance to coast – the total distance from the segment to the coast, measured along the river network; Condition – as described in the Methods section.

River ecosystem	Count	Total length (km)	Mean flow (m^{-3} sec^{-1})	Summer temp (°C)	Sediment	Segment slope (°)	Down slope (°)	Distance to coast (km)	Condition
A1	8880	5,605	0.49	18.8	2.14	0.83	0.34	59.6	0.262
A2	2445	1,548	1.42	18.6	1.28	0.39	0.38	45.0	0.221
A3	5911	3,581	0.07	19.3	1.73	0.66	0.81	5.7	0.325
A4	261	165	0.04	17.9	2.47	1.30	0.92	31.4	0.309
B1	87	57.0	0.02	19.4	1.20	0.15	0.16	34.8	0.216
C1	216	141	0.02	17.6	4.20	10.30	5.52	6.8	0.649
C4	5598	3,456	1.37	19.2	3.50	1.43	0.92	18.4	0.385
C5	2592	1,645	0.08	18.5	4.08	5.03	0.95	16.4	0.509
C6	2340	1,484	0.29	18.5	3.68	2.61	0.10	107.3	0.362
C7	65	34.3	0.01	17.2	4.41	14.77	0.57	73.6	0.645
C8	1229	816	0.12	17.1	4.24	4.64	0.45	90.2	0.466
C10	6	1.8	0.01	18.2	4.45	14.36	0.13	91.6	0.712
C11	1	1.0	0.02	18.1	4.20	13.49	0.08	140.0	0.651
C12	1	1.0	0.02	18.1	4.10	11.86	0.44	25.1	0.692
Total/Avg.	29,632	18,536	0.57	18.8	2.64	1.65	0.63	40.4	0.337

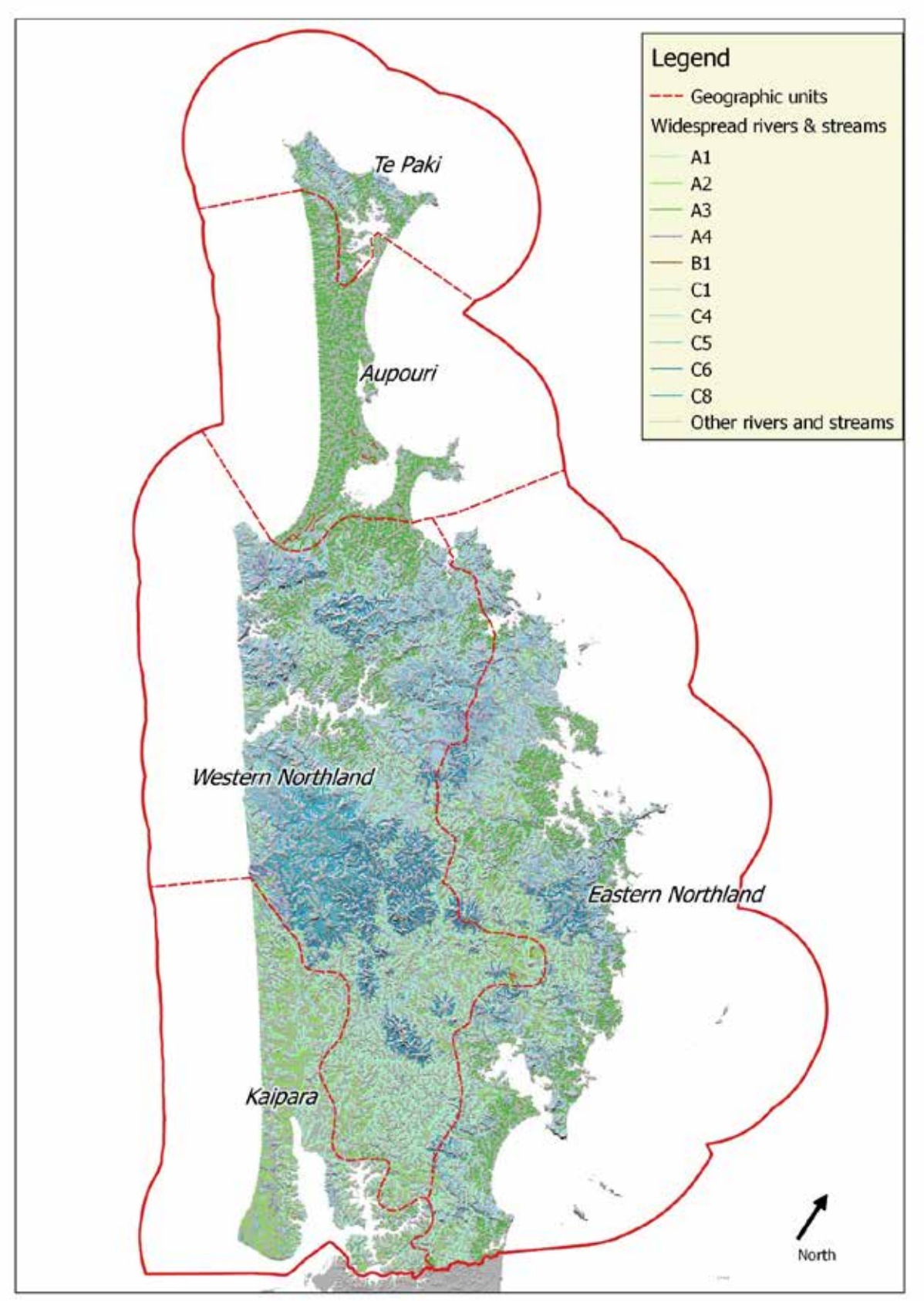


Figure 2 – Widespread river ecosystems of the Northland Region.

Lakes

Dune lakes, formed in depressions created by wind-movement of sand, are by far the most numerous and widespread of the natural lake groups occurring in the Northland Region (Table 4a); they vary widely in size, with the largest exceeding 200 ha in extent; they occur predominantly in the Aupouri and Kaipara geographic units (Table 4b), although small numbers also occur in the other three units. Riverine lakes, the next most numerous natural lake group, have a small average size and the lowest average condition; the majority of them are split about equally in number between the Eastern and Western Northland units, with a small number in the Kaipara unit. Seven volcanic lakes show the greatest variation in size, with the largest (Omapere) covering over 1200 ha; all are located on the main Northland landmass. Only five shoreline lakes and three geothermal lakes occur within the Region, with the first group widely distributed around the coast, and the second clustered together on an inland site at Ngawha near Kaikohe. Artificial dams and reservoirs outnumber the total number of lakes in the four least numerous natural lake categories.

Table 4. Number of lakes within the Northland Region and their distributions across geomorphic categories (a) and by geographic unit (b).

a) Overall lake statistics

Geomorphic group	Count	Average size	Size range	Total extent	Mean condition	Range
Dune	183	10.0	1–204.0	1833.7	0.47	0.1–0.99
Geothermal	3	2.4	1.7–2.9	7.1	0.32	–
Riverine	31	2.7	1.0–8.3	82.8	0.29	0.10–0.68
Shoreline	5	7.9	1.6–19.1	39.6	0.47	0.29–0.80
Volcanic	7	191.0	2.2–1205.7	1337.2	0.49	0.30–0.65
Reservoir	66	7.4	1.02–126.7	488.4	0.32	0.10–0.99
Overall	295	12.6	1–1205.7	3788.8	0.42	0.1–0.99

b) Lakes by geographic unit

Geomorphic group	Te Paki	Aupouri	Western Northland	Eastern Northland	Kaipara	Total
Dune	14	92	6	1	70	183
Geothermal				3		3
Riverine			13	14	4	31
Shoreline	2		1	1	1	5
Volcanic			3	4		7
Reservoir		1	27	33	5	66
	16	93	50	56	80	295

Loss of terrestrial ecosystems

While fire was an occasional feature of the pre-human forests of Northland (Newnham 1992), extensive firing of the landscape commenced approximately 600–800 years ago following human settlement (Elliott et al. 1995); some firing might have occurred as early as 1000 years ago at a few sites with particularly favourable soils and climates for settlement (Elliott 1997). A further period of extensive change began in the early 1800s with the arrival of European settlers (Elliott 1997).

Greatest losses of indigenous terrestrial ecosystems have occurred in the Kaipara geographic unit, which has retained only 24% of its former indigenous cover (right of Table 5, Fig. 3); primary forest cover comprises 17% of this, with secondary forest and wetland ecosystems the most extensive, followed by non-forest ecosystems, principally dunes. Similarly, the Aupouri unit has retained only 27% of its former indigenous cover, with its former primary forests now almost completely eliminated; as in the Kaipara unit, wetlands and non-forest ecosystems are the most extensive surviving ecosystem groups, followed by secondary forest ecosystems.

More extensive indigenous cover survives in both the Eastern and Western Northland geographic units, i.e., around 37%; both retain around 60–70% of this in primary forests, and both support extensive areas of secondary ecosystem cover. The Te Paki geographic unit has retained the greatest proportion of its former indigenous cover, although primary forest ecosystems comprise only 4% of this, leaving secondary ecosystems the most extensive, followed by wetland and non-forest ecosystems.

Table 5. Extent of surviving indigenous primary forest, non-forest, secondary, and wetland terrestrial ecosystems (1000's ha) in the Northland Region by Ecological Region.

Ecological	Total	Primary		Secondary		Wetland		Non-forest		Bare		Total	
Region	area	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%
Te Paki	39.1	1.1	4.2	16.5	64.6	5.4	21.1	2.1	8.1	0.5	2.0	25.6	65.5
Aupouri	100.4	0.4	1.3	5.5	20.0	13.2	48.1	8.0	29.0	0.4	1.4	27.4	27.3
West. Northland	618.6	160.8	69.9	55.9	24.3	10.0	4.4	3.0	1.3	0.3	0.1	230.1	37.2
East. Northland	380.4	82.7	59.4	47.1	33.8	7.1	5.1	1.5	1.1	0.7	0.5	139.2	36.6
Kaipara	144.3	3.9	16.7	8.7	37.1	6.8	28.9	3.6	15.4	0.4	1.9	23.6	16.3
Total/average	1,282.8	248.9	55.8	133.7	30.0	42.5	9.5	18.1	4.1	2.4	0.5	445.9	34.8

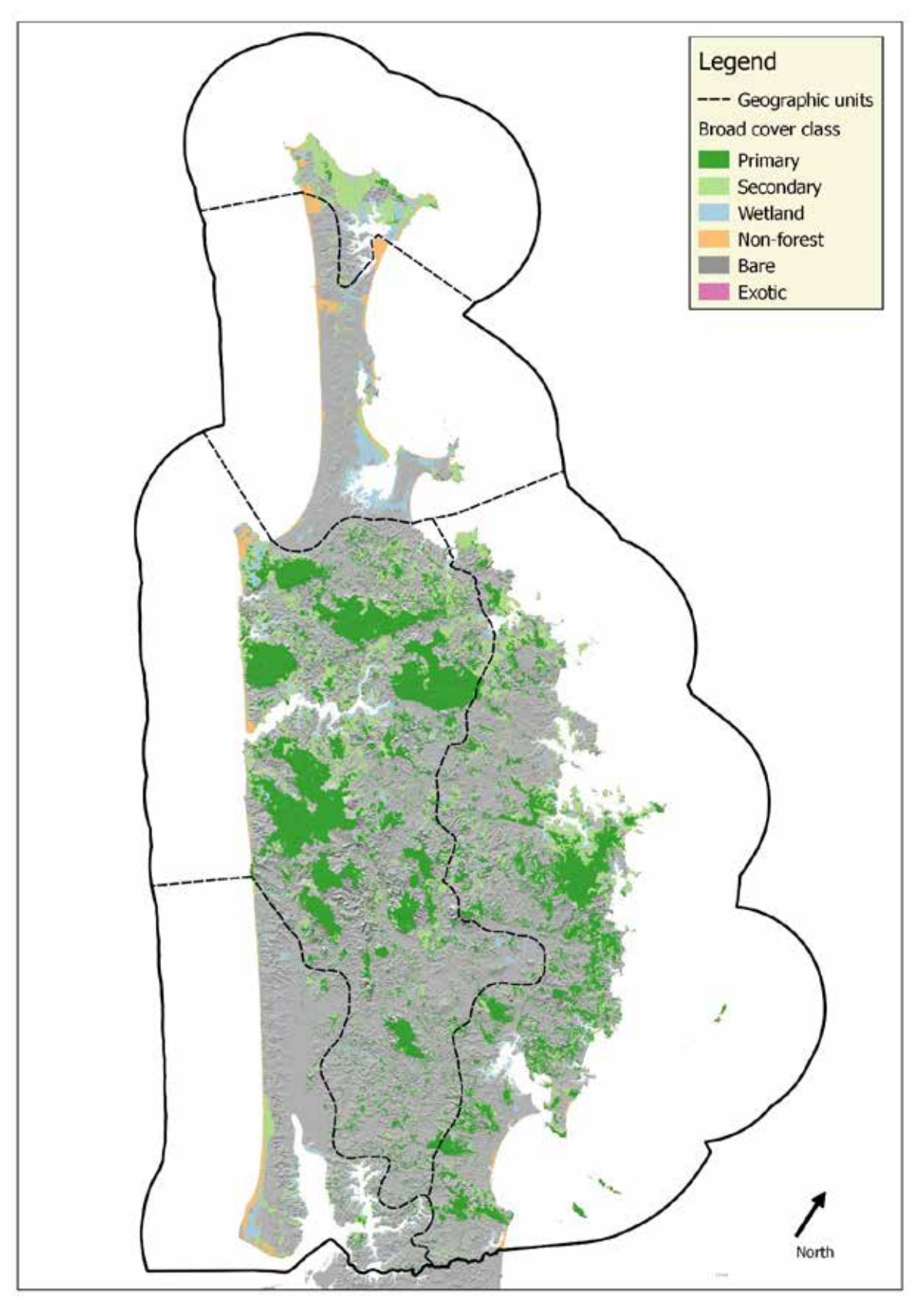


Figure 3. Current distribution of broad, indigenous-dominated, terrestrial ecosystem classes in the Marlborough Region.

Estimated biodiversity condition

These marked differences in loss of primary ecosystem cover, and expansion of secondary cover are reflected in subtle but important differences in the estimated current terrestrial condition. In particular, the average condition of terrestrial sites is highest in the two northern geographic units, i.e., Aupouri and Te Paki, reflecting at least in part the extensive wetland and dune ecosystems that occur there; it is lowest in Eastern Northland, reflecting the very high degree of fragmentation of the former forest cover that was once dominant in this geographic unit; average condition scores are slightly higher in Western Northland, reflecting the dominance of this landscape by a number of extensive forest patches.

There are also marked differences in the *maximum* condition scores across the geographic units, depending on whether they include offshore islands receiving intensive predator control. In particular, the inclusion of offshore islands in both the Aupouri and Eastern Northland geographic units results in them having maximum condition estimates of one, while the remaining three geographic units have maximum condition scores of around 0.6–0.7, these levels being attained in more extensive indigenous remnants receiving reasonably intensive conservation management.

Table 6. Terrestrial and freshwater condition estimates for the Northland Region.

	Terrestrial		Rivers and streams		Lakes	
Ecological Region	Mean	Range	Mean	Range	Mean	Range
Te Paki	0.331	0.05–0.63	0.497	0.12–0.97	0.749	0.40–0.99
Aupouri	0.374	0.04–1.00	0.269	0.07–0.99	0.416	0.10–0.99
Western Northland	0.267	0.03–0.68	0.353	0.05–0.97	0.541	0.10–0.99
Eastern Northland	0.224	0.02–1.00	0.347	0.04–0.87	0.417	0.10–0.91
Kaipara	0.264	0.04–0.59	0.213	0.03–0.98	0.594	0.20–0.99
Overall	0.247	0.03–1.00	0.331	0.03–0.97	0.548	0.10–0.91

By contrast, highest average estimated condition for both rivers and streams and lakes occur in the Te Paki Ecological Region. On average, river and stream conditions are at intermediate levels in the extensive Western and Eastern Northland geographic units, but are much lower in both the Aupouri and Kaipara geographic units. Average lake condition estimates are relatively high in the Kaipara and Western Northland Ecological Regions, but are lower in the Eastern Northland Aupouri Ecological Regions.

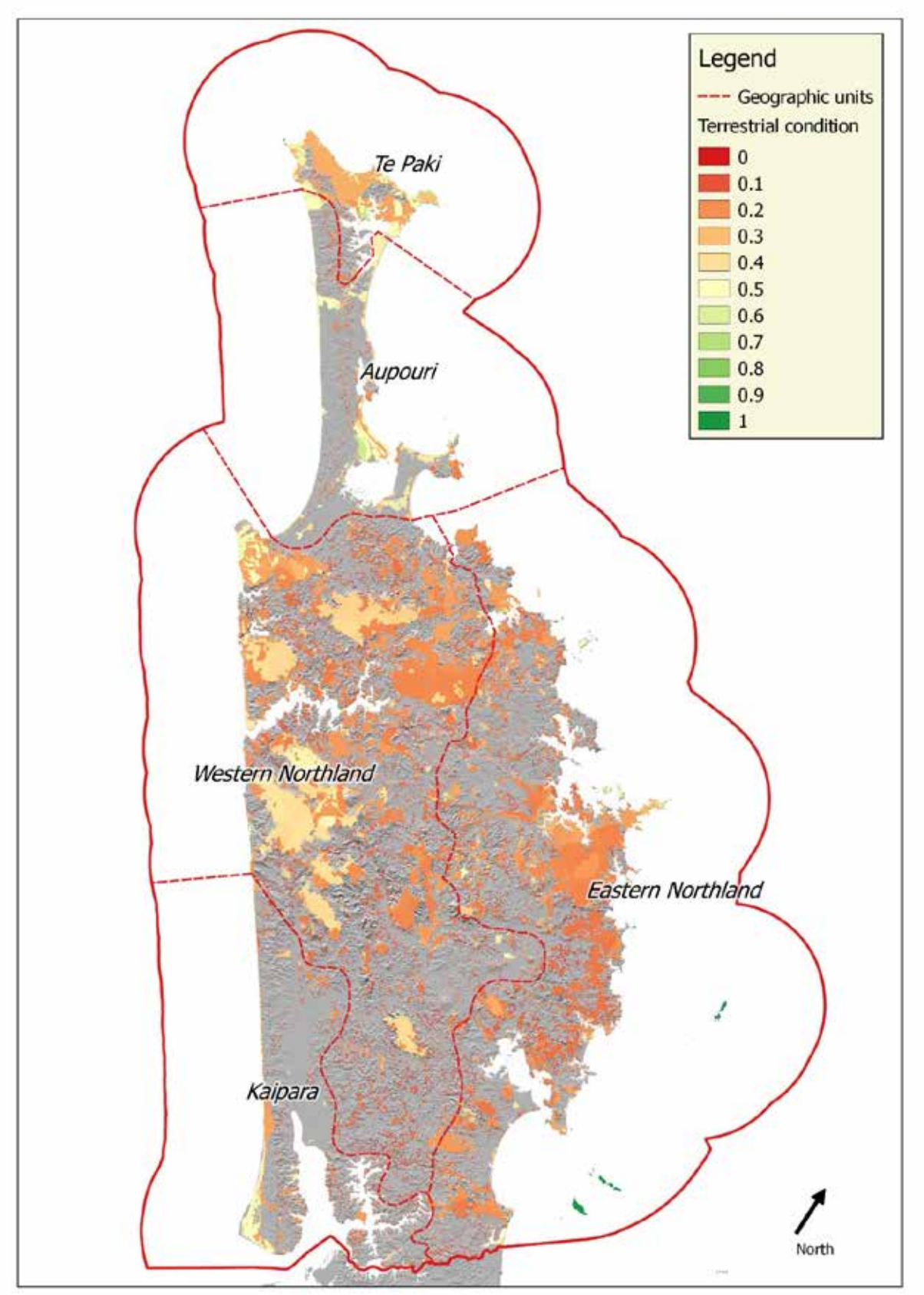


Figure 4. Estimated current terrestrial condition for the Northland Region.

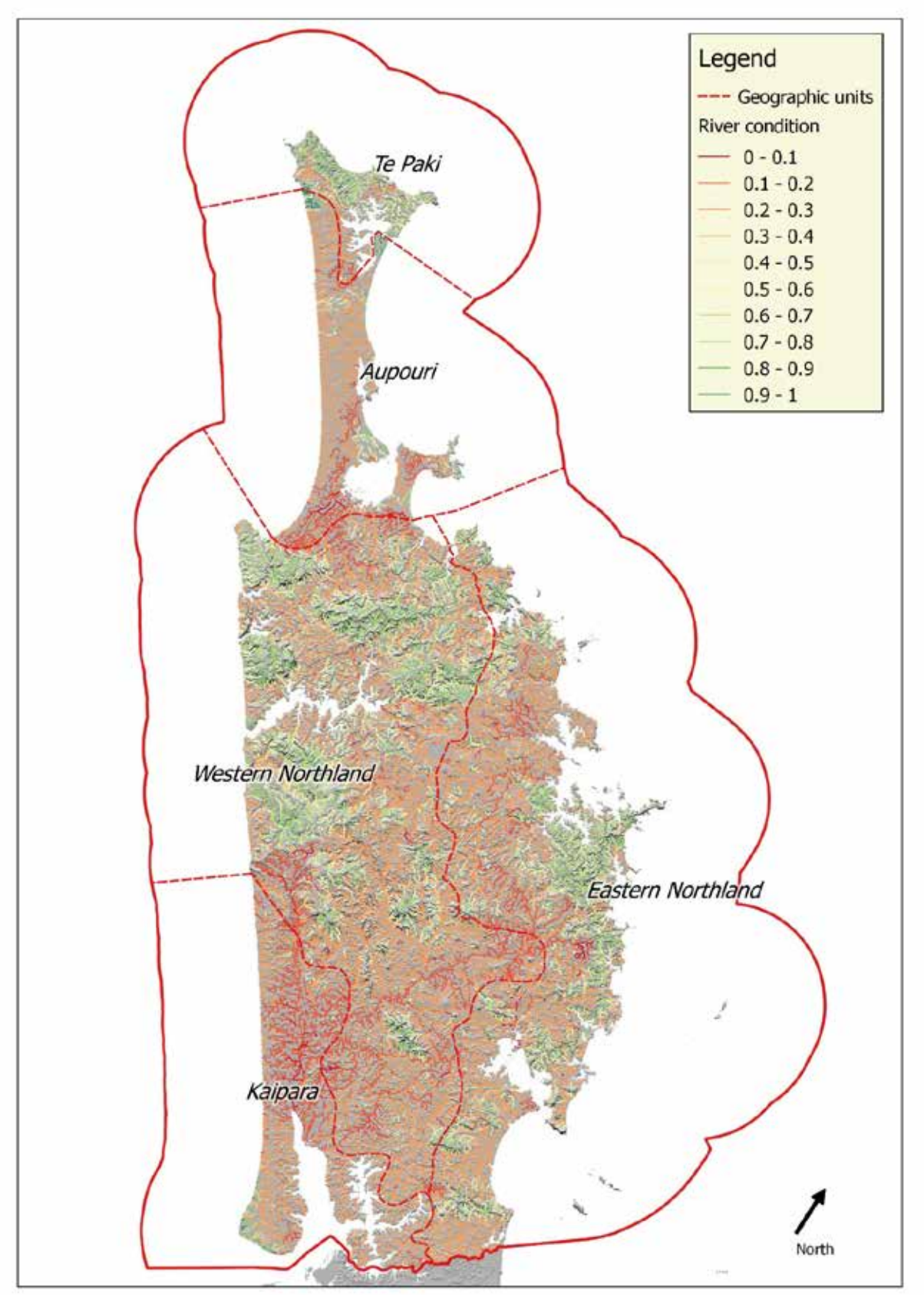


Figure 5. River condition estimates for the Northland Region.

Biodiversity rankings

Results from the primary Zonation analysis for the Northland Region have been processed to provide separate rankings for all surviving indigenous-dominated terrestrial ecosystems, for rivers and streams, and for lakes. These rankings integrate information about both the intrinsic values of individual biodiversity features, and their connectivity with other ecosystems within their surrounds. Rankings are expressed on a continuous proportional scale, and indicate how each site (or lake or river segment) is ranked relative to all other surviving indigenous-dominated sites (or lakes or river segments) in the Northland Region. That is, the top 10% of sites within the region comprise sites with values of 0.1 or less, those within the top 20% comprise sites with values of 0.2 or less, and so on.

The following descriptions of the ranking results focus on the top 30% of sites for terrestrial and riverine ecosystems, and the top 30% of lakes by number; note that the choice of this threshold is not fixed, but is used to constrain the description to a reasonable-sized set of the most highly ranked sites; different thresholds could be used as budget or management requirements dictate.

Terrestrial ecosystems

The top 30% of terrestrial sites in the Northland Region cover a total area of 133,545 ha, made up of 103,465 ha of primary ecosystems, and 30,079 ha of secondary ecosystems (Table 7); this equates to an area equivalent to 10.6% of Northland's pre-human indigenous terrestrial cover. Within this set of high priority sites, representation (= the proportion of the total current extent of an ecosystem contained within the top 30% of sites) averages just over 83% for primary ecosystems, and 64% for secondary ecosystems; the lower representation for the latter group reflects the lower weightings given to them in the analysis as described in the Methods section. Importantly, these priority sites include examples of all 29 primary terrestrial ecosystems.

Within this set of priority sites, there is a general trend whereby ecosystems that are of more limited extent, either because they are naturally rare, or because they have been reduced in extent by human activity, receive higher levels of representation; more extensive ecosystems generally have lower levels of representation. In particular, the fourteen primary ecosystems now occupying less than 1000 ha (as listed in Table 7) have average representation of 97.8% within the top 30% of sites; the eight ecosystems occupying between 1000 and 5000 ha have average representation of 82%; the five ecosystems occupying between 5000 and 10,000 ha have average representation of 71.7%; and the two ecosystems occupying more than 10,000 ha have average representation of 24%. The most extensive primary ecosystem, kauri, podocarp, broadleaved forest (WF11), which currently occupies 167,813 ha, has the lowest representation within the top 30% of sites at 13.5% – but this still comprises nearly 23,000 ha.

A similar trend is evident in the representation of the LCDB-mapped secondary ecosystems, with the extensive 'Manuka and/or Kanuka' and 'Broadleaved Indigenous Hardwoods' ecosystems receiving lower levels of representation in the top 30% of sites (12.5 and 16.9% respectively) than the less extensive 'Fernland' and 'Grey Scrub' ecosystems (79.5 and 90.4%). Note also that the rankings assigned to individual sites supporting secondary ecosystems are guided by data describing both their current cover, and their likely historic or potential ecosystem cover.

Table 7. Cover of terrestrial ecosystems of the Northland Region, showing their historic extent, their current effective area (EA) as described by the input data layers, and their representation in the top 30% of sites identified by a ranking of indigenous dominated terrestrial ecosystems: a) primary ecosystems; b) secondary and other cover classes from the Land Cover Database (LCDB4.1).

	Historic	Current extent		
a) Primary ecosystems	extent (ha)	EA	Top 30%	%
MF24, Rimu, towai forest	9,542	9,254	8,439	91.2
WF4, Pohutukawa, puriri, broadleaved forest	28,201	4,821	3,664	76.0
WF5, Totara, kanuka, broadleaved forest [Dune forest]	47,406	556	474	85.3
WF7-1, Puriri, totara forest	35,776	2,228	1,669	74.9
WF7-2, Puriri, taraire forest	44,380	3,479	2,898	83.3
WF7-3, Kahikatea, puriri forest	26,122	1,570	1,274	81.1
WF8, Kahikatea, pukatea forest	61,891	1,793	1,408	78.5
WF9, Taraire, tawa podocarp forest	108,528	53,100	18,320	34.5
WF10, Kauri forest	13,346	3,011	2,864	95.1
WF11, Kauri, podocarp, broadleaved forest	743,467	167,813	22,655	13.5
WF12, Kauri, podocarp, broadleaved beech forest	346	41.3	41.3	100
WF13, Tawa, kohekohe, rewarewa, hinau, podocarp forest	10,254	7,511	6,663	88.7
CL1, Pohutukawa treeland/flaxland/rockland	2,119	1,024	906	88.5
CL6, Hebe, whararikiflaxland/ rockland	41.2	32.8	32.5	99.2
UM1, Pohutukawa, tanekaha forest/scrub/rockland	175	170	170	100
WL1, Manuka, Gumland grass tree, Machaerina scrub/sedgeland [gumland]	40,539	7,690	6,598	85.8
WL10, Oioi restiad rushland/reedland	59.7	58.5	58.2	99.5
WL14, Ephemeral Wetland	14.1	2.5	2.5	100
WL15, Herbland [Lakeshore turf]	28.3	6.3	6.3	100
WL19, Raupo reedland	7.5	0.5	0.5	100
WL, Bog mosaic	9,318	2,511	2,310	92.0
WL, Fen mosaic	14,238	5,473	4,838	88.4
WL, Swamp mosaic	14,267	4,398	3,017	68.6
DN2, Spinifex, pingao grassland/sedgeland	32,061	16,146	5,716	35.4
DN5, Oioi, knobby clubrush sedgeland	520	384	381.0	99.1
DN5-1, Sand sedge sand flats [Dune slack]	81.3	55.9	55.9	100
SA1, Mangrove forest and scrub	18,183	15,491	8,907	57.5
SA4, Shore bindweed, knobby clubrush gravelfield/stonefield	6.1	4.2	4.2	100
SA7, Ice plant, glasswort herbfield/loamfield	132	94.1	94.1	100
Subtotal	1,261,049	308,721	103,465	33.5
b) Secondary ecosystems and other LCDB cover classes				
Herbaceous Freshwater Wetland		3,803	2,468	64.9
Herbaceous Saline Vegetation		2,661	2,169	81.5
Manuka and/or Kanuka		102,994	17,406	16.9
Broadleaved Indigenous Hardwoods		19,062	2,383	12.5
Fernland		146	116	79.5
Matagouri or Grey Scrub		434	392	90.4
Flaxland		106	102	96.6
Low Producing Grassland		1,972	1,223	62.0
Gravel, Rock, Sand		4,809	3,646	75.8
Deciduous Hardwoods		261	175	67.1
Subtotal		136,248	30,079	22.1
Overall		444,969	133,545	30.0

Results from the ranking analysis were used to delineate a total of 1293 priority sites that comprise the top 30% of terrestrial sites for the Northland Region. These are reasonably evenly distributed throughout the Region by number, so that numbers of priority sites in the individual geographic units are broadly proportional to unit size, with approximately one priority site for every 1000 ha of land area (Table 8). The strongest exception to this pattern is Eastern Northland, which has a larger than expected number of priority sites given its size, reflecting the highly fragmented character of its surviving indigenous terrestrial cover.

Table 8. Number, size, and priority of terrestrial sites comprising the top-ranked 30% of indigenous terrestrial ecosystems in the Northland Region, by Ecological Region. Note that the total area of the priority sites is slightly less than the total area of terrestrial ecosystems as listed in Table 7, reflecting the exclusion of sites less than one ha in extent.

		No of	Mean	Extent			
Ecological Region	Total area	sites	rank	Mean	Range	Total	%
Te Paki	39,130	29	0.180	356.7	1.4–3012	10,345	26.4
Aupouri	100,366	107	0.189	157.3	1.2–5998	16,828	16.8
Western Northland	618,572	548	0.195	127.6	1.1–25,491	69,935	11.3
Eastern Northland	380,401	460	0.165	53.0	1.1–1709	24,377	6.4
Kaipara	144,349	149	0.175	79.5	1.1–8077	11,844	8.2
Overall	1,282,818	1293	0.181	103.1	1.1–25,491	133,329	10.4

There are also marked differences in the extent and mean ranks of priority sites across the different geographic units; priority sites in the Te Paki geographic unit have by far the largest average size, followed by those in the Aupouri and Western Northland geographic units; Western Northland contains the largest single priority site, and its sites have the lowest mean ranks (highest numerical values). Priority sites in the Eastern Northland unit have the smallest average size but highest mean ranks (lowest numerical values), reflecting at least in part its inclusion of several very highly ranked off-shore islands; those in the Kaipara unit are only a little larger on average and have slightly lower mean ranks.

As a consequence of these differences, priority sites occupy the greatest proportion of the landscape in the Te Paki unit, followed by the Aupouri and Western Northland units; Eastern Northland has the lowest proportional representation, reflecting its high degree of clearance. The Kaipara unit also has relatively low proportional representation, but its sites are somewhat larger on average than in Eastern Northland.

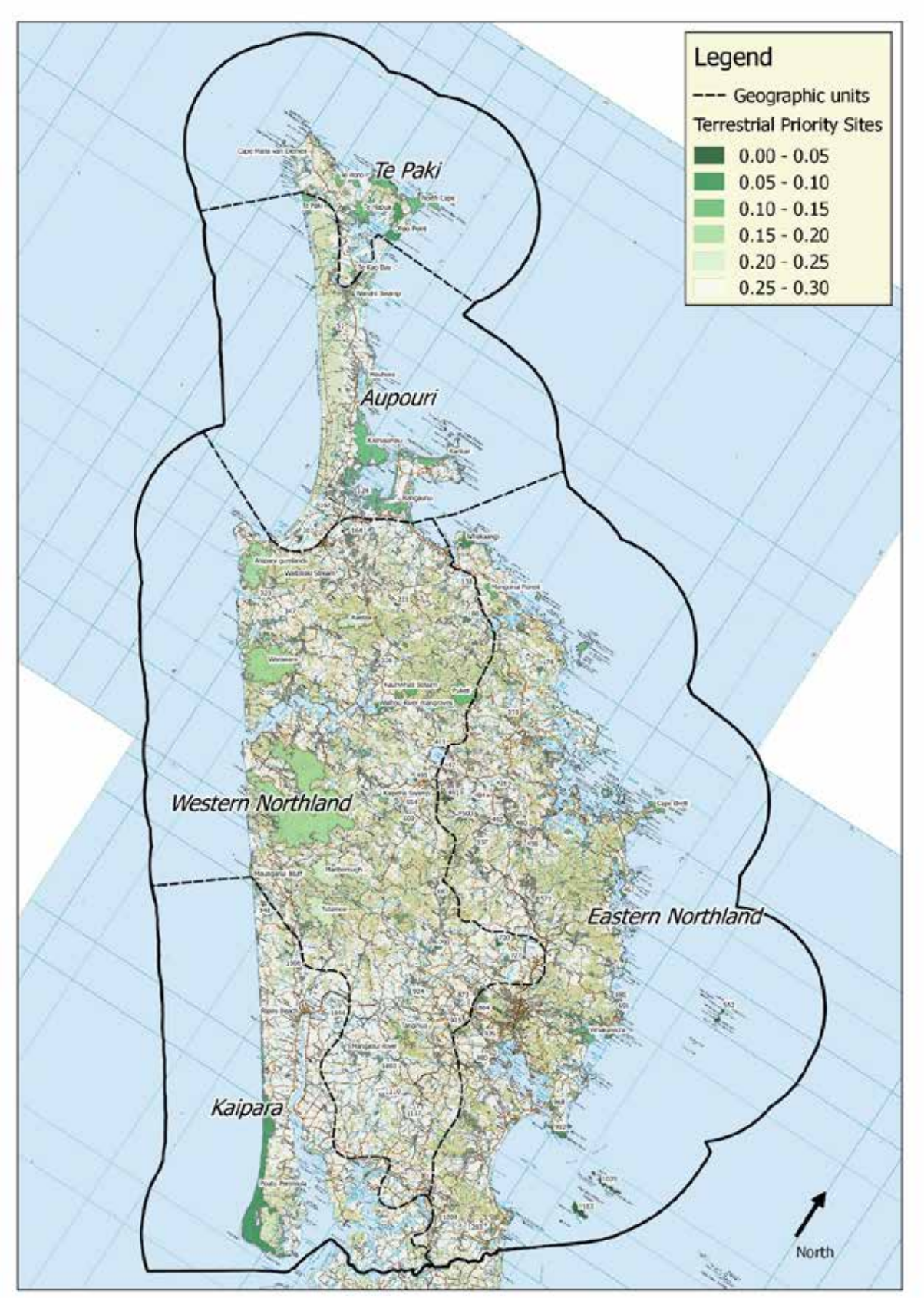


Figure 6. Terrestrial biodiversity priority sites for the Northland Region, i.e., indigenous dominated ecosystems within the top 30% of sites regionally, chosen for their ability to represent a full range of terrestrial ecosystems. Named units are greater than 500 ha in extent, while numbered units are of intermediate size (50–500 ha), but are ranked within the top 10% of sites regionally.

Terrestrial priority sites by geographic unit

Starting in the north of the Northland Region, the **Te Paki** geographic unit contains 29 priority sites that together contain a little over 10,000 ha, or just over 26% of the unit. Six of these exceed 500 ha in size, all of which are dominated by coastal ecosystems, although with some important additional features. In order of decreasing size they are as follows:

- The diverse *North Cape* priority site (#1, 3012 ha, mean rank – 0.111) is located in the far north-east of the Te Paki unit, stretching from North Cape in the east, around the northern coast to Tom Bowling Bay and then to Ngataea or Hooper Point. Although its historic cover was predominantly pohutukawa, puriri, broadleaved forest (WF4), around three-quarters of this has now been replaced by secondary manuka and/or kanuka. The most distinctive ecosystem of this site is the area of pohutukawa, tanekaha forest/scrub/rockland (UM1) that occupies a small area of ultramafic substrates around the de Surville Cliffs; this the only occurrence of this ecosystem in New Zealand. Elsewhere, pohutukawa, treeland/flaxland/rockland (CL1) occurs on cliffs along the north coast; spinifex, pingao grassland/sedgeland (DN2) occurs on dunes at Tom Bowling Bay and Waikuku Beach; small areas of moderately fertile wetland occur on valley floors in the east; *Hebe*, whahariki flaxland/rockland occupies cliffs around the high point The Pinnacle in the west; and two patches of totara, kanuka, broadleaved dune forest (WF5), along with a mosaic of bog and fen wetlands and manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1) occupy the older dunes that lie between Tom Bowling Bay and Waikuku Beach.
- The *Te Hapua* priority site (#9, 1818 ha, mean rank – 0.123), which is located on the western shores of Parengarenga Harbour, contains a mix of secondary forest (33%) and wetland ecosystems (66%). Its original primary forest cover across much of the hill-country was kauri, podocarp, broadleaved forest (WF11), but this has now been almost completely replaced by secondary manuka and/or kanuka forest; other hill-country sites support manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1). Extensive mangrove forest and scrub (SA1) occurs in sheltered embayments and inlets, fertile swamps (WLS) occur on some valley floors, and oioi restiad rushland/reedland (WL10) occurs north of Te Hapua; a small area of kahikatea, pukatea forest (WF8) is predicted to have occurred on poorly drained alluvium near the township, but this site now supports secondary manuka and/or kanuka.
- The *Ohao Point* priority site (#14, 1752 ha, mean rank – 0.087) encompasses an area of gently sloping terrain on sandstone and mudstone that stretches north from Ohao Point to the Taumataroa Flat, reaching a maximum elevation of around 160 m. Manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1) or gumland, is the most the widespread ecosystem; small areas of kauri, podocarp, broadleaved forest (WF11) occur locally on steeper sites, but comprise only 3% of the total area. Sites on dunes support a mix of totara, kanuka, broadleaved forest (WF5) and spinifex, pingao grassland/sedgeland (DN2), while an extensive swamp/fen mosaic occupies a basin flowing into the Ponaki Stream.
- The *Te Horo* priority site (#12, 1034 ha, mean rank – 0.130) consists of three small, coastal catchments on volcanic and sedimentary substrates that flow into Te Horo Bay. Historically, these supported a mix of coastal pohutukawa, puriri, broadleaved forest (WF4) and kauri, podocarp, broadleaved forest (WF11) on hillslopes, with smaller areas of puriri, totara forest (WF7-1) on recent soils; however, these have now been largely replaced by secondary manuka and/or kanuka. Extensive wetlands occur on the valley floors, the largest of which is the Paranoa Swamp. Small areas of totara, kanuka, broadleaved dune forest (WF5) and

more extensive spinifex, pingao grassland/sedgeland (DN2) occur on the coastal dunes. The very highly ranked Waitahora Lagoon is located in the northwest of this unit.

- The *Cape Maria van Diemen* priority site (#7, 706 ha, mean rank – 0.207) is located in the northwest of the Te Paki unit, encompassing an area dominated by wind-blown sand, but with smaller areas of outcropping basalt near the west coast. It contains an approximately equal mix of secondary forest, wetland, coastal non-forest ecosystems, and bare surfaces. Coastal pohutukawa, puriri, broadleaved forest (WF4) was once the most dominant forest ecosystem, but the sites that it once occupied now predominantly support manuka and/or kanuka, or secondary broadleaved forest; coastal pohutukawa, treeland/flaxland/rockland (CL1) occurs on some of the headlands. Spinifex, pingao grassland/sedgeland (DN2) is extensive, with dunes occurring nearly two km in from the coast. An extensive swamp/fen mosaic occurs along the Te Werahi Stream.
- The *Te Kao Bay* priority site (#30, 662 ha, mean rank – 0.192) stretches along both sides of the southernmost arm of the Parengarenga Harbour, encompassing a mix of coastal and marine sediments, with some sedimentary rocks. Wetlands form the predominant ecosystem cover, with mangrove forest and scrub (SA1) extensive below the high tide mark, and manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1) widespread on the surrounding, gently sloping hillsides. Kahikatea, pukatea forest (WF8) is predicted to have once occurred on the valley floor in the Ngakarapu Stream on a site now supporting wetland. A small area of spinifex, pingao grassland/sedgeland (DN2) occurs in the northeast at the base of Kokota or The Sandspit.

Moving south, the larger **Aupouri** geographic unit contains 107 priority sites containing 16,828 ha, or 16.8% of the unit. Six of these exceed 500 ha in size, all of which are dominated by coastal and/or wetland ecosystems. In order of decreasing size they are as follows:

- The *Kaimaumau* priority site (#82, 5998 ha, mean rank – 0.114) is not only the largest, but also the highest ranked of the larger priority sites in the Aupouri unit, i.e., those that exceed 500 ha in extent. The core of the site consists of the extensive wetlands of low to intermediate fertility that occupy an area of older dunes between Houhora Harbour in the north and Rangaunu Harbour in the south, and that are variously known as the Waihuahua or Motutangi Swamp; it also includes extensive areas of mangrove forest and scrub (SA1) along the western margins of the Rangaunu Harbour south to the mouth of the Awanui River; together these saline and freshwater wetlands comprising around 72% of the total area. Spinifex, pingao grassland/sedgeland (DN2) occupies the youngest dunes along the Ngarui-o-te-Marangai Beach, with totara, kanuka, broadleaved forest (WF5) on more stable younger dunes. Small inland areas in the southwest near Paparore were once occupied by kauri, podocarp, broadleaved forest (WF11) but now support manuka and/or kanuka, along with manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1).
- The *Rangaunu* priority site (#101, 3418 ha, mean rank – 0.126) lies immediately to the east of the Kaimaumau priority site, occupying the eastern shores of Rangaunu Harbour north of the mouth of the Awanui River, and then across the base of the Karikari Peninsula to Tokerau Beach. Wetlands comprise 93% of the site; sheltered sites with saline influence in Rangaunu Harbour are dominated by extensive areas of mangrove forest and scrub (SA1), while sites on the Karikari Peninsula support a mix of wetlands of low to moderate fertility and manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1); spinifex, pingao grassland/sedgeland (DN2) occurs on the younger dunes along Tokerau Beach. Kauri, podocarp, broadleaved forest (WF11) and kahikatea, pukatea forest (WF8) once occupied

small areas in the south, but these now support secondary manuka and/or kanuka or broadleaved indigenous hardwoods.

- The *Karikari Peninsula* priority site (#73, 1435 ha, mean rank – 0.140) is centred on the north-facing Karikari Beach, but also includes areas in the northeast towards Cape Karikari. Wetlands comprise over 70% of the site, consisting of a mix of manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1) and freshwater wetlands of low to intermediate fertility. Extensive spinifex, pingao grassland/sedgeland (DN2) occurs on dunes along Karikari Beach, with smaller areas in Maitai and Waipapa Bays. A small area of kauri, podocarp, broadleaved forest (WF11) survives at the northern end of Maitai Bay, while pohutukawa, treeland/flaxland/rockland (CL1) and a small area of ice plant, glasswort herbfield/loamfield (SA7) occurs around Matawherohia Point. Alteration of the natural drainage has resulted in the creation of extensive areas of open water adjacent to Matai Bay Road.
- The *Te Paki* priority site (#18, 1383 ha, mean rank – 0.134) is located at the northern end of Ninety Mile Beach/ Te Oneroa-a-Tohe. Nearly 75% of the unit supports dunes, mostly spinifex, pingao grassland/sedgeland (DN2), with some oioi, knobby clubrush sedgeland (DN5), and with extensive areas of non-vegetated sand-field. Inland parts of the unit once supported kauri, podocarp, broadleaved forest (WF11), but manuka and/or kanuka now dominates these sites. Other inland sites support areas of manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1) and infertile wetland (WLB), while patches of totara, kanuka, broadleaved forest (WF5) occur along the Kauaeparaoa Stream.
- The *Wairahi Stream* priority site (#41, 975 ha, mean rank – 0.152) is a convoluted site located on extensive, low elevation dunes near Te Kao. It is dominated by freshwater wetlands of varying nutrient status, located along the Wairahi Stream and its tributary the Ngatahinga Stream. More elevated sites support manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1), and better drained older dunes support totara, kanuka, broadleaved forest (WF5), while younger coastal dunes support spinifex, pingao grassland/sedgeland (DN2). Two small inland sites once supported kauri, podocarp, broadleaved forest (WF11) and kahikatea, pukatea forest (WF8), but these have been replaced by manuka and/or kanuka and freshwater wetland respectively.
- The *Houhora* priority site (#62, 830 ha, mean rank – 0.163) is located at the head of the Houhora harbour, extending to Otaipango/Henderson Bay on the outer east coast. Wetlands form the predominant ecosystem cover (>70%), with mangrove forest and scrub (SA1) the most extensive; smaller areas are occupied by freshwater wetlands of moderate to high nutrient status. Manuka, gumland grass tree, Machaerina scrub/sedgeland (WL1) and totara, kanuka, broadleaved forest (WF5) occupy small areas on older dunes near the township of Houhora, while younger dunes on the outer coast support spinifex, pingao grassland/sedgeland (DN2). Small remnants of pohutukawa, puriri, broadleaved forest (WF4) occupy steep hillslopes at Granville Point, and some kauri, podocarp, broadleaved forest (WF11) survives in the southeast on the Houhora Peninsula.

A further three priority sites in the Aupouri Unit are of small to intermediate size (10–500 ha), but have rankings that place them within the top 10% of sites regionally. They include areas of dunes supporting totara, kanuka, broadleaved forest (WF5) and wetlands surrounding Lake Half, west of Lake Ngataki (#51), a small area of wetland along the Sweetwaters Access Track to Lake Rotoroa (#167), and an extensive area of wetland, along with small fragments of puriri, totara forest (WF7-1) on sandy and peat soils west of Kaitaia (#207).

The very large **Western Northland** geographic unit contains 548 priority sites comprising nearly 70,000 ha, or 11% of the unit. Fourteen of these exceed 500 ha in size, of which most are dominated by forest ecosystems, the majority of which are located on steeper volcanic uplands. In order of decreasing size they are as follows:

- The *Waipoua-Mataraua-Waima* priority site (#573, 25,491 ha, mean rank – 0.155), which consists of much of the Waipoua, Mataraua, and Marlborough Forests, is the largest single site in the whole of Northland. It is located mostly on volcanic substrates and extends over a wide elevation range, i.e., from sea level on the coast at the mouth of the Waimamaku River to 781 m on Te Raupua in Waima Forest. Primary forest provides by far the dominant ecosystem cover (94%), the balance consisting of small areas of secondary forest, wetland, and minor occurrences of coastal dunes. Kauri, conifer, broadleaved forest (WF11), with smaller areas of pure kauri forest (WF10), is most widespread at lower elevations in the west; small areas of WF11 also occur at the western end of Waima Forest. At middle elevations, these give way to taraire, tawa, podocarp forest (WF9) and tawa, kohekohe, rewarewa, hinau, podocarp forest (WF13), with the latter generally at higher elevations than the former. High elevation sites, e.g., on the high plateau in Mataraua Forest and the high points in Waima Forest, support rimu, towai forest (MF24). Secondary manuka and/or kanuka is largely restricted to low elevation sites in the west, while the most leached and infertile soils support manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1). Spinifex, pingao grassland/sedgeland (DN2) occupies the youngest dunes along the coast.
- The *Warawara* priority site (#409, 9063 ha, mean rank – 0.157) consists of an elevated basalt plateau with elevations reaching over 700 m, located on the west coast between the Hokianga and Whangape Harbours. Extensive areas of gently rolling country are located on the high elevation plateau, but very steep terrain occurs around the plateau margins and along the larger streams that drain it. Forest forms the predominant ecosystem cover, comprising 85% of the unit; taraire, tawa, podocarp forest (WF9) is the most widespread forest ecosystem, with smaller areas of tawa, kohekohe, rewarewa, hinau, podocarp forest (WF13). An area of kauri, conifer, broadleaved forest (WF11) is located on steep hillslopes in the south, with smaller patches on ridges in the north-west; southern parts of the plateau support pure kauri forests (WF10), with extensive areas still little modified by logging. Small patches of coastal pohutukawa, puriri, broadleaved forest (WF4) are located along the coast, along with areas of secondary manuka and/or kanuka, and spinifex, pingao grassland/ sedgeland (DN2) on the younger dunes. Secondary manuka and/or kanuka also occurs on the northern slopes running down to the coast, where it merges into mangrove forest and scrub (SA1) in the Whangape Harbour. This pattern is repeated in the south-east, where the unit extends down the Whakarapa River to the Hokianga Harbour; kahikatea, pukatea forest (WF8) also is predicted to have once occurred here on a site in the Waireia Creek, but this now supports freshwater wetland.
- The *Ahipara Gumlands* priority site (#261, 4581 ha, mean rank – 0.179) is located on the west coast south of Tauroa Point, comprising an area of extensive, low-relief older dunes, along with steeper terrain formed on basalt. It contains an approximately equal mix of primary forest (28%), secondary forest (32%) and wetland (36%), with the balance comprising coastal dunes (DN2). Kauri, podocarp, broadleaved forest (WF11) is the dominant surviving forest ecosystem, occurring mostly on the dissected basalt terrain; a smaller area of taraire, tawa, podocarp forest occurs in the north; areas of secondary manuka and/or kanuka occupy once forested sites in many of the gullies. Areas of flatter

terrain on the older dune surfaces are occupied by manuka, gumland grass tree, *Machaerina* scrub/sedgeland (WL1).

- The *Tutamoe* priority site (#848, 3167 ha, mean rank – 0.212) comprises an area of primary forest located on the Tutamoe Range, the southernmost extremity of the elevated basalt plateau that elsewhere stretches northward to Waipoua and beyond. Taraire, tawa, podocarp forest (WF9), along with smaller areas of kauri, podocarp, broadleaved forest (WF11), dominates on the lower slopes around the plateau sides, while tawa, kohekohe, rewarewa, hinau, podocarp forest (WF13) is the predominant cover on the steeper upper slopes. Rimu, towai forest (MF24) occupies the flat terrain of the plateau, which reaches an elevation of 770 m; this is the most extensive area of this ecosystem in the whole of Northland. Very small areas of secondary manuka and/or kanuka occur in the southeast.
- The *Marlborough* priority site (#781, 2648 ha, mean rank – 0.218) is closely similar in character to the Tutamoe Priority Site to the south (#848), also comprising an area of primary forest on an elevated basalt plateau. Taraire, tawa, podocarp forest (WF9) is dominant at lower elevations, tawa, kohekohe, rewarewa, hinau, podocarp forest (WF13) occupies the midslopes, and rimu, towai forest (MF24) occupies more gentle terrain at higher elevations.
- The *Puketi* priority site (#314, 1638 ha, mean rank – 0.140) contains the most extensive, unlogged stands of kauri in Puketi Forest, these being located on a mix of sedimentary and volcanic rocks in the upper part of the Waipapa catchment. Primary forest comprises more than 98% of the site, comprising a mix of kauri, podocarp, broadleaved forest (WF11), mostly on lower slopes, and pure kauri forest (WF1), mostly on broad upper ridge sites. A small area of manuka and/or kanuka forest is located on the eastern boundary of the site.
- The *Raetea* priority site (#305, 1525 ha, mean rank – 0.228) is located along the basalt spine of the Maungataniwha Range, centred on the high point Raetea (744 m). Primary forest covers nearly 99% of the site, comprising approximately equal parts of taraire, tawa, podocarp forest (WF9) on lower slopes, and tawa, kohekohe, rewarewa, hinau, podocarp forest (WF13) on upper slopes. A small area of secondary manuka and/or kanuka occupies a site in the north that once supported kauri, conifer, broadleaved forest (WF11).
- The elongated *Maunganui Bluff* priority site (#849, 948 ha, mean rank – 0.154) is centred on the high point Maunganui (459 m), the western edge of the extensive Waipoua basalts that drops steeply into the Tasman Sea on its western side to form the Maunganui Bluff; at its southern end it includes dissected dunes and wetlands located south of the settlement of Aranga Beach. Primary forest occupies 32% of the site, comprising tawa, kohekohe, rewarewa, hinau, podocarp forest (WF13) on upper slopes, and pohutukawa, puriri, broadleaved forest (WF4) at lower elevations on the steep western slopes; the latter grade into pohutukawa treeland, flaxland, rockland (CL1) with progression to the coastal cliffs. Spinifex, pingao grassland/ sedgeland (DN2) occupies dunes at both end of the site, with the most extensive dunes occurring in the south, some of which consist of sandflats. Totara, kanuka, broadleaved forest (WF5) was once extensive on more inland parts of the southern dunes, but large areas of its former range now supports low producing grassland. Wetlands of moderate to high fertility occur in the middle reaches of the Waihaupai Stream. This is also a notable site for the distributions of a number of species of restricted range, including *Hebe speciosa, Leptinella rotundata*, and *Chionochloa bromoides*.
- The *Tangihua* priority site (#999, 918 ha, mean rank – 0.174) comprises an area of primary forest located on the elevated basalts of the Tangihua Range. Primary taraire, tawa, podocarp forest (WF9) extends across more than 98% of the unit, with a small area of kauri,

conifer, broadleaved forest (WF11) in the south; a small area of secondary broadleaved indigenous hardwoods occurs in the north.

- The *Lower Manganui River* priority site (#1074, 861 ha, mean rank – 0.140) is a convoluted site located on gently sloping lower hillslopes and floodplains along the lower reaches of the Manganui River, a major lowland tributary of the Wairoa River; it comprises an approximately equal mix of freshwater wetland (51%) and primary forest with some secondary stands (49%). The numerous primary forest fragments are principally kahikatea, pukatea forest (WF8) or kahikatea, puriri forest (WF7-3) on floodplain sites, with some kauri, conifer, broadleaved forest (WF11) on adjacent hillslopes. Extensive areas that once supported kahikatea-dominant forest (WF7-3, WF8) now support freshwater wetlands, while manuka and/or kanuka occupies a number of small areas that once supported kauri, conifer, broadleaved forest (WF11).
- The *Kaipeha Swamp* priority site (#553, 707 ha, mean rank – 0.150) is a convoluted area located southwest of Kaikohe that includes both the Kaipeha Swamp, its surrounding hillslope cover, and a number of primary and secondary riparian forest remnants along the Punakitere River and its tributaries. Wetlands of moderate to high nutrient status comprise nearly 40% of the unit, occurring entirely within the Kaipeha Swamp. Kauri, podocarp, broadleaved forest (WF11) once occupied the hillslopes surrounding and draining into the wetlands, but approximately two-thirds of these have been converted to secondary manuka and/or kanuka. Further downstream, stands of kahikatea, pukatea forest (WF8) occupy recent soils on the floodplain of the Punakitere River, with remnants of taraire, tawa, podocarp forest (WF9) occurring on the adjacent lower hillslopes. Further west are a number of small remnants of puriri, totara forest (WF7-1) and puriri, taraire forest (WF7-2); secondary stands of manuka and/or kanuka are scattered among these primary remnants.
- The *Waihou River mangroves* priority site (#380, 691 ha, mean rank – 0.077) contains an extensive area of Holocene river sediments in the lower reaches of the Waihou River that is dominated by extensive areas of mangrove scrub and forest (SA1). Two small areas of primary kauri, conifer, broadleaved forest (WF11) are located in the north on low ridges just west of Rangiahua, and a small area of kahikatea, pukatea forest survives adjacent to Rangiahua Road. Secondary manuka and/or kanuka occupies nearby sites, both on the alluvial flood plain (once WF8) and adjacent hillslopes (once WF11). An area in the north is predicted to have once supported kahikatea, pukatea forest (WF8), but now supports freshwater wetland.
- The *Waitotoki Stream Kauri* priority site (#306, 690 ha, mean rank – 0.201) consists of a single stream catchment on steep basalt hill-country at the western end of the Herekino Forest, extending over an elevation range from 20 to 460 m. Primary forest comprises nearly 97% of the site, consisting of a mix of kauri, podocarp, broadleaved forest (WF11), taraire, tawa, podocarp forest (WF9), and pure kauri forest (WF10). A small patch of secondary manuka and/or kanuka forest is located on the forest margin at the foot of the catchment.
- The *Kauriwhati Stream* priority site (#350, 670 ha, mean rank – 0.109) is located in the mid-reaches of the Kauriwhati catchment within Omahuta Forest, containing steep, sandstone hill-country. The site is entirely forested, containing a mix of kauri, conifer, broadleaved forest (WF11), along with a small enclave of kauri, conifer, broadleaved, beech forest (WF12).

A further thirty-nine priority sites in the Western Northland Unit are of small to intermediate size (10–500 ha), but have rankings that place them within the top 10% of sites regionally. Many of these

contain smaller forest remnants, including surviving patches of puriri, totara forest (WF7-1 – #'s 138, 554, 600, 727, 846); puriri, taraire forest (WF7-2 – #'s 164, 206, 218, 236, 495, 554, 873, 914, 915, 924, 984); kahikatea, puriri forest (WF7-3 – #'s 164, 554, 889, 915, 924, 1110, 1117); kahikatea, pukatea forest (WF8 – #'s 377, 495, 924, 1110); taraire, tawa, podocarp forest (WF9 – #'s 554, 651, 924); kauri, podocarp, broadleaved forest (WF11 – #'s 138, 164, 180, 221, 278, 316, 326, 377, 411, 461, 495, 554, 565, 600, 626, 662, 683, 709, 790, 846, 889, 915, 924, 1110, 1117) and rimu, towai forest (MF24 – #651).

Wetlands are dominant in a smaller number of these high priority but less extensive sites, including swamps (WLS – # 454), and bog/fen mosaics (WLBF – #'s 411, 706, 720, 7270). Mangrove forest and scrub (SA1) occurs in three of these smaller, high priority sites (# 323, 326, 347), and *Hebe*, whahariki flaxland/rockland (CL6) occurs in one site (# 180).

The large **Eastern Northland** geographic unit contains 460 priority sites comprising over 24,000 ha, or 6.4% of the unit. In marked contrast to Western Northland, only four of these exceed 500 ha in size. In order of decreasing size they are as follows:

- The *Whakareora* priority site (#735, 1709 ha, mean rank – 0.130) is centred on greywacke hill-country in the lower parts of the Ngunguru and Horahora Rivers, approximately 15 km northeast of Whangarei, with its name taken from a high point on the coast between the two river mouths. Its rather convoluted shape encompasses a mix of primary forest (58%), secondary forest (21%) and wetland (18%), with small areas of coastal ecosystems. Kauri, podocarp, broadleaved forest (WF11) is the dominant forest ecosystem, although pohutukawa, puriri, broadleaved forest (WF4) occurs on coastal sites. Sites where forests have been cleared are now mostly occupied by manuka and/or kanuka. A mosaic of kahikatea, pukatea forest (WF8) and fertile freshwater wetland (WLS) is predicted to have once occupied several sites on poorly drained valley floors, but these sites now support only wetlands. Spinifex, pingao grassland/sedgeland (DN2) occurs on a sandspit on the southern side of the mouth of the Ngunguru River; totara, kanuka, broadleaved forest (WF5) also once occurred here but has been replaced by low producing grassland. Extensive areas of mangrove forest and scrub occupy sheltered sites with saline influence in the lower reaches of both rivers.
- The *Whakaangi* priority site (#111, 744 ha, mean rank – 0.081) is centred on a volcanic cone (basalt and gabbro) located immediately to the north of Mangonui Harbour. Its original ecosystem cover consisted of kauri, podocarp, broadleaved forest (WF11) at lower elevations, this giving way to kauri, podocarp, broadleaved, beech forest (WF12) around the summit where the elevation reaches 335 m. Most of this forest has been modified, resulting in a dominance now of manuka and/or kanuka, which accounts for 96% of the site; a few small, surviving primary forest remnants are located in the northeast around Taemaro Bay. A small area there, once occupied by pohutukawa, puriri, broadleaved forest, now supports low producing grassland.
- The *Cape Brett* priority site (#256, 535 ha, mean rank – 0.109) is located in the northeast of the Eastern Northland Unit, comprising the steep greywacke terrain of the narrow headland that culminates in Cape Brett and Otuwhanga Island. Although primary coastal pohutukawa, puriri, broadleaved forest (WF4) is extensive (43%), large areas that once supported this ecosystem now support secondary cover of manuka and/or kanuka (33%). Pohutukawa, treeland/flaxland/rockland (CL1) occurs on the extensive, steep, coastal cliffs, and a small area of ice plant, glasswort herbfield/loamfield (SA7) is mapped on Otuwhanga Island.

- The *Mangonui Forest* priority site (#134, 526 ha, mean rank – 0.124) is located at the western end of the Mangonui Forest, and includes the high point Akatere (377 m) formed from volcanic breccia. Primary forest forms the dominant ecosystem cover, consisting of a mix of kauri, podocarp, broadleaved forest (WF11) in the east, and taraire, tawa, podocarp forest (WF9) in the west. Small areas of secondary manuka and/or kanuka occur on the northern flanks, and several cliffs on the southern and eastern sides of Akatere support *Hebe*, whahariki flaxland/rockland (CL6).

A further twenty-five priority sites in the Eastern Northland Unit are of small to intermediate size (10–500 ha), but have rankings that place them within the top 10% of sites regionally. Three of these are offshore islands, i.e., the Poor Knights Islands (#552), Marotere Islands (#1039), and Taranga Island (#1103), all of which have rankings that place them within the top 1-2% of sites regionally, reflecting their pest-free status. A site centred on Ngawha Springs (#491) contains distinctive wetland ecosystems (and lakes) with geothermal influence that rank within the top 4% of sites regionally. Other sites contain remnants of more widespread ecosystems, including wetlands (site #s 416, 480, 491, 500, 537); coastal pohutukawa, puriri, broadleaved forest (WF4 – #s 467, 680, 992); puriri, totara forest (WF7-1 – #s 926, 571, 1203, 1209); puriri, taraire forest (WF7-2 – #s 484, 492, 864, 1209); kahikatea, puriri forest (WF7-3 – #s 492, 498, 500, 537, 571); kahikatea, pukatea forest (WF8 – #s 273, 416, 926, 980); taraire, tawa, podocarp forest (WF9 – #s 178, 447, 864), and kauri, podocarp, broadleaved forest (WF11 – #s 178, 447, 491, 498, 500, 537, 571, 968, 980, 1203, 1209); pohutukawa treeland/flaxland/rockland (CL1 – #s 680, 992); and *Hebe*, whahariki flaxland/ rockland (CL6 – # 968).

The **Kaipara** geographic unit contains 149 priority sites comprising nearly 12,000 ha, or 8.2% of the unit. Only two of these exceed 500 ha in size. In order of decreasing size they are as follows:

- The extensive and highly ranked *Poutu Peninsula* priority site (#1190, 8077 ha, mean rank – 0.096) is located around the western and southern sides of the Poutu Peninsula, an extensive area of dunes along the west coast that that encloses the Kaipara Harbour. It comprises a mix of modified forest (43%), wetland (24%) and non-forest, coastal ecosystems (32%). Younger dunes along the western side of the Peninsula support spinifex, pingao grassland/sedgeland (DN2) with extensive sandfields, and some oioi, knobby clubrush sedgeland (DN5). More stable dunes further back from the beach support extensive totara, kanuka, broadleaved forest (WF5), although large areas, particularly in the north, have been replaced by low producing grassland. An extensive area of fertile wetland occurs in the southern half of the site, lying adjacent to a number of dune lakes, the largest of which is Lake Mokeno. Smaller dune lakes occur further to the north.
- The *Ripiro Beach* priority site (#1089, 543 ha, mean rank – 0.109) consists of a narrow coastal fringe that extends from Baylys Beach in the north to just south of Glinks Gully. It supports a mix of duneland, sandflats and secondary cover; totara, kanuka, broadleaved forest (WF5) was once extensive on older dunes, but this ecosystem has been extensively modified, with much of the former range of this ecosystem now occupied by extensive sandflats. Spinifex, pingao grassland/sedgeland (DN2) is extensive on younger dunes.

A further three priority sites in the Kaipara Unit are of small to intermediate size (10–500 ha), but have rankings that place them within the top 10% of sites regionally. Two of these contain remnants of primary and secondary forest (WF8, WF11), one in the middle reaches of the Kaihu River (#1006) and one at the mouth of the Manganui River where it enters the Wairoa River (#1044). The third

contains wetlands along with secondary manuka and/or kanuka, including gumland, at the Kaiiwi Lakes.

River and stream ecosystems

The top-ranked 30% of rivers and streams identified from the Zonation analysis for the Northland Region (Fig. 7) contain 5523 km of rivers and streams (by length) out of the 29,632 km of rivers and streams mapped in the region; this comprises 8457 segments (by number) or 28.5% of all river and stream segments occurring within the Region (Table 9).

This set of top-ranked river and stream segments provides average representation of 66.4% across the 14 river and stream ecosystems occurring within the Region. However, as with the terrestrial ecosystems, levels of representation are inversely related to the number of river and stream segments occupied by the different ecosystems. River ecosystems occurring in only a few locations have very high levels of representation, this averaging 99.8% for those occurring in less than 100 segments. It declines to 61.9% for the five river ecosystems occurring in more than 100 but less than 1000 segments, and to 30.1% for the four river ecosystems occurring in more than 1000 segments; the lowest representation (18.9%) is provided for river ecosystem A1, which accounts for more than 5600 km of river and stream segments, or more than 30% of the regional river and stream network. The next two most widespread river and stream ecosystems, A3 and C4, receive somewhat higher levels of representation at 26.6% and 29.6% respectively.

Table 9. River ecosystems of the Northland Region, their length, mean condition, and representation in the top 30% of sites regionally, based on an integrated regional prioritisation.

River	All Rivers			Top 30%		
Ecosystem	Count	Length (km)	Condition	Count	Length (km)	%
A1	8880	5,605	0.262	1545	1,058	18.9
A2	2445	1,548	0.221	1126	699	45.2
A3	5911	3,581	0.325	1510	952	26.6
A4	261	165	0.309	236	152	92.6
B1	87	57.0	0.216	87	56.9	99.8
C1	216	141	0.649	205	140	98.8
C4	5598	3,456	0.385	1515	1,024	29.6
C5	2592	1,645	0.509	680	431	26.2
C6	2340	1,484	0.362	772	487	32.8
C7	65	34.3	0.645	64	34.0	99.3
C8	1229	816	0.466	709	484	59.3
C10	6	1.8	0.712	6	1.8	100.0
C11	1	1.0	0.651	1	1.0	100.0
C12	1	1.0	0.692	1	1.0	100.0
Total/average	29632	18406.0	0.337	8457	5,523	30.0

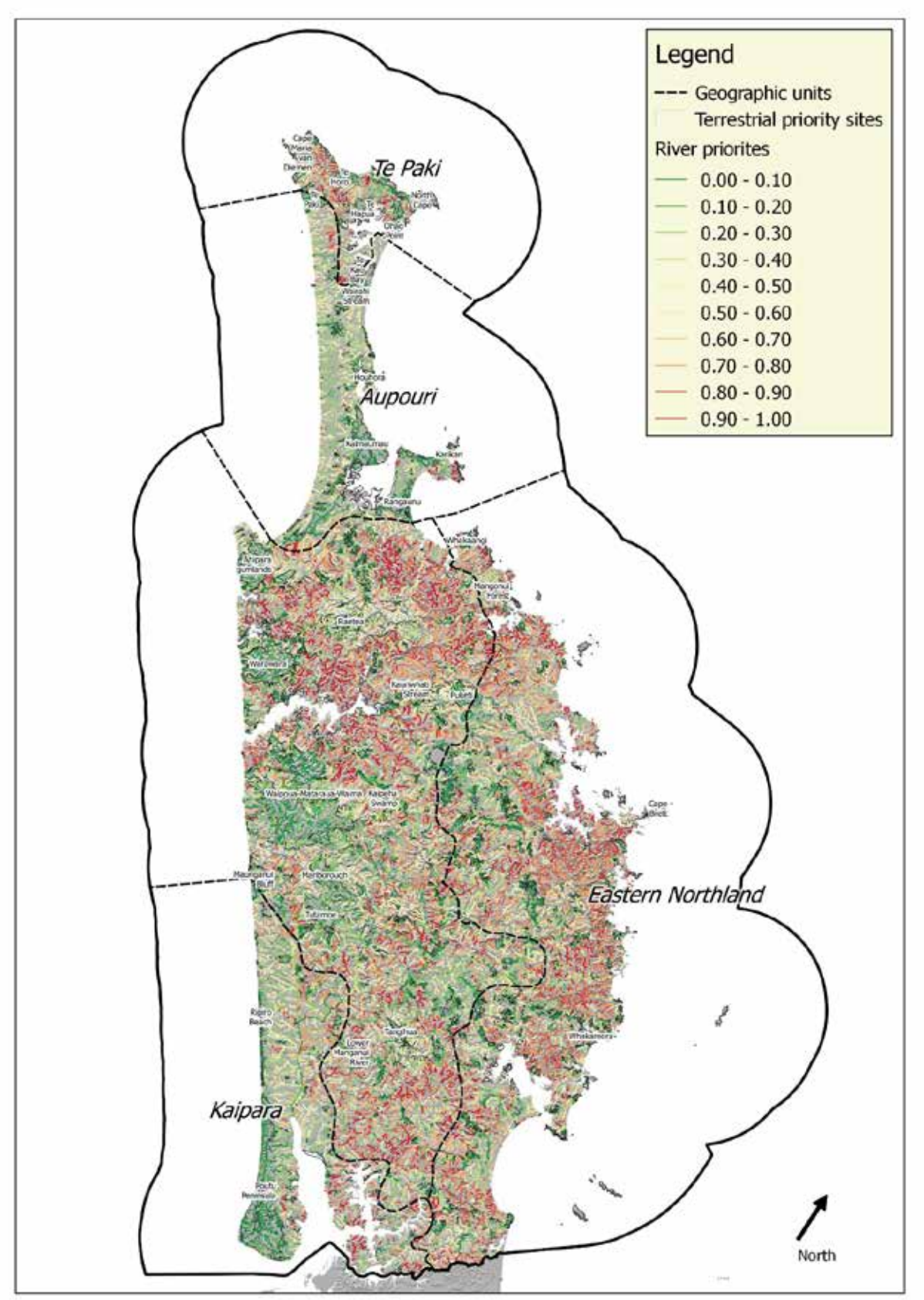


Figure 7. Indigenous biodiversity priorities for rivers and streams of the Northland Region, based on an integrated ranking designed to maximise representation of a full range of indigenous-dominated ecosystems. Outlines for terrestrial priority sites (top 30%) are also shown to highlight the correspondence between riverine and terrestrial priorities.

One important feature of the ranking analysis is that rankings for the different river and stream segments are influenced not only by their in-stream values, but also by their connectivity with terrestrial and lake ecosystems. As a consequence, many of the highly ranked river segments occur at the same locations as highly ranked terrestrial and/or lake ecosystems. This effectively minimises the redundancies that would occur if co-occurrences of high value terrestrial and riverine ecosystems were ignored when calculating site rankings, and should help encourage the implementation of management regimes that benefit both terrestrial and aquatic values in an integrated and holistic fashion.

Examples of this type of co-occurrence are widespread throughout Northland. For example, high ranked examples of the widespread river ecosystem, C5, occur along with high ranked terrestrial ecosystems in the Warawara and Waipoua-Mataraua-Waima priority sites (#'s 409 & 573). Similarly in the lowlands, highly ranked examples of river ecosystem A2 are directly associated with highly ranked wetland sites (#'s 720 & 727) in the headwaters of the Wairua River west of Hikurangi. Alternatively, some examples of widespread lowland stream ecosystems are highly ranked because they flow into high-ranked lakes, e.g., small streams (A1) flowing into Lake Omapere, or in the far north streams (C4) that flow into Waitahora Lagoon. Similar linkages are also evident for some high ranked terrestrial sites, including a number of streams classified as A2 that drain into the extensive, high ranked dune ecosystems along the Poutu Peninsula. Elsewhere, the linkages with terrestrial ecosystems are less obvious, with the need for connectivity along the river network also playing a role; for example, many of the high-ranked segments for the widespread, lowland river ecosystem, C4, are located along the main stems of the mid-sized rivers that drain more inland parts of Northland, including the Wairoa, Punakitere, Waitangi and Awanui Rivers; these connected sets of river segments play an important role in providing longer range connectivity both with headwater stream ecosystems, and with high ranked terrestrial remnants or lakes distributed along the river network.

Lake ecosystems

Interpretation of the ranking results for lakes is complicated both by their wide variation in size (as described above), and their discrete nature, i.e., individual lakes can generally only be managed in their entirety. A total of 88 lakes in the Northland Region fall within the top 30% of lakes *by number*, these comprising 59.2% of all lakes *by area* (Table 10). This includes nearly 28% of the most numerous geomorphic class (dune lakes), but a higher proportion of the other, less numerous lake groups. The exception to this trend is the volcanic lake group, for which only one lake, Lake Omapere, has been selected within the top thirty percent; however, while this lake makes up only 14% of all volcanic lakes by number, it accounts for over 90% of the total area of all volcanic lakes. Reservoirs have the lowest number of lakes falling within the top thirty percent, reflecting the weighting of zero that they were allocated in the ranking analysis, because of their artificial character. Inspection of the high ranked reservoirs in this category indicates that rather than having high biodiversity value, they are located in planning units that contain high value terrestrial or riverine sites. As a consequence of the connectivity settings applied in the analysis, these lakes cannot be given lower rankings without also allocating lower ranks to the other terrestrial and riverine features with which they share a planning unit.

Table 10. Lake ecosystems of the Northland Region, their occurrence, extent, condition, and representation in the top 30% of lakes regionally, by number, based on an integrated regional prioritisation.

	All lakes				Top 30%			
Geomorphic group	Count	Mean size	Total extent	Condition	Count	Percent	Total extent	Percent
Dune	183	10.0	1833.7	0.47	40	27.9	910.7	49.7
Geothermal	3	2.4	7.1	0.32	3	100.0	7.1	100.0
Riverine	31	2.7	82.8	0.29	23	74.2	70.9	85.6
Shoreline	5	7.9	39.6	0.47	5	100.0	39.6	100.0
Volcanic	7	191.0	1337.2	0.49	1	14.3	1205.7	90.2
Reservoir	66	7.4	488.4	0.32	5	7.6	7.5	1.5
Overall	295	12.6	3788.8	0.42	88	29.8	2241.5	59.2

DISCUSSION

Overall, the rankings described above provide a strongly evidence-based approach to assessment of the biodiversity value of all surviving indigenous-dominated terrestrial sites, and all lakes, rivers and streams in the Northland Region. The analytical approach used to produce these rankings is designed to maximise representation of a full range of biodiversity features, while focussing on those that are in the best condition and taking account of landscape-scale linkages between different biodiversity features, including between terrestrial and freshwater ecosystems. It also uses information describing the likely historic distributions of terrestrial ecosystems to guide the weighting of different ecosystems so that greater weightings are given to those that have been most reduced in extent since human settlement of these landscapes. However, given both the nature of the data used for this analysis, and the complex nature of the rankings themselves, care will be required in translating these rankings into practical decisions regarding future conservation management interventions.

Use of the rankings

In broad terms, the Zonation rankings are designed to identify the subset of sites at which an appropriate set of management actions (e.g., providing formal protection, controlling weeds or vertebrate pests, or establishing restoration or riparian plantings) could be implemented to produce maximum benefits for biodiversity. Its design assumes (i) that there are limits to the amount of such work that can be implemented, e.g., because of budget or resource limitations, so that only a subset of sites can be managed, (ii) that management actions are most effective when applied to a suite of related biodiversity features in larger, connected landscape patches, and (iii) that overall benefits for biodiversity will be maximised when these larger patches are selected to maximise the representation of a full range of biodiversity features (Margules & Pressey 2000, Wilson et al. 2009). This need for protection of sites representative of the full range of New Zealand's biodiversity is foundational to Goal Three of New Zealand's biodiversity strategy (Department of Conservation & Ministry for the Environment 2000 – pp. 18, 20 in particular).

As presented in this report, the rankings from the Zonation analysis indicate directly the proportion (or percentage) of all indigenous-dominated terrestrial sites (or all lakes and rivers) in the Northland Region that would be selected for management for that site to be included. That is, a ranking value of 0.1 for a site indicates that it would be included if management were to be applied to 10% of all sites in the Region; by contrast a site with a score of 0.2 would only be included when 20% of sites are to be managed. Sites to be managed are therefore typically found by identifying all of those with scores below some chosen threshold – a threshold of 0.3 or 30% of all sites, has been chosen in this

report for illustrative purposes, but a different threshold might be used for specific management purposes, depending on the goals and the resources available.

One potential source of difficulty that arises with this approach is if users attempt to assess the relative value of different sites within a selection that have been chosen using a particular ranking threshold. For example, once a decision has been made to apply management across the top 30% of a landscape, is a site with a ranking score of 0.1 'more valuable' than a site with a ranking score of 0.2? And are all components within a site of equal value? The answer to these questions is sometimes yes, and sometimes no, depending on the context.

When a biodiversity feature is rare, occurring in only one or a few places, perhaps because of highly specific environmental requirements, or because its former extent has been substantially reduced by clearance, Zonation will tend to allocate very high priorities to the sites where it occurs to ensure its representation, even when only a very small proportion of a landscape is to be managed. In this case, the high priorities allocated to (surviving) occurrences can be seen to reflect their irreplaceability, which makes them of high value. Examples of such sites can be found, for example, in the *Hebe*, whararikiflaxland/rockland (CL6) that occurs on bluffs at just a few sites (e.g., the Mangonui Forest priority site – #134, Akatere – #180, and Manaia – #968), and in the surviving remnants of the lowland kahikatea forests (WF7-3, WF8) that were once extensive on alluvial surfaces throughout Northland, but which have now been reduced to around 10% of their former extent.

However, when a biodiversity feature is more widespread, interpretation of the relative value of the sites at which it occurs is less straightforward. This is because Zonation attempts to maximise the representation of a full range of features throughout a full range of implementation choices, including when only a very small proportion of the landscape is to be managed. As a result, Zonation will allocate high priorities to at least some small sites containing widespread features to ensure that they are represented under a scenario when only minimal management is to be applied (e.g., < 5% of a landscape). By contrast, more extensive examples of these same widespread ecosystems, which can be expected to deliver a higher contribution to biodiversity protection when more of the landscape is to be managed, will likely have lower priorities. In this case, the lower priorities accorded to extensive sites does not reflect a lower value, but simply that Zonation has ranked smaller examples of these widespread ecosystems more highly to ensure their inclusion under scenarios where only a small part of the landscape is to be managed.

Finally, any assessment of the comparative biodiversity value of different patches within some chosen proportion of the landscape needs to also take account of the role that connectivity plays within the ranking process. That is, some biodiversity features will be allocated high rankings not so much because of their intrinsic value, but because of their landscape connectivity with adjacent biodiversity features that have high intrinsic value because of their condition or rarity. This includes, for example, patches of forest ecosystems that are widespread, but that play a particular role in protecting the catchments of high value lakes or river and stream segments. Conversely, some features that have high intrinsic value may have been allocated lower ranks because they are only very poorly connected with other features in the surrounding landscape.

Identification of both of these circumstance is easily achieved using the supplementary hierarchical ranking as shown in Figure 8. With connectivity considerations set aside, this ranking identifies areas of pohutukawa, tanekaha forest/scrub/rockland (UM1) on ultramafic rocks along the de Surville

Cliffs as having the highest *individual* priority (dark green) within this priority site. Similarly, surviving patches of pohutukawa, puriri, broadleaved forest (WF4) between North Cape and Tokatoka Point, and wetlands that occur both along several narrow valley floors and on inland parts of the older dunes between Waikuku Beach and Tom Bowling Bay are identified as having slightly lower intrinsic priority. By contrast, extensive areas just south of the ultramafic zone that once supported pohutukawa, puriri, broadleaved forest (WF4), but that now have a cover of secondary manuka and/or kanuka, are identified as having relatively low intrinsic priority (pale green). The inclusion of these secondary features within the top 30% of sites reflects the important role that they play in providing connectivity between adjacent higher value biodiversity features, while their proximity to primary forest remnants increases their chances of recovery of their original species complement compared to more isolated secondary stands elsewhere in the landscape.

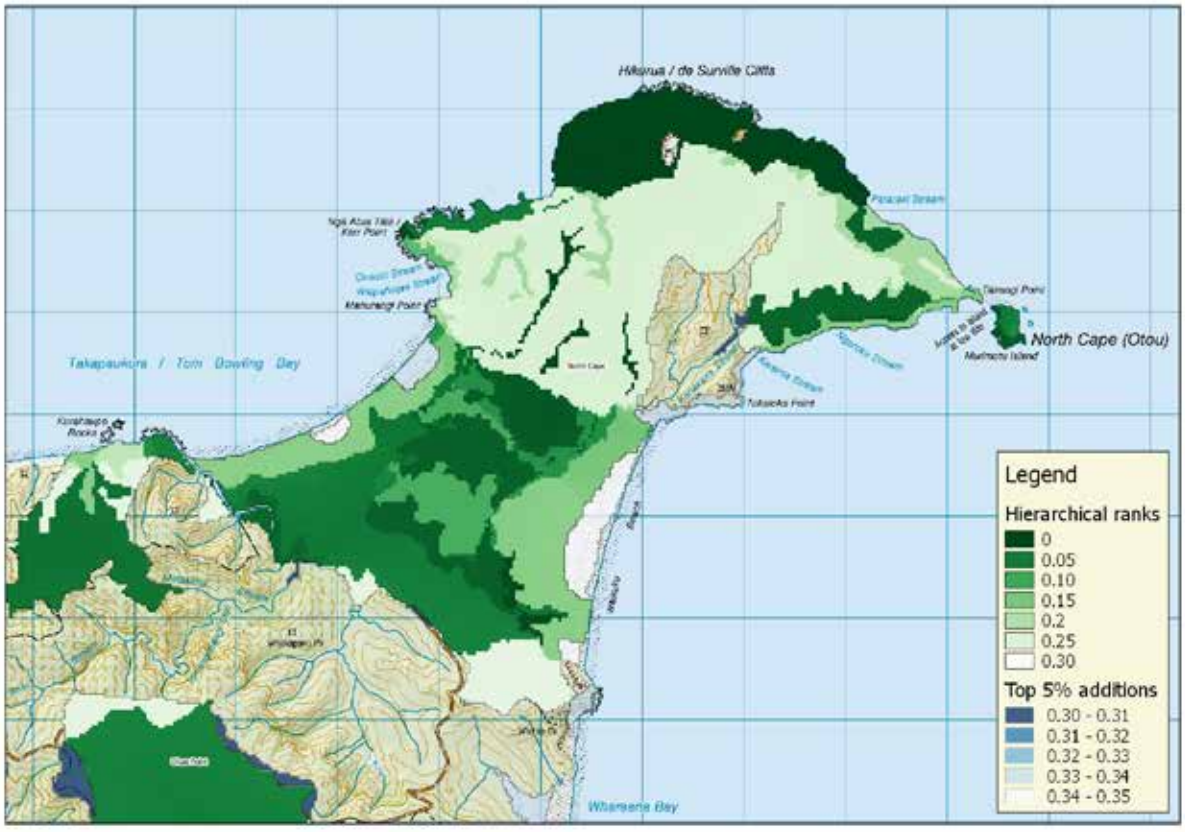


Figure 8. Hierarchical ranks for terrestrial features within the North Cape priority site (# 1). Rankings show the priority of terrestrial biodiversity features based solely on their representation of regional biodiversity features, i.e., ignoring connectivity considerations.

Conversely, blue polygons in Fig. 8 identify several biodiversity features that, while having a potentially strong contribution to representation as standalone features, fell outside the top 30% of sites in the main ranking because of their lower connectivity. Examples of this include a narrow wetland along the Te Kanakana Stream (north of Tokatoka Point), and areas of manuka, gumland grass tree, Machaerina scrub/sedgeland (WL1) around the margins of the Ohao Point priority site (lower left); all of these features are located in watershed planning units dominated by lower value biodiversity features, resulting in them receiving a lower ranking in the primary analysis.

Overall then, once a decision has been made to protect a certain proportion of a landscape based on the primary ranking, say 30%, care should be exercised when comparing relative values both *within* individual sites, and between sites contained in the chosen set. Highly distinctive biodiversity features can be readily identified from their high priorities in the supplementary hierarchical ranking. Conversely, widespread features and those whose rankings reflect mostly the important role played by their connectivity with other features (including lakes, rivers and streams) will generally have lower rankings in the supplementary hierarchical ranking. Finally, additional biodiversity features that have high intrinsic value but are poorly connected with other features can be identified from the additions layer that identifies the highest value features immediately outside the top 30% sites from the primary ranking; further gains may be possible through the management of some of these sites, provided that adequate provision can be made for any requirements that they may have for connectivity to larger managed sites.

In general, management of the full set of sites required to achieve the total managed area is the important goal, as this will ensure the maximising of overall biodiversity gains for the chosen level of management action. However, greater gains might be achieved by specifically targeting particularly high value features within some sites, or perhaps some high value features that are less well connected. Alternatively, greater gains might be made for a widespread ecosystem by focusing management into its more extensive surviving patches, and possibly even by choosing new extensive examples at the expense of a several smaller, but more highly ranked patches. However, care would need to be exercised with the latter approach to ensure that other considerations, such as differences in condition, or linkages with other ecosystems, are also taken into account.

Selecting a different threshold

Users of the rankings also need to be aware that should a decision be made to manage a different proportion of the landscape, e.g., the top 10% of sites as opposed to the top 30% of sites described above, then these sites must be identified from the continuous gridded priority layer, rather than by selecting the subset of the 30% polygons that have mean scores less than 0.1. While the latter approach is intuitively appealing, it will inevitably result in highly misleading outcomes, reflecting the strong local variation in rank that can occur *within* many of the individual priority sites, particularly those of larger size.

This is clearly apparent for the extensive priority site centred on Waipoua, Mataraua and Waima Forests (# 573 – Figure 9), which has an average rank of 0.155, but has marked local variation in ranks, i.e., between 0.002 and 0.30. Highest ranks (< 0.01) occur in the stands of dense kauri forest (WF10) in Waipoua Forest, but high values (< 0.1) also occur in the surrounding forests (WF9, WF11, WF13, MF24) that extend to high elevations in Mataraua and Waima Forests (red polygons in Fig. 9). If a decision to manage only the top 10% of sites regionally was implemented by selecting from the top 30% polygons those with mean ranks less than 0.10, then these high-ranked forests would be excluded in their entirety. By contrast, if the top 10% of sites were selected using the correct procedure of identifying all cells in the continuous gridded ranking layer with ranks of 0.10 or less, these high value sites would all be included.

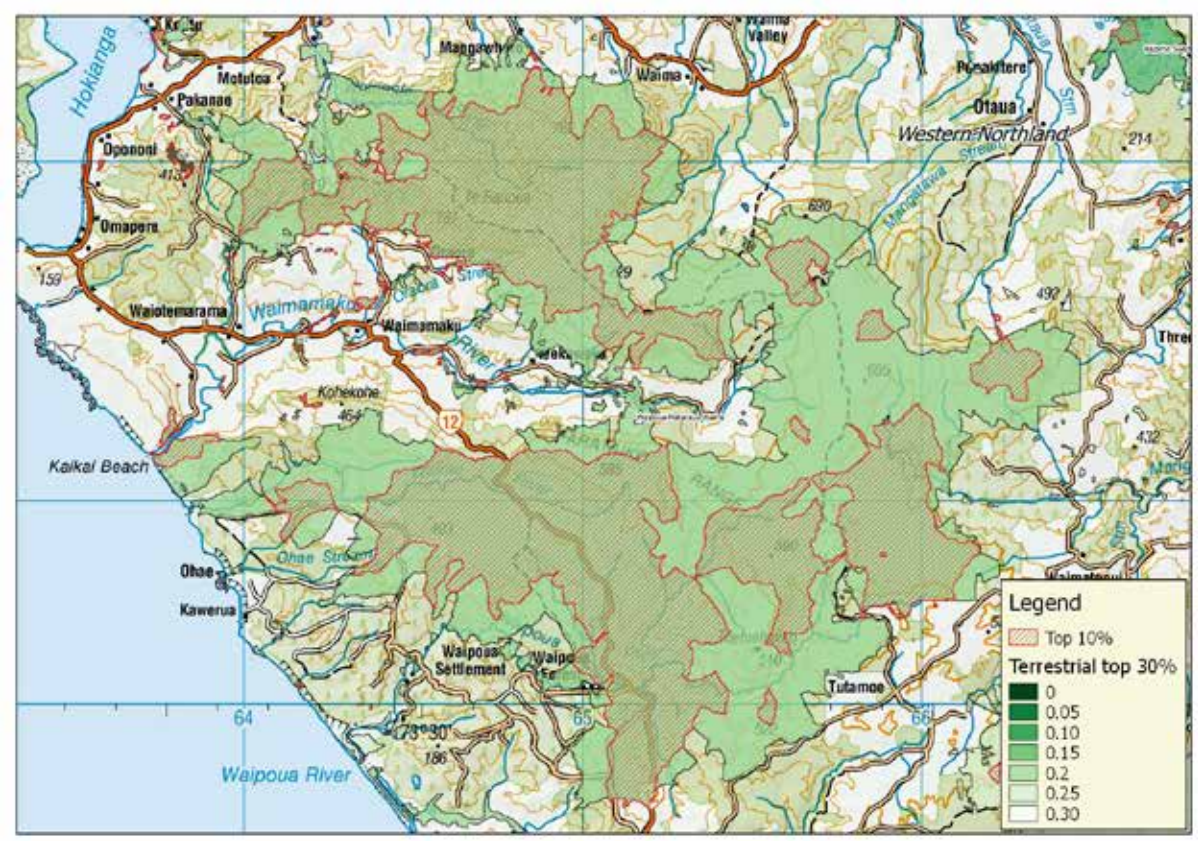


Figure 9. Variation in priority within the Waipoua-Mataraua-Waima priority site (# 573), which was identified using a query designed to identify all sites with priorities of 0.3 or higher (green polygons). The subset of sites that have ranks of 0.1 or higher are shown by red, cross-hatched polygons.

Scale and data limitations

The purpose of this analysis was to identify broad-scale priorities within a regional context, identifying those sites that provide representation of a full range of ecosystems, and comprising 30% of the Northland Region's surviving indigenous-dominated terrestrial ecosystems, lakes and rivers. Given the limited time within which this work was completed, it relied predominantly on existing, broad-scale descriptions of current and potential ecosystems patterns, much of which was derived from remote sensed imagery and expert interpretation of broad landscape patterns.

As a consequence, when interpreting the results, users need to remain aware of the desk-top nature of this analysis. In particular, the descriptions of priority sites are based on the potential ecosystem mapping layer, for which not all sites were able to be individually checked for composition. While this broad scale mapping data is well suited to the establishment of regional-scale patterns of protection that maximise representation of the regional biodiversity pattern, caution should be exercised when interpreting priorities assigned to individual ecosystem patches, lakes or river segments, particularly those that are modified and/or of limited extent. Here, field-checking of sites is recommended to verify the local accuracy of both the potential ecosystem and LCDB input data, supported by cross-checking with other information sources such as PNAP reports[7], before the rankings are used to guide management decisions.

[7] https://www.doc.govt.nz/about-us/science-publications/conservation-publications/land-and-freshwater/land/northland-conservancy-ecological-districts-survey-reports/

Including recent management effort

In the analysis described above the spatial distribution of highly ranked sites is influenced locally to a small degree by the estimates of gains in ecological condition made by recent management, as incorporated into the condition layer. Some might argue that this runs the risk that existing biodiversity projects will be given high priority, not so much because of the values that they protect, but because of the difference that has already been made at these sites. However, while priorities could be calculated without this information, such an approach is likely to be less effective overall for several reasons.

First, it ignores the potentially high economic and biodiversity costs of relocating major projects, including not only the costs of relocating project infrastructure, but also the gradual loss of biodiversity values at sites where management is ceased, and the likely delay in delivery of equivalent values at sites where new management is initiated. Second, it is likely that at least some existing managed sites were selected based at least in part on information describing the distributions of threatened species — information that has not been able to be included in this analysis (see below), but which would ideally also contribute to development of a more complete picture of priorities. Third, it is likely that the *overall, long-term* biodiversity benefits delivered from management of the top 30% of sites identified from analyses with and without management gains would be closely similar. This reflects the degree to which some of the sites currently receiving intensive management contain widespread ecosystems for which a range of spatial choices is possible, all giving broadly similar outcomes, i.e., relocating these projects to new sites identified from an analysis omitting management gains is unlikely to give major net benefits for the ecosystems that they contain, over and above those already being delivered by existing management projects.

Future improvements

While the rankings as currently calculated provide a robust initial prioritisation of native ecosystems for the Northland Region, two aspects of the analysis could potentially be strengthened or improved.

Threatened species data

First, data describing the distributions of threatened species would ideally have been included in this analysis, allowing the maintenance of a full complement of both the ecosystems *and species* of the Region in a healthy functioning state. However, while the inclusion of data describing the distributions of threatened species in Zonation analyses is technically very simple, and is widely practised in other countries, it is frustrated in New Zealand by difficulties in obtaining such data. This largely reflects the very significant degree to which New Zealand lags behind other western nations in our establishment of a centralised, national collection(s) of standardised information describing the distributions of our threatened species.

Linking with broader regional and national priorities

Finally, consideration should be given to how best to handle issues of scale and context, i.e., how would these regional-scale priorities compare with priorities calculated using the same data layers but analysed across the entire North Island, or even nationally? As for threatened species, such an analysis is technically feasible, but the lack of complete national coverage of potential ecosystem mapping presents a significant practical obstacle. If such an analysis were to be implemented, it is highly likely that some of Northland Region's biodiversity features would be given very high national

rankings, including the pohutukawa, tanekaha forest/scrub/rockland (UM1) at de Surville Cliffs, which have no counterpart elsewhere within New Zealand, and the dense kauri stands (WF10) of Waipoua Forest, which have been extensively modified almost everywhere else within their former range (WF10).

Significant gains would also be possible through more explicit consideration of work done by other agencies, and the Department of Conservation in particular. This is likely to become more feasible once the Department of Conservation completes its project designed to identify national priority sites for the protection of indigenous ecosystems (EMUs – Department of Conservation 2016). The value of including results from this national project in regional analyses is likely to be further increased by the Department's stated intention to incorporate information on the distributions of threatened species into its rankings (Department of Conservation 2016 – p. 12). Support for stronger integration between the Department of Conservation and regional councils is contained in a regional council-sponsored think-piece on the future of biodiversity management in New Zealand (Willis 2016). Successful implementation of such an approach can be reasonably expected to produce significant improvements both in the efficient use of scarce resources and in better outcomes for biodiversity both regionally and nationally (Parkes et al. 2017), provided that funding mechanisms are put in place to ensure that adequate funding is provided to protect sites identified as nationally significant.

REFERENCES

Auckland Council. 2012. Auckland Council's Indigenous Biodiversity Strategy. http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/plansstrategies/Councilstrategies/Documents/indigenousbiodiversitystrategy.pdf.

Brown, M.A. 2018. Transforming community conservation funding in New Zealand: a report prepared for the Predator Free New Zealand Trust. The Catalyst Group, Palmerston North.

Burns, B.R., Floyd, C.G., Smale, M.C., Arnold, G.C. 2011. Effects of forest fragment management on vegetation condition and maintenance of canopy composition in a New Zealand pastoral landscape. Austral Ecology 36: 153–166.

Christensen, N.L. et al. 1996. The report of the Ecological Society of America committee on the scientific basis for ecosystem management. Ecological Applications 6: 665–691.

Cieraad, E., Walker, S., Price, R., Barringer, J. 2015. An updated assessment of indigenous cover remaining and legal protection in New Zealand's land environments. New Zealand Journal of Ecology 39: 309–315.

de Winton, M., Kelly, D., Leathwick, J., Julian, K. 2008. Production of pressure estimates for New Zealand lakes. NIWA Client Report HAM2008–127 prepared for the Department of Conservation. NIWA, Hamilton.

Department of Conservation and Ministry for the Environment. 2000. The New Zealand Biodiversity Strategy: Our chance to turn the tide. Department of Conservation and Ministry for the Environment, Wellington.

Department of Conservation. 2010. Freshwater Ecosystems of New Zealand. Department of Conservation, Wellington. Available at http://www.doc.govt.nz/our-work/freshwater-ecosystems-of-new-zealand/.

Department of Conservation 2016. Statement of Intent 2016–2020. Department of Conservation, Wellington.

Dymond, J.R., Shepherd, J.D., Newsome, P.F., Belliss, S. 2017. Estimating changes in areas of indigenous vegetation cover in New Zealand from the New Zealand Land Cover Database (LCDB). New Zealand Journal of Ecology 41: 56–64.

Elliott, M.B. 1997. The late Quaternary vegetational and climatic history of far northern New Zealand. Unpublished PhD thesis, Massey University.

Elliot, M., Striewski, B., Flenley, J., & Sutton, D. 1995. Palynological and sedimentological evidence for a radiocarbon chronology of environmental change and polynesian deforestation from Lake Taumatawhana, Northland, New Zealand. Radiocarbon 37: 899–916.

Ferrier, S., Drielsma, M. 2010. Synthesis of pattern and process in biodiversity conservation assessment: a flexible whole-landscape modelling approach. Diversity and Distributions 16: 386–402.

Leathwick, J.R. 2016. Integrated biodiversity ranking and prioritisation for the Waikato Region. Waikato Regional Council Technical Report 2016/12. Waikato Regional Council, Hamilton. 38 pp.

Leathwick, J.R., Julian, K. 2007. Production of pressure estimates for New Zealand river catchments. NIWA Client Report HAM2007–027 prepared for the Department of Conservation. NIWA, Hamilton.

Leathwick, J.R., Snelder, T., Chadderton, W.L., Elith, J., Julian, K., Ferrier, S. 2011. Use of generalised dissimilarity modelling to improve the biological discrimination of river and stream classifications. Freshwater Biology 56: 21–38.

Lehtomäki, J., Tomppo, E., Kuokkanen, P., Hanski, I., Moilanen, A. 2009. Applying spatial conservation prioritization software and high-resolution GIS data to a national-scale study in forest conservation. Forest Ecology and Management 258: 2439–2449.

Lowe, D., Green, J.D. 1987. Origins and development of the lakes. Pp. 1-64 in A. B. Viner (ed.) Inland waters of New Zealand. DSIR Bulletin 241, Wellington.

Margules, C.R., Pressey, R.L. 2000. Systematic conservation planning. Nature 405: 243–253.

McEwen, W. M. 1987. Ecological regions and districts of New Zealand. Biological Resources Centre, New Zealand. ISBN 0-478-01000-1.

Moilanen, A., Franco, A.M.A., Early, R., Fox, R., Wintle, B., Thomas, C.D. 2005. Prioritising multiple use landscapes for conservation: methods for large multi species planning problems. Proceedings of the Royal Society London B Biological Sciences 272: 1885–1891.

Moilanen A., Wilson K.A., Possingham H. (Eds.) 2009. Spatial Conservation Prioritization, Oxford University Press.

Moilanen, A., Meller, L., Leppanen, J., Montesino Pouzols, F., Arponen, A., Kujala, H., 2012. Zonation user manual. Biodiversity Conservation Informatics Group.

Newnham, R.M. 1992. A 30,000 year pollen, vegetation and climate record from Otakairangi (Hikurangi), Northland, New Zealand. Journal of Biogeography 19: 541–554.

Parkes, J.P., Nugent, G., Forsyth, D.M., Byrom, A.E., Pech, R.P., Warburton, B. Choquenot, D. 2017. Past, present and two potential futures for managing New Zealand's mammalian pests. New Zealand Journal of Ecology 41: 151–161.

Singers, N.J.D., Lawrence, C.C.E. unpublished. Potential Vegetation of the Northland Region (2018) based upon N J D Singers & G M Rogers (2014), A classification of New Zealand's terrestrial ecosystems, Science for Conservation 325, Department of Conservation, Wellington.

Singers, N.J.D., Rogers, G.M. 2014. A classification of New Zealand's terrestrial ecosystems. Science for Conservation 325. Department of Conservation, Wellington.

Snelder, T.H., Biggs, B.J.F. 2007. Multiscale river environment classification for water resources management. Journal of the American Water Resources Association 38: 1225–1240.

Thompson A.P., Nicholls, J.L. 1973. Scientific reserves in New Zealand indigenous forests. New Zealand Journal of Forestry 18: 17–22.

Timmins, S.M., Williams, P.A. 1991. Weed numbers in New Zealand's forest and scrub reserves. New Zealand Journal of Ecology 15: 153–162.

Willis, G. 2017. Addressing New Zealand's Biodiversity Challenge. A Regional Council thinkpiece on the future of biodiversity management in New Zealand. Enfocus, Pukekohe.

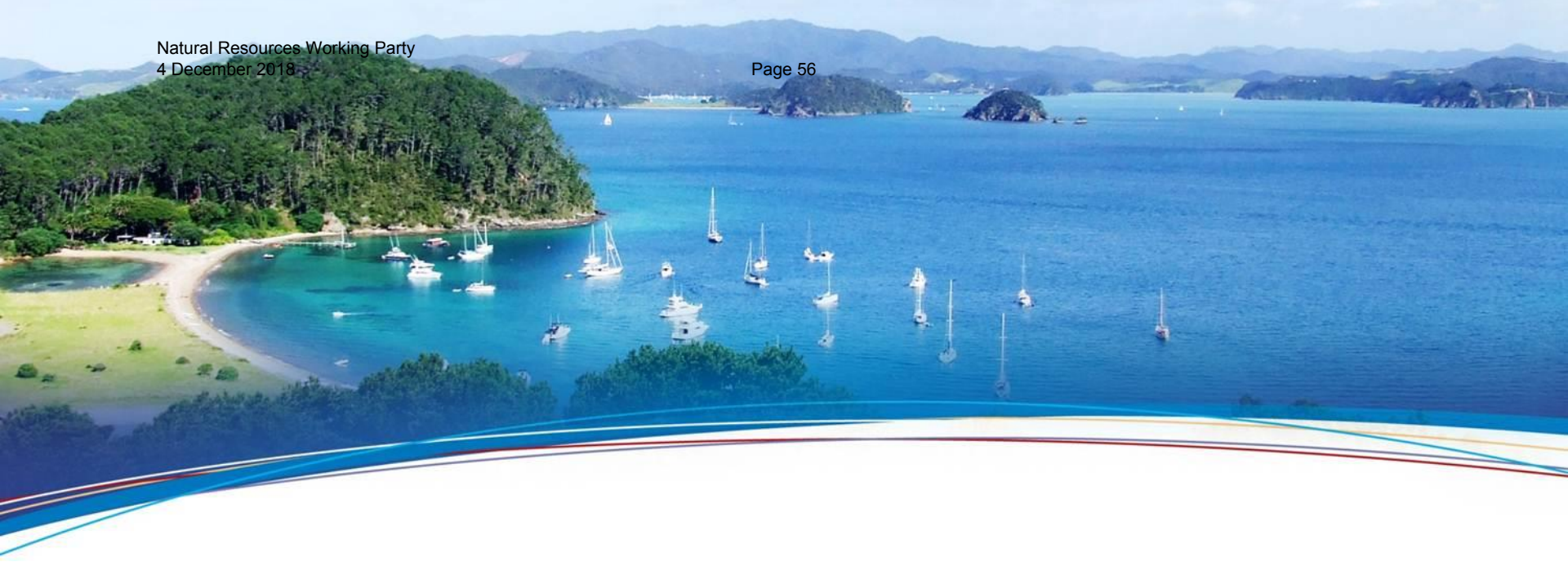
Wilson, K.A., Cabeza, M., Klein, C.J. 2009. Fundamental concepts of spatial conservation prioritization. Pp. 16–27 in Moilanen A., Wilson K.A., Possingham H. (Eds.) *Spatial Conservation Prioritization*, Oxford University Press.

Young, A., Mitchell, N.D. 1994. Microclimate and vegetation edge effects in a fragmented podocarp-broadleaf forest in New Zealand. Biological Conservation 67: 63–72.

APPENDIX I – LCDB CLASSES USED IN THE ANALYSIS

The following classes from LCDB4.1 were used in the development of layers to describe the distributions of terrestrial ecosystems. Class descriptions are taken from Dymond et al. (2017).

Class	Description
Coastal Sand and Gravel	Bare surfaces dominated by unconsolidated materials of texture generally finer than coarse gravel (60 mm). Typically mapped along sandy seashores and the margins of lagoons and estuaries, lakes and rivers; and some areas subject to surficial erosion, soil toxicity and extreme exposure.
Landslide	bare surfaces arising from mass-movement erosion generally in mountain-lands and steep hill-country
Gravel and Rock	Bare surfaces dominated by unconsolidated or consolidated materials of texture generally coarser than coarse gravel (60 mm). Typically mapped along rocky seashores and rivers, sub-alpine and alpine areas, scree slopes and erosion pavements.
Low Producing Grassland	Sward grassland and indigenous short tussock grassland of poor pastoral quality reflecting low soil fertility and extensive grazing management or non-agricultural use. Browntop, sweet vernal, danthonia, fescue, and Yorkshire fog dominate, with indigenous short tussocks (hard tussock, blue tussock, and silver tussock) common in the eastern South Island and locally elsewhere.
Herbaceous Freshwater Vegetation	Herbaceous wetland communities occurring in freshwater habitats where the water table is above or just below the substrate surface for most of the year. The class includes rush, sedge, restiad, and sphagnum communities and other wetland species, but not flax or willows, which are mapped as flaxland and deciduous hardwoods respectively.
Herbaceous Saline Vegetation	Herbaceous wetland communities occurring in saline habitats subject to tidal inundation or saltwater intrusion. Commonly includes club rush, wire rush and glasswort, but not mangrove which is mapped separately.
Flaxland	Areas dominated by New Zealand flax usually swamp flax (harakeke) in damp sites but occasionally mountain flax (whaririki) on cliffs and mountain slopes.
Fernland	Bracken fern, umbrella fern or ring fern, commonly on sites with low fertility and a history of burning. Mānuka, gorse, and/or other shrubs are often a component of these communities and will succeed fernland if left undisturbed.
Mānuka and/or Kānuka	Scrub dominated by mānuka and/or kānuka, typically as a successional community in a reversion toward forest. Mānuka has a wider ecological tolerance and distribution than kānuka, with the latter somewhat concentrated in the north with particular prominence on the volcanic soils of the central volcanic plateau.
Broadleaved Indigenous Hardwoods	Lowland scrub communities dominated by indigenous mixed broadleaved shrubs such as wineberry, mahoe, five-finger, Pittosporum spp., fuchsia, tutu, titoki, and tree ferns. This class is usually indicative of advanced succession toward indigenous forest.
Matagouri or Grey Scrub	Scrub and shrubland comprising small-leaved, often divaricating shrubs such as matagouri, Coprosma spp., Muehlenbeckia spp., Casinnia spp. and Parsonsia spp. which, from a distance, often have a grey appearance.
Deciduous Hardwoods	Exotic deciduous woodlands, predominantly of willows or poplars but also of oak, elm, ash or other species. Commonly alongside inland water (or as part of wetlands), or as erosion-control, shelter and amenity plantings.
Indigenous Forest	Tall forest dominated by indigenous conifer, broadleaved and beech species.
Mangrove	Shrubs or small trees of the New Zealand mangrove (Avicennia marina subspecies australascia) growing in harbours, estuaries, tidal creeks and rivers north of Kawhia on the west coast and Ohiwa on the east coast.



Subtidal Habitat Surveying

Presentation to Natural Resources Working Group

Ricky Eyre, James Griffin, Richard Griffiths

4 December 2018

Northland REGIONAL COUNCIL

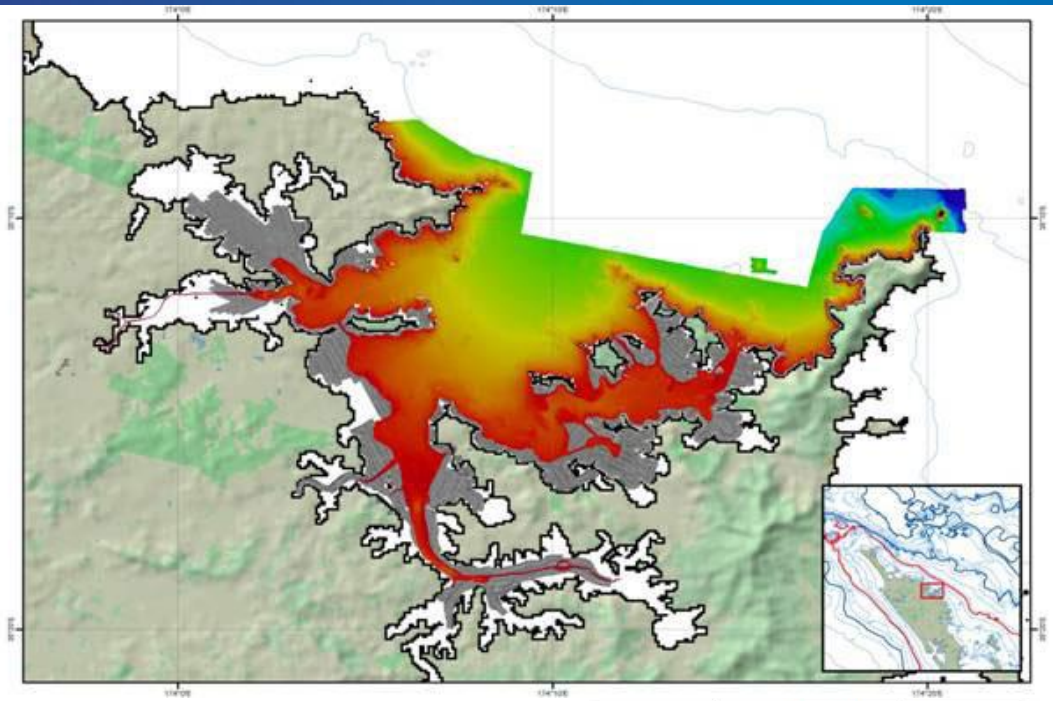
Why subtidal habitats survey

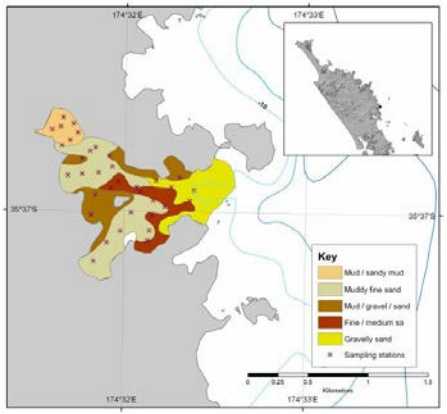
- RMA requires council to
  a. establish, implement and review of objectives, policies, and methods to maintain indigenous biodiversity, and
  b. Under our RPS, set up priorities to meet a. above; also
  c. NZ Coastal Policy Statement, NZ Biodiversity Strategy & NPS's, Environmental Reporting (Topics for Environmental Reports) Regulations 2016, etc.
- Aid our management of resources
  - Planning (significant ecological areas)
  - Values of habitat (ecological, community, iwi, etc.)
  - Pressures (anchorage, marine farming, etc.)
  - Changes over time

Status quo

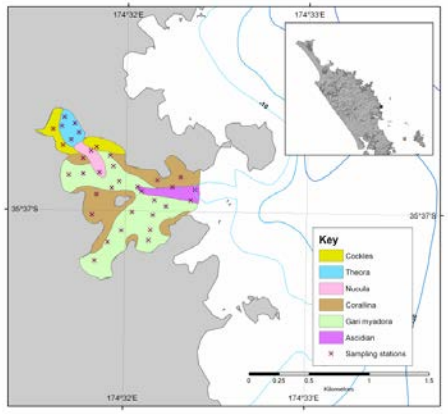
- NRCs existing monitoring programmes focus on intertidal habitats in our estuaries.
  - Council has an estuary monitoring programme with 13 sentinel sites
  - Council has undertaken ecological surveys in Waitangi, Whangārei, Kaipara, Ngunguru and Mangonui
  - Council has mapped seagrass, saltmarsh and mangrove habitat in Northland
  - Council has identified ecological significant marine areas in the proposed regional plan
- Biosecurity
  - Port surveys
  - Long-term monitoring of invasive species impact at marine reserve

Examples of marine habitat mapping





Tutukaka Harbour sediment types and sampling stations (adapted by Morison 2005 from Brook et al. 1981)



Tutukaka Harbour dominant benthic species and sampling stations (adapted by Morison 2005 from Brook et al. 1981)

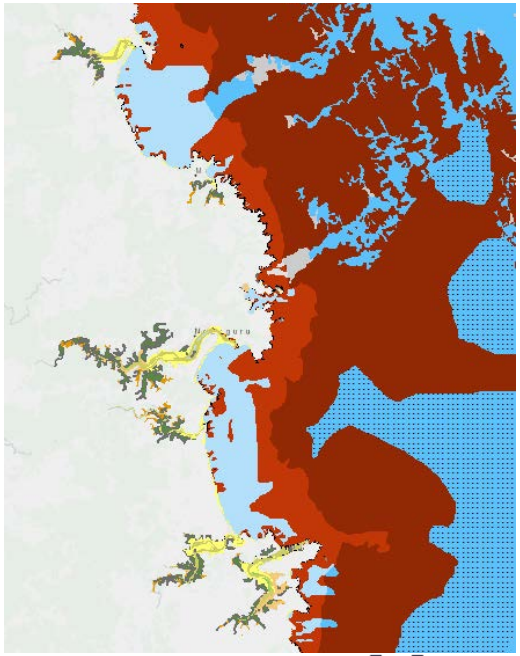
Intertidal and subtidal habitats of Doubtless Bay, Northland, N.Z.

Roger Grace[i] and Vince Kerr[c]

for

Department of Conservation
Northland Conservancy,
Whangarei

December 2005



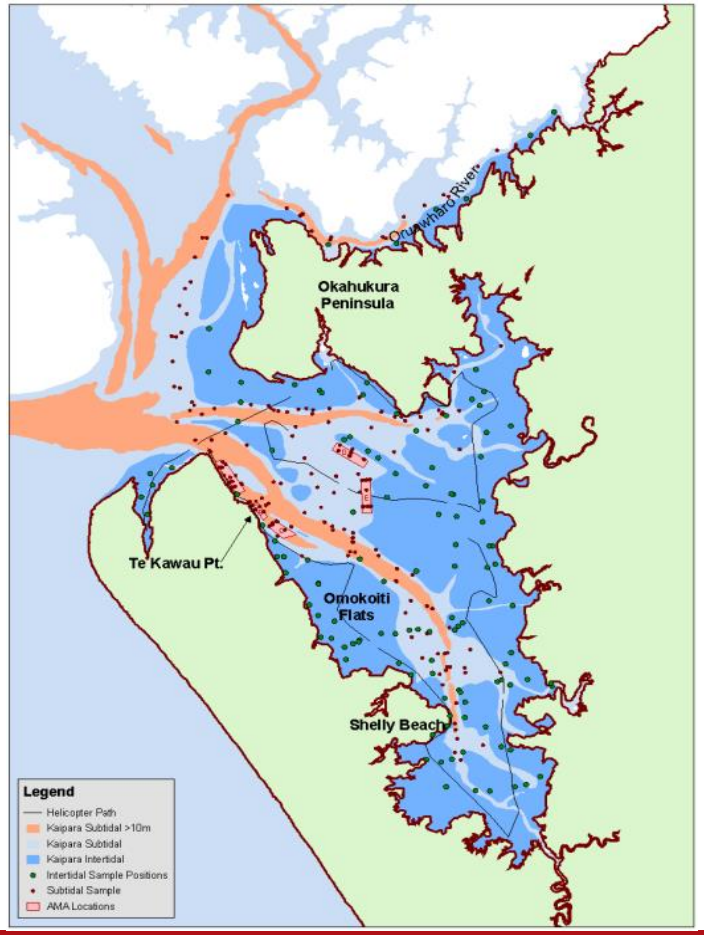
Northland REGIONAL COUNCIL

Examples of marine habitat mapping

Auckland Regional Council
TE RAUHITANGA TAIAO

Benthic marine habitats and communities of the southern Kaipara.

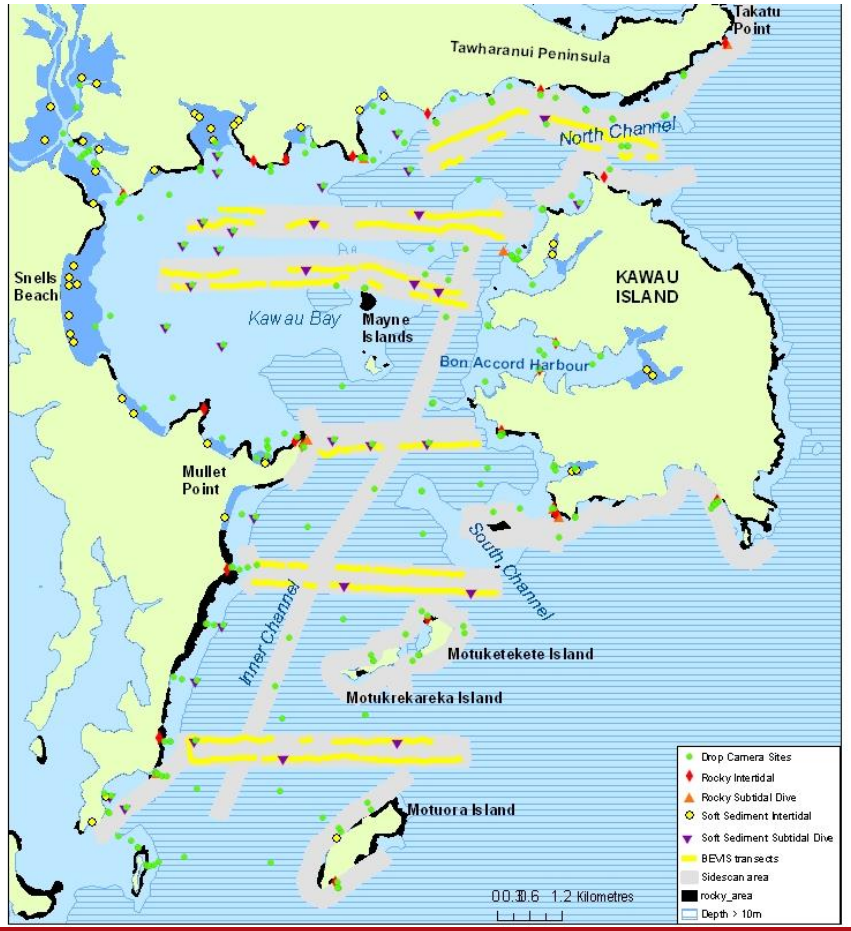
August 2005 ARC Technical Publication 275



Auckland Regional Council
TE RAUHITANGA TAIAO

Benthic Marine Habitats and Communities of Kawau Bay

August 2008 TR 2008/006



Options for council

- Option One: Status quo
  - Most activities council administer within the coastal marine area occur in estuaries or the near shore
    - 90% of coastal consents and 81% of incidents within estuaries.
  - Council does not have the resources or expertise to survey subtidal habitats
  - Other agencies responsibilities/overlaps

Risks:

- Poor knowledge of our CMA
  - 58% of Northland Region is Coastal Marine Area
  - 95% of is Open Coast, 5% Estuary.

Options for council

- Option Two: Undertake stocktake/gap analysis and engage with stakeholders
  - A lot of data exists for Northland (e.g. SEA maps and accompanying reports, other agency data, consent applications, etc.)
  - Drive future work in partnership with other agencies
  - Potential for external funding
- Option Three: Undertake surveys of subtidal habitat
  - Improve knowledge of SEA and
  - Requires significant resources not budgeted

Risks:

- inefficient use of resources

Thank you

Ricky Eyre
Coastal Monitoring Manager

09 470 1258

rickye@nrc.govt.nz

www.nrc.govt.nz

Northland
REGIONAL COUNCIL

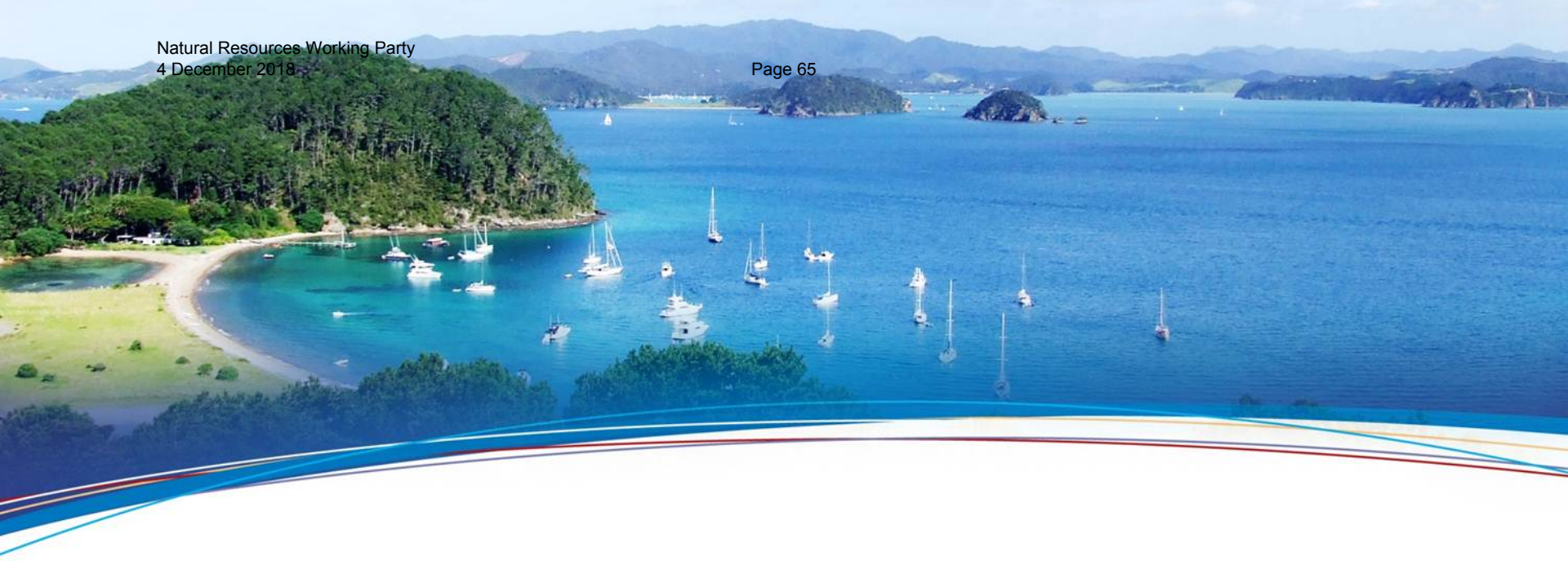
Stay connected

0800 002 004

www.nrc.govt.nz

24/7 Environmental Hotline 0800 504 639

Northland REGIONAL COUNCIL



Subtidal Habitat Surveying

Presentation to Natural Resources Working Group

Ricky Eyre, James Griffin, Richard Griffiths

4 December 2018

Northland REGIONAL COUNCIL

Why subtidal habitats survey

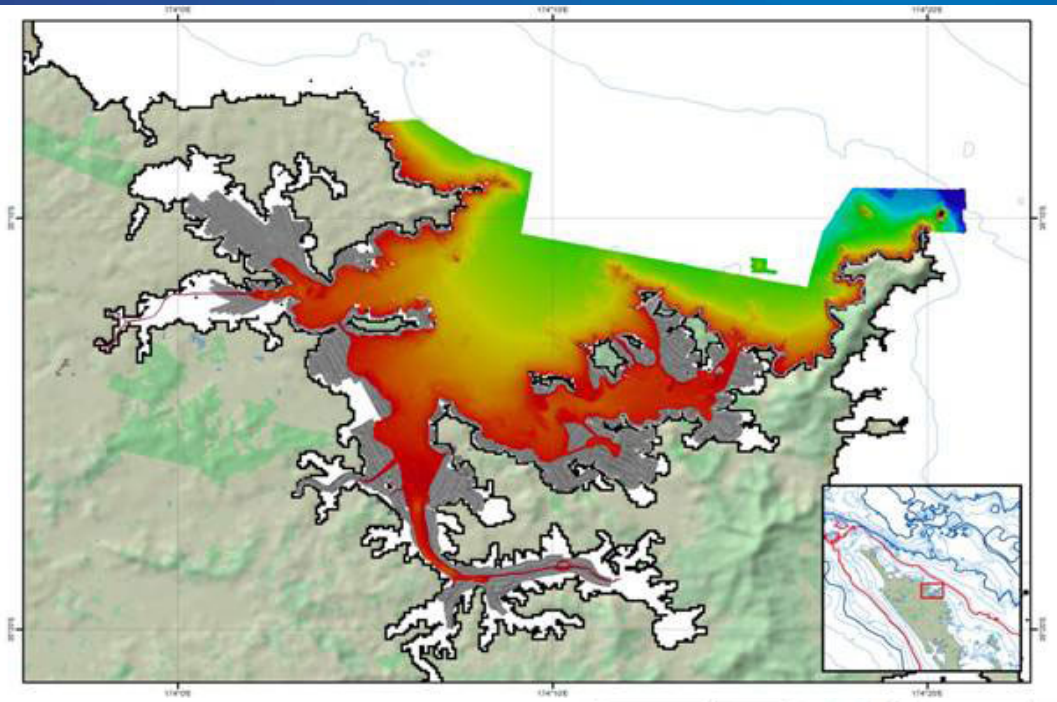
- RMA requires council to
  a. establish, implement and review of objectives, policies, and methods to maintain indigenous biodiversity, and
  b. Under our RPS, set up priorities to meet a. above; also
  c. NZ Coastal Policy Statement, NZ Biodiversity Strategy & NPS's, Environmental Reporting (Topics for Environmental Reports) Regulations 2016, etc.
- Aid our management of resources
  - Planning (significant ecological areas)
  - Values of habitat (ecological, community, iwi, etc.)
  - Pressures (anchorage, marine farming, etc.)
  - Changes over time

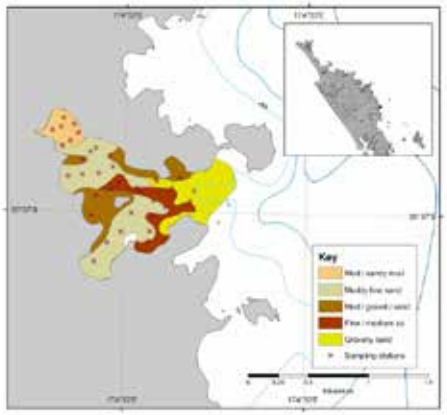
Status quo

- NRCs existing monitoring programmes focus on intertidal habitats in our estuaries.
  - Council has an estuary monitoring programme with 13 sentinel sites
  - Council has undertaken ecological surveys in Waitangi, Whangārei, Kaipara, Ngunguru and Mangonui
  - Council has mapped seagrass, saltmarsh and mangrove habitat in Northland
  - Council has identified ecological significant marine areas in the proposed regional plan
- Biosecurity
  - Port surveys
  - Long-term monitoring of invasive species impact at marine reserve

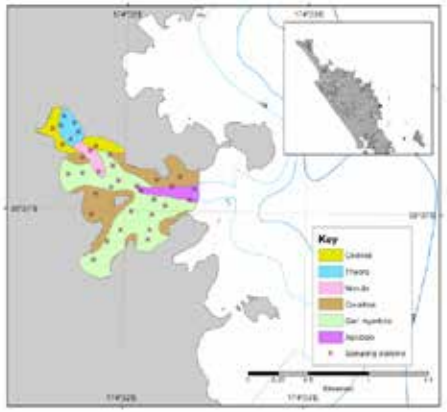
Northland REGIONAL COUNCIL

Examples of marine habitat mapping





Tutukaka Harbour sediment types and sampling stations (adapted by Morison 2005 from Brook et al. 1981)



Tutukaka Harbour dominant benthic species and sampling stations (adapted by Morison 2005 from Brook et al. 1981)

Intertidal and subtidal habitats of Doubtless Bay, Northland, N.Z.

Roger Grace[1] and Vince Kerr[2]

for

Department of Conservation
Northland Conservancy,
Whangarei

December 2005

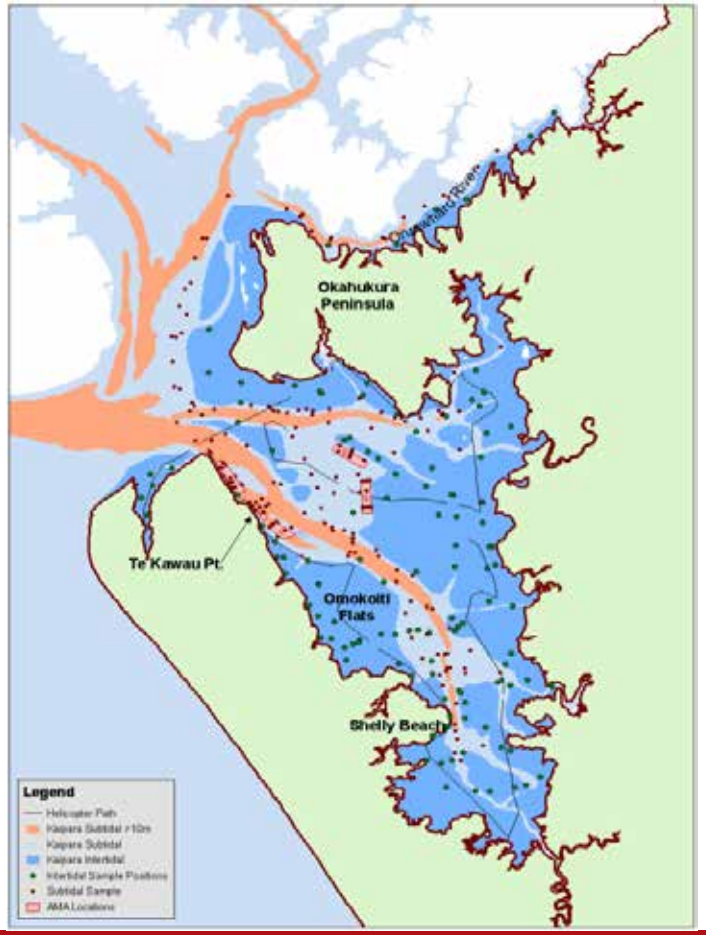
Northland REGIONAL COUNCIL

Examples of marine habitat mapping

Auckland Regional Council

Benthic marine habitats and communities of the southern Kaipara.

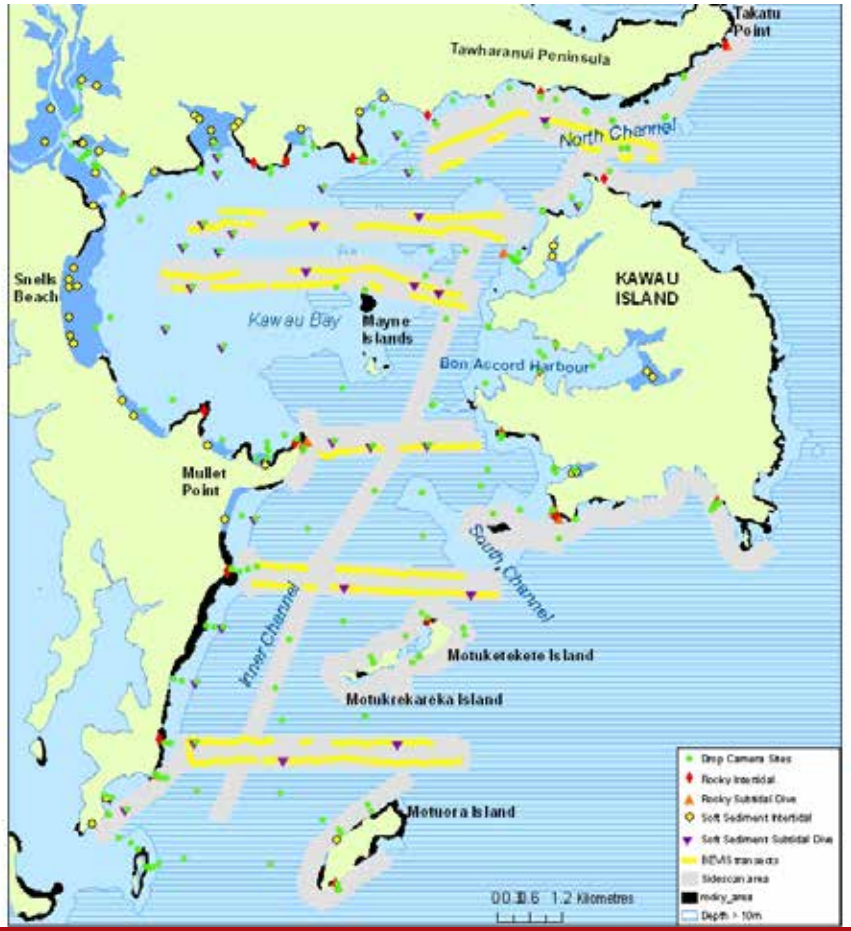
August 2006 ARC Technical Publication 275



Auckland Regional Council
TE RAUHĪTANGA TAIAO

Benthic Marine Habitats and Communities of Kawau Bay

August 2008 TR 2008/006



Options for council

- Option One: Status quo
  - Most activities council administer within the coastal marine area occur in estuaries or the near shore
    - 90% of coastal consents and 81% of incidents within estuaries.
  - Council does not have the resources or expertise to survey subtidal habitats
  - Other agencies responsibilities/overlaps

Risks:

- Poor knowledge of our CMA
  - 58% of Northland Region is Coastal Marine Area
  - 95% of is Open Coast, 5% Estuary.

Options for council

- Option Two: Undertake stocktake/gap analysis and engage with stakeholders
  - A lot of data exists for Northland (e.g. SEA maps and accompanying reports, other agency data, consent applications, etc.)
  - Drive future work in partnership with other agencies
  - Potential for external funding
- Option Three: Undertake surveys of subtidal habitat
  - Improve knowledge of SEA and
  - Requires significant resources not budgeted

Risks:

- inefficient use of resources

Thank you

Ricky Eyre
Coastal Monitoring Manager

09 470 1258

rickye@nrc.govt.nz

www.nrc.govt.nz

Northland
REGIONAL COUNCIL

Stay connected

0800 002 004

www.nrc.govt.nz

24/7 Environmental Hotline 0800 504 639

Northland
REGIONAL COUNCIL

Northern Wairoa Freshwater Improvement Fund (NWFIF) Standard Operating Procedures (SOP) Summary

Purpose

The NWFIF Project has a specific set of objectives around water quality improvement. The SOP aims to create clarity for the Northern Wairoa Partnership whilst trialling a new funding system within NRC by using the existing NWFIF budget of $1.6m for the following reasons:

- This proposed process provides more value to the Farm Environment Plan and helps guide and monitor implementation.
- Enables a wider range of mitigation tools over multiple years (three year programmes) to improve water quality, biodiversity and simplify funding process.
- Enables project LMAs to provide a consistent level/approach of customer service over multiple years and increased behavioural change and facilitation of more complex projects on farm.
- Allows a testing environment for new structures for funding projects, testing new types of mitigation and efficient resourcing for farm advisory services.

Key changes recommended

- Projects will be planned and budgeted for up to 3 years in the Farm Environment Plan (FEP). This will become the legal funding agreement/contract with the landowner/land trust and secures their funding for the period of the signed agreement (up to 3 years). These will be approved by a delegation from the partnership and delegation from council.
- Annual estimated budgets for each project will be provided to the council delegation and partnership for approval
- The NWFIF FEP and funding proposal provides for a larger scope of works to be funded on private land (compared to the current E fund) to achieve the objectives of the project and improve the diversity of mitigation types and increase the technical expertise of NRC staff. Below provides a summary of qualifying works:

Table One: Proposed qualifying works and % contribution from the FIF environmental fund.

Qualifying work Categories	Percentage Contribution
Fencing and fence line preparation · In some situations, the council can fund up to 100% of materials and the landowners fund 100% of the cost of the works to prepare and install the fence.	Up to 50
Alternative Water Supplies (non- Capital works) (Cost of troughs and tanks)	Reflects a 50:50 agreement
Native Plant Establishment and Maintenance	Reflects a 50:50 agreement
Wetland Construction & Restoration	Up to 50
Valuation of wetland ecosystem services for retirement of wetlands (>5ha) from grazing to be provided as in-kind contribution	Up to $2500 per ha
Detention Bund construction Erosion Tree Planting	Up to 50
Pest Plant Control	Up to 50
Works to restore fish passage (culvert remediation, weirs, floodgates)	Up to 50

Overview of environment fund criteria review: 2019 financial year

Lorna Douglas & Duncan Kervell

Context

This review sits alongside, but separate from, the Northern Wairoa FIF criteria which is a potential test for the general fund. The environment fund criteria last changed 2015/16 financial year. The LTP saw the annual allocation increased but there is also increased demand through external partnership projects and growing landowner awareness of improved sustainability in farming practice. So, we need to be smarter about how we allocate funds for best environmental benefit. Reviewing the criteria now fits in with the land team review of operations to streamline our processes.

Key changes recommended

- FEPs to be written first and works prioritised with landowner for buy-in of action, potential issues to clarify include: no alternative stock water – no fence
- Small number of DAs:
    - #1 – to manage the majority of applications that have come out of plans written over the previous financial year. All will be reviewed and ranked at one time for consistency of spend. Timing for this DA to be after over-allocation approved by council (e.g. September)
    - #2 – prior to Xmas, to 'mop up' any leftover budget / early withdrawals etc
    - Simple, objective ranking system will be reinstated to help maintain consistency and improve clarity of advice given to landowners regarding funding prospects
- Revise caps, based on property size (rather than industry purpose), e.g.:
    - Lifestyle blocks / small farms: 4-10ha = $2,000; 11-50ha = $5,000
    - 51-199ha = $10,000
    - 200ha – 599ha = $15,000
    - 600ha+ = $20,000 (LMA discretion involved here – may be better to spread over more years)
- Funding rates for fencing will continue to be reviewed each year, but will be simplified via a ranking system for complexity, e.g. contour, angles required, rocks or tree roots etc
- Buffer width will be specified more clearly, based on set risk analysis metric (to be developed by the land team) that will be included in the agreement
- Dedicated portion of the fund to be set aside for riparian or wetland planting, including provision of stakes & fertiliser(?) to help ensure successful establishment
- Some flexibility for the above needs to be maintained for high values projects involving Top 150 wetlands, lakes etc
    - Larger properties to be allowed more grants, lifestyle blocks only 1

Future focus

Potential future changes, based on trials by the Northern Wairoa FIF project include:

- Addition of contributing towards stock water reticulation (e.g. troughs) for larger drystock
- Dedicating funds over several financial years for specific larger projects (i.e. larger properties) to support implementation of key works

Ministry for Primary Industries
Manatū Ahu Matua

Hill Country Erosion Fund

2019 - 2023 Application Form

APPLICANT	Northland Regional Council			
PROJECT TITLE	Sustainable Hill country And Regional Priorities (SHARP)			
TOTAL FUNDING REQUESTED	MPI	Regional Council	Landowners	TOTAL
	$5,497,000	$5,089,472	$1,098,333	$11,684,805

Application opening date:

1 October 2018

Draft Applications due date:

3pm, 19 October, 2018

Application closing date:

3pm, 26 October 2018

E-mail both the draft and final applications, with any supporting attachments to: funding@mpi.govt.nz.
Please include the project title in the 'Subject' line of your email.
Late applications will not be eligible

Ministry for Primary Industries
Manatū Ahu Matua

Contents

Ministry for Primary Industries
Manatū Ahu Matua

SECTION ONE: PROJECT OVERVIEW

Please provide an overview of your project.
Please note: the term "project" refers to all the work you intend on applying for under this application.

When completing this application do not include unnecessary and superfluous information –keep to the principle that "**less is more**". Try to keep your application streamlined and focussed.

Please remember to differentiate between Outputs, Outcomes and Impacts. The primary factors that distinguish outputs and outcomes are time and measurability:

- **Outputs** are project results which are achieved immediately after implementing, and with defined metrics and deliverables. These include, for example: the number of trees planted; the number of land management plans developed; the size / hectares treated; the number of workshop attendees, etc.
- **Outcomes** can be considered as mid-term results, documented through evaluating the changes and benefits achieved following your project's completion. They are not seen immediately after the project's completion, but after some time. Outcomes would include, for example: the adoption of land management skills; a reduction in the rate of and area affected by erosion; decreasing the impacts of erosion on communities and infrastructure.
- **Impact** is usually a long-term result and it may not be achievable even during the life cycle of the project.

<table>
<tr><th>Title</th><th>Response</th></tr>
<tr><td>Region Covered</td><td>Northland</td></tr>
<tr><td>Primary Contact
Include name, email address, and contact number</td><td>Duncan Kervell
duncank@nrc.govt.nz
027 672 0004</td></tr>
<tr><td>Legal Entity
Include name and address to be contracted</td><td>Northland Regional Council
36 Water Street
Whangarei 0110</td></tr>
<tr><td>Project Title</td><td>Sustainable Hill country And Regional Priorities (SHARP)</td></tr>
<tr><td>Proposed Start Date</td><td>1st July 2019</td></tr>
<tr><td>Proposed End Date</td><td>30th June 2023</td></tr>
<tr><td>Total Funding Requested
(contributions are encouraged to be evenly split)</td><td>
<table>
<tr><th>Contribution Breakdown</th><th>1/7/19 - 30/6/20</th><th>1/7/20 - 30/6/21</th><th>1/7/21 - 30/6/22</th><th>1/7/22 - 30/6/23</th><th>Total</th></tr>
<tr><td>MPI</td><td>786,500</td><td>1,212,000</td><td>1,566,500</td><td>1,932,000</td><td>5,497,000</td></tr>
<tr><td>Reg. Council</td><td>1,075,809</td><td>1,239,662</td><td>1,370,074</td><td>1,403,927</td><td>5,089,472</td></tr>
<tr><td>Landowner</td><td>187,167</td><td>250,333</td><td>308,500</td><td>352,333</td><td>1,098,333</td></tr>
<tr><td>Total</td><td>$2,049,476</td><td>$2,701,996</td><td>$3,245,074</td><td>$3,688,260</td><td>$11,684,805</td></tr>
</table>
</td></tr>
</table>

Executive Summary Include a high-level summary of your project (200 words or less). *[This needs to be able to stand alone as it will be incorporated into public and internal MPI communications.]*	Northland has significant erosion issues, inherited from a legacy of deforestation on weathered clay soils susceptible to the region's heavy rainfall events. As a result, sediment (eroded soil) is the principal contaminant affecting freshwater quality and impacting the health and mauri of the shallow harbour environments in Northland. Northland Regional Council's (NRC) 2017 soil conservation strategy (Appendix A) identified and mapped approximately 5,000 farms in Northland with Highly Erodible Land (HEL) under pasture. Based on current resourcing, it is estimated it would take over 30 years to complete Farm Environment Plans for all these farms. The Northland region therefore requires extensive resources to expand their soil conservation programme to meet this challenge. This project will accelerate the rate in which NRC can work with landowners to implement sustainable land management practices, produce the desired environmental gains, and meet community expectations for improved water quality. This application is designed to support the implementation of the NRC proposed Sustainable Hill Country and Regional Priorities (SHARP) programme. SHARP aims to increase stakeholder engagement, build capacity and capability of contractors, and accelerate the implementation of land treatments on HEL, including; afforestation (exotic and native), soil conservation planting, land retirement and assisted regeneration. The development of SHARP consolidates NRC's soil conservation resources into one programme and importantly provides a solid foundation to align with Central Government initiatives for the One Billion Trees Programme, including direct funding for afforestation for landowners and the proposed partnership fund.
Overview of the Project For example, include: background, performance to date, aims, outcomes, targets, etc.	With over 60% of the Northland region (747,788ha) and 40% of the region's pastoral land (245,008ha) being classified as Highly Erodible Land (HEL), the scale of the erosion problem, and the legacy of previous hill country erosion, are massive and require multi-generational solutions. The consequences of soil erosion in Northland has resulted in the accumulation of excessive levels of sediment in streams, lakes, harbours and coastal systems. The negative impact on the mauri of these important taonga has recently been highlighted by the closure of the scallop fishery in the Kaipara Harbour in October 2018. The Northland Regional Council (NRC) has had limited resources dedicated to soil conservation and hill country erosion in the past. Efforts to date have focussed on Farm Environment Plans, riparian fencing and the development of our own poplar and willow nursery to provide a timely supply of poplar and willow poles. Recognising the scale of the issue, building off the success and momentum gained from the previous 4-year Hill Country Erosion Fund project (focussed on the Kaipara Harbour catchment), and producing an ambitious Long-Term Plan (2018-2028) has reinvigorated NRC's enthusiasm and commitment to addressing hill country erosion. The building of capacity and capability within the land management team at NRC is ongoing and resources are being prioritised through the HCEF Boost Year project. This will ensure NRC is ready to implement the next stage of their soil conservation work through the Sustainable Hill Country and Regional Priorities (SHARP) programme while aligning with regional partnerships and supporting the national direction for change.

Programme SHARP has been developed and will be built on the initiatives funded through the recently adopted NRC Long-Term Plan (2018-28). These include:

- Additional Land Management Advisors (Soil Conservation) x 6;
- Funding and development of an NRC Regional Afforestation Grant Scheme (RAGS) to complement and fill potential gaps in the MPI direct funding scheme e.g. funding smaller areas of afforestation (from 1-5ha);
- Tripling the productive area and output of the existing NRC poplar/willow nursery and the purchase of land and development of a new poplar/willow nursery in the Far North District.
- The dedicated Northland soil conservation programme (SHARP), providing the platform for the Hill Country Erosion Fund and alignment with the subsequent (to be announced November 2019) 4-year funding packages of the One Billion Trees Programme.

The aim of project SHARP is to increase engagement with landowners and communities, build capacity and capability of local planting contractors and partner agencies and increase the implementation of sustainable land management initiatives to reduce long term risk and ongoing costs of soil erosion on HEL. With assistance from the Hill Country Erosion Fund, the objectives of SHARP during the first 4-years (2019-2023), are to:

- Complete over 500 Farm Environment Plans, covering over 127,000 ha;
- Train and engage local contractors to plant poplar/willow poles and riparian reversion trees;
- Increase landowner and community engagement by holding regular workshops and field days in priority and active catchments;
- Undertake research regarding the management of mature poplar and willow trees and coastal erosion that produces applications that are specific to Northland and can be implemented by affected landowners; and
- Provide incentives to landowners to increase the amount of HEL being actively treated through the most appropriate method. This includes:
    - Forest planting
      Exotic forest (*Pinus radiata* and others), 360ha / 540,000 trees
      Native forest (Mānuka and others), 540ha / 1,350,000 trees
    - Space planting
      Poplar and willow poles, 300ha / 30,000 trees
    - Reversion and retirement of HEL
      At least 1,236ha
    - Fencing areas to assist reversion/retirement of new forest of hill country
    - Fencing of riparian reversion areas and areas susceptible to streambank erosion
    - Assist water reticulation to allow for the removal of barriers to hill country retirement/reversion.

The outcomes of SHARP include:

- Educating landowners and community partner agencies about all aspects of hill country erosion, including the erosion processes, the economic and environmental effects of erosion and the tools available to mitigate the risks;

	· Reducing the rate of erosion and the area at risk by completing Farm Environment Plans for over 127,000 ha and implementing the extensive targeted land treatments; · Developing an industry capable of catering to the increased demand in tree planting through training and engaging local contractors; · Improving our understanding of coastal erosion, it's relative contribution to Northland's erosion issues and potential treatments available to landowners; · Managing mature willow and poplar trees in a sustainable way, developing value-added products and succession plans for affected landowners; · Decreasing the impacts of soil erosion on communities and infrastructure; and · Reducing the rates of sedimentation in our waterways and harbours and to restore the mauri of these environments.

Ministry for Primary Industries
Manatū Ahu Matua

Key facts and figures over the life of the project

Catchment* Name	Catchment Area (ha)	Area of Erodible Land within Catchment (ha)	# Farms Affected	# Whole Farm / Land Management Plans to be Carried Out	Treatment Proposed (ha)	Species Proposed	Estimated Stocking Rates (per ha)	Total Number of Trees Proposed
Northland	1,251,776	747,788 (60% of region)	~4,990	508 (127,000ha)	Forestry planting (360)	Exotic – Pine + others	1,500 stems/ha	540,000
					Forestry planting (540)	Native – Mānuka + others	2,500 stems/ha	1,350,000
					Space Planting (300)	Exotic – Poplar + willow	100 stems/ha	30,000
					Riparian Reversion/Streambank Stabilisation (30.5)	Riparian trees (various including willow)	4,000 stems/ha	142,000
					Reversion/Retirement (1,236)	Various	N/A	N/A
							Total # trees	2,062,000

* While this project is intended to be undertaken throughout the whole Northland region, a prioritisation exercise in terms of at-risk catchments is currently being undertaken through the HCEF Boost funding year. It is envisaged that the results of the HCEF Boost work will inform the priority catchments for this project.

Ministry for Primary Industries
Manatū Ahu Matua

Completing the Key Facts and Figures Table

Erodible Land	Hill Country erodible land is that classified as 6e, 7e and 8e. Other classes of land that is erodible but not on hill country will also be considered (e.g. riparian, alpine).
Whole Farm / Land Management Plans	The number of whole farm plans or equivalent studies that demonstrate planning, property design and management based on natural resources and economic factors. (Including for example, information on land classing, soils, water supply, biodiversity, grazing management, drought management, biodiversity, developed action plans, etc.)
Treatment Proposed	Provide details of the treatment proposed (ha) in your project – e.g. afforestation, reversion, retirement, riparian, poles, etc.
Species Proposed	Provide details of the types of trees you are planning, including percentages where possible.
Estimated Stocking Rates (per ha)	These rates can vary by region. Used for indication purposes only.
Total Number of Trees	This captures the projects contribution to **Assessment Criteria 2**: Contribution to the 1 Billion Trees Initiative. Projects need to clearly demonstrate how many trees will be planted as a result of this funding.

Ministry for Primary Industries
Manatū Ahu Matua

SECTION TWO: ELIGIBILITY CRITERIA

Complete the boxes below to demonstrate how your application meets the Cabinet-mandated eligibility for funding. Please complete boxes I or II, and III and IV.

(Provide a high level overview as additional detail is required further on in the application.)

I. The problem is significant and is considered beyond the scope of the local authority because it:

a. has significant national effects (positive or negative); or
b. requires solutions at a multi-regional scale; or
c. the problem affects an area of national significance (i.e. people outside the region place a significant value or receive significant benefit from the resource)

See box II

OR

II. The problem may currently (or may in the near future) be beyond the capacity of local government because:

a. the sheer scale of the problem when considered on a total catchment basis exceeds the resources of the council;
b. the region lacks the income from its rating base, or other assets or cannot prioritise resources to address the problem and carry out its other functions;
c. the problem is longstanding and was inherited by the regional council at the time of its establishment and it is therefore at a disadvantage compared with other regions.

Northland's erosion issues (as New Zealand's 5th most erodible region) have been inherited from a legacy of deforestation on weathered clay soils susceptible to a variety of erosion processes following the region's heavy rainfall events. Eroded soil (sediment) is the principal contaminant affecting water quality in Northland's freshwater systems and our numerous shallow harbour taonga.

Using the MPI definition of Highly Erodible Land (HEL) (LUC class 6e, 7e and 8e), irrespective of landcover, over 747,000 hectares or 60% of the region is classified as highly erodible. Of this, 245,008 hectares of HEL is pastoral land, making up 20% of the region's area and 40% of the region's total pastoral land. With such a large proportion of the region's farmland classified as HEL, the potential impacts of soil erosion on the regions environment and economy is enormous.

From 2012, after decades of under resourcing, NRC accelerated their land management efforts. Currently 10% ($2.786M) of the total rates are used for all land management activities, with a good portion of this used directly for hill country erosion. The NRC 30-year soil conservation strategy identified approximately 5,000 farms with HEL that require farm plans. Based on the current resources it would take approximately 30 years to complete that number of plans. Northland region requires extensive resources to implement sustainable land use to produce the environmental gains required to meet community expectations.

AND

III. The problem must be quantified in environmental and economic terms. The costs and benefits of the proposal need to be clearly described to enable a balanced judgment of whether the proposal is rational to fund from an economic perspective.

In Northland, the environmental and economic costs of hill slope and streambank erosion, have been analysed and documented for many large catchments (Oceans 20/20 Bay of Islands (2011), Kaipara sediment mitigation study (2018)

and Whangarei Harbour sediment and E. coli study: catchment economic modelling (2015). The studies covered the environmental impact of sediment in harbours, the development of sediment water quality attributes in freshwater systems, and the economic impacts from the loss of production and the costs of treatments and their effectiveness at reducing sediment.

The Kaipara sediment study, covering 33% of Northlands area, modelled the outcomes of different land treatments. The research found re-foresting the catchment could reduce sediment loss substantially (68–88%), and provide catchment-wide improvements in stream and river ecosystem health, at a cost of between $255 and $331 million per year, which is mostly opportunity cost. A combination of stock exclusion rules (fencing with riparian planting) and stabilising large tracts of highly erodible land in pasture with poplars could reduce total catchment sediment loss by 41% at a cost of about $13.0 million per year. Any increase in activity over the next 4 years will significantly reduce the long-term remediation costs for future generations and hold the line of further ecological degradation.

Northland's 2017 GDP was $7 billion, with 11.6% ($81.2M) of that coming from primary industries. Any proposed investment will be targeting the 38% (238,996 ha) of pasture on highly erodible land, which is fundamental to provide the best cost/benefit proposal possible. To ensure barriers (e.g. existing farmer values highlighted in the MPI 2017 Drivers and barriers to land use change report) and enablers for landowners are best managed, this project is focused on advice services, practical research projects, subsidies and incentives for landowners. Any decisions regarding land use change or mitigation options from different afforestation or agroforestry proposals, will be promoted in economic terms where possible. Long term financial appraisal for the treatments recommended and economic scenarios and options for land use change will be presented to landowners.

AND

IV. The proposed solution is consistent with achieving Government's desired Sustainable Land Management (SLM) outcomes. (See SLM outcomes below.)

The proposal aims to meet regional and local scale community expectations of improving water quality, while meeting our obligations within the NPS-FW, NES-PF, Good Farming Practices (GFP) Action Plan and objectives of the 1 Billion Trees Programme and preparation for the imminent NPS for Biodiversity.

We aim to build our region's capacity and capability by the promotion of land management skills, via local and centralised forms of farm environment planning and extension involving community and partners. We will be working closely with landowners, industry and regional partnerships to deliver afforestation services, increasing soil conservation and promoting good farming practices including reducing critical source areas of contaminants.

The project is consistent with future focussed, best practice soil conservation solutions throughout New Zealand, utilising principles of Land Use Capability (LUC), trained and trusted expert advisors and the most up to date remote sensing and models.

At a regional scale, the project aims to improving the resilience of communities by balancing the productive capability of the land and diverse rural incomes while reducing the impacts of flooding and erosion, including improving water quality for catchment communities downstream and coastal/estuary values.

Note: SLM outcomes include:

- Maintenance of the potential of New Zealand's soils for a range of uses for present and future generations;
- The adoption of land management skills and the application of appropriate technologies to enable individuals and communities to provide for their social and economic well-being;

- The avoidance, mitigation, and remediation of the impacts of land-related hazards, including flooding, subsidence and erosion;
- The maintenance of catchments to provide high quality water resources for downstream users and for users of coastal spaces (intertidal areas, seabed, water); and
- Protection of communities and infrastructure.

Ministry for Primary Industries
Manatū Ahu Matua

SECTION THREE: PROJECT DETAILS

Please provide details of your project.

The following questions will give us the details of your project and how it aligns to our assessment criteria (refer Appendix 3).

1 Significance of the problem

(Criteria 1)
Describe how significant the problem is to the region and its relative priority to the region.
Links to strategic plans or policy objectives (if applicable) will be taken into account.

The principal environmental stressor in Northland is excessive levels of eroded soil (sediment), ending up in the region's waterways and harbours. With over 60% of the region (747,788ha) classified as Highly Erodible Land (HEL), the scale of the problem, and the legacy of previous hill country erosion, is enormous. The significance of the problem has recently been highlighted by the closure of the scallop fishery in the Kaipara Harbour, with many of the values of lakes, waterways and other estuary systems demonstrating signs of impact.

Through the formation, consultation and implementation planning of the proposed regional plan, priority catchment plans and the adoption of the subsequent NRC Long Term Plan (2018-2028), the significance of hill country erosion and declining forest health in Northland has led to land management (biodiversity, riparian and soil conservation) becoming the highest priority for the NRC. A significant rate increase (30%) for the LTP (2018-2021) was designated towards mainly land management and biosecurity, and NRC servicing of these functions.

Initiatives and funding in the 2018-2021 LPT include:

- Additional soil conservation staff (x 6) to progress council's soil conservation programme;
- Funding and development of an NRC Regional Afforestation Grant Scheme (RAGS) to complement the MPI direct funding by supporting smaller areas of afforestation (up to 5ha);
- Tripling of area (ha) and forecasted output of the existing NRC poplar/willow nursery;
- Land purchase and development of a new poplar/willow nursery in the Far North District'
- Biosecurity and Forest Protection projects (to work with MPI kauri dieback and predator free NZ programmes)
- Significant increase in funding for landowner environmental grants for lakes (pest fish and lake catchment management), riparian management, soil conservation, wetlands and terrestrial ecosystem health (biosecurity, forest ecosystem priorities).
- Significant funding to support FIF projects and their partnerships with iwi/hapū.

To guide and determine the priorities and future activities in Northland, a 30-year Long-Term Soil Conservation Strategy was developed in 2017 (attached in application email). This strategy (based on SedNetNZ and assumed economic and treatment parameters) was developed to assist identification of target land, catchment priorities and qualification of resources: (FEPs, planting materials, technologies and resource modelling and staff).

In doing this we have aligned and prescribed aspirations for soil conservation over the next 30 years in Northland. It is evident the scale of the problem is challenging.

2 Contribution to environmental sustainability

(Criteria 3)

Demonstrate how your project will contribute to environmental sustainability for the region.

Clearly identify:

- what is the status of target land in the proposal (include regional map showing target areas);
- proposed engagement with landowners;
- how you are going to treat the land;
- how this application will result in a tree planting outcome.

For example, describe:

- the expected timeframe required to reach sufficient behavioural change to ensure the new land use practices become self-sustaining, or what percentage of the target land within the affected catchment / catchments would have been treated to ensure the new land use practices become self-sustaining. Also, describe what the framework/strategy for monitoring and evaluating this;
- provide a full description of how the approach will be managed, including methods and improvements for modelling of sediment load reduction, detailed planning at a farm scale and quality assurance for targeted implementation of treatment (there is the expectation that all applicants will be able to demonstrate how the longer-term effects from the programme will be planned for and realised)
- links to any other environmental initiatives in your region, including catchment-based groups.

Note: Duplication of funding on the same land or for the same work is not permitted.

Target Land

Northland's HEL (Class 6e, 7e and 8e) is shown in Figure 1. Land and catchment prioritisation for treatment (understanding and technologies) has been developing over the last few years and we intend to improve this understanding through the HCEF Boost project 2018/19 and further refine into the future. The targeting process will guide this HCEF project to ensure we understand the biophysical attributes and define the most at-risk land areas and catchments.

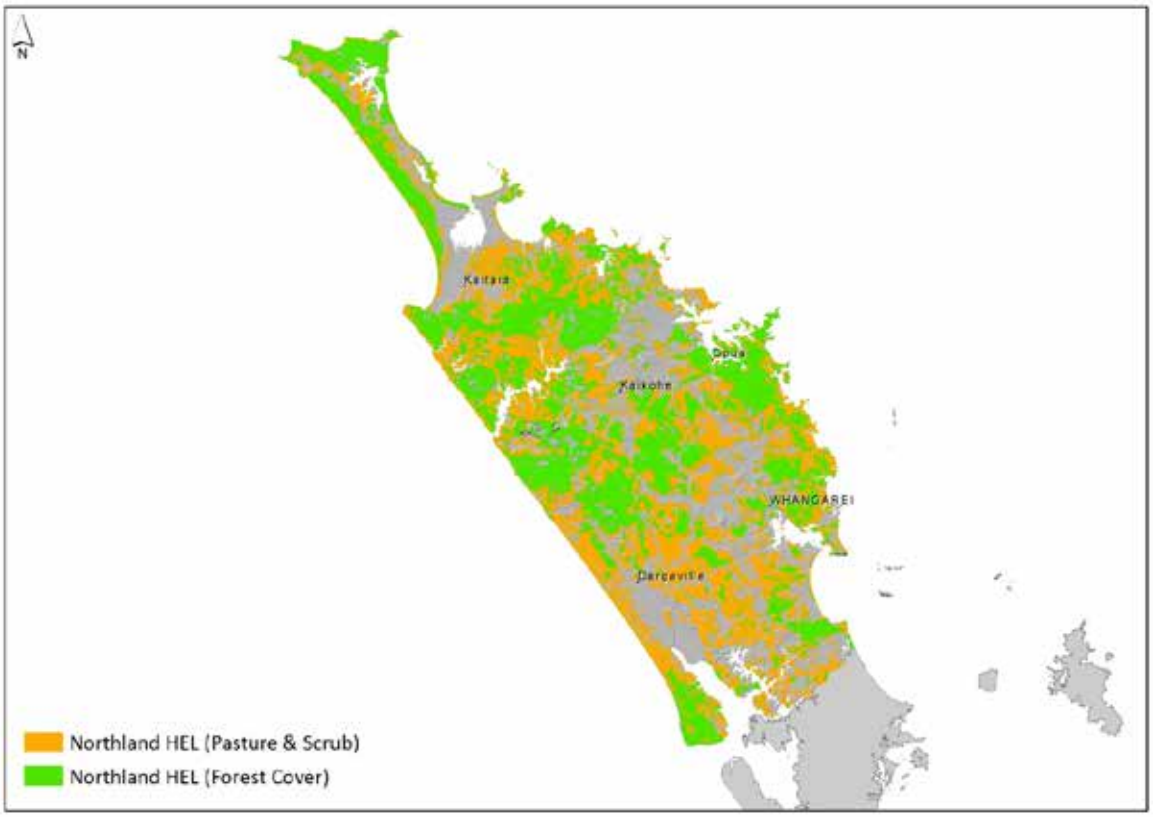


Figure 1: Highly Erodible Land (HEL) in Northland under pasture/exotic (weed) shrub (target land) and forest cover.

Tools available to assist prioritisation of work and subsequent implementation, include the regional water quality monitoring data, regional ecosystem priority modelling, regional oblique photography dataset, SedNetNZ (sediment yield model) and S-PAL (sediment physiographic attribute layer, based on 2011 radiometric data) and sediment source tracking and commissioned Regional LIDAR (delivery imminent.)

Already defined regional priorities (rules related to targeted land, non-regulatory and operational requirements), have been consulted on for the Proposed Regional Plan, operational circa 2021) these target areas have been defined through a collaborative catchment group process. In these cases, the relevant water quality monitoring is in place to see if long term improvement in sediment water quality attributes is realised and gives the rest of the region's catchments a good trajectory of travel.

Landowner Engagement

Proponents of sustainable land management require a unique mix of skills including excellent people interaction skills, and a good understanding of the biophysical and farm system they are working with.

Due to the scale of the issue and the need for rapid behavioural change, it is critical that we engage effectively, therefore this project includes the following:

- One on one tailored advice to landowners (circa 580 FEP's)
- Trained facilitation of catchment communities to support peer to peer learning
- Dedicated landowner engagement and communications planning milestones within the project
- Development of promotional materials and approaches that resonate with farmers and other sectors and agencies (outputs from HCEF boost year 2018)
- Effective monitoring and tracking all project progress: GIS and digital FEP components i.e. farmer and NRC progress reporting
- Facilitated workshops with groups of landowners, identifying priority catchments or sub-catchments and working with groups that actively want to make a difference
- Influence, mentor and work alongside primary sectors and rural professionals to promote GFPs and best advice around soil conservation and afforestation.

Land Treatments

There are seven primary land treatments included in this project, including different tree planting treatments and soil conservation practices.

Research designed to support this project will also look into 1) coastal margin erosion treatments and development of techniques and best practice around coastal buffers; and 2) management of mature poplar and willow in the landscape and the legacy of 1960-1990s soil conservation plantings, which is a continuation from the previous Kaipara HCEF project.

FEPs have been very effective in Northland for achieving land use change, and will continue to be the foundation for managing the relationships, and implementation of land use changes by landowners. For this reason, this project will focus on FEPs and has over 500 farm plans included in the SHARP milestones with an estimated land area of 127,000 ha (approximately 8% of the region's area) to be covered and completed.

Table 1: Summary of the land treatments and activities included in this project

Activity	Description / Purpose	Costings / Deliverables
Forestry Planting	§ All forest planting grants are "top-ups" and must be made in conjunction with Te Uru Rākau direct grants or NRC Regional Afforestation Grants to provide additional funds for difficult and priority sites. § Rate ($500 per ha for exotic species including *Pinus radiata* and $1,000 per ha for native species including Manuka) provided to landowners for the planting of new forest. § To be used by landowners to assist with initial establishment, monitoring and maintenance costs. § Could also be used to assist with the cost of using forest manager services, which is often required by farmers with no forest growing experience. § By providing a forest planting incentive (on top of potential direct funding) it would ensure Land Management Advisors (LMAs) are involved in the Te Uru Rākau application process with landowners. § No funding for Year 1 as planting would be undertaken in Year 2-4. § Recognition that the criteria and details of the new MPI AGS are yet to be released.	§ Year 1 – No planting § Year 2 – 90ha (exotic), 90ha (native) § Year 3 – 120ha (exotic), 150ha (native) § Year 4 – 150ha (exotic), 300ha (native)

Space Planting	§ Subsidies for various aspects of space planting with poplar or willow poles. § 3m poles are valued at $12. Cost of poles are to be split evenly at $4 (MPI), $4 (NRC) and $4 (landowner). § Dynex sleeves (which are recommended to all landowners but not always required if poles planted behind fences etc.) are valued at $6. Cost to be split $4 (MPI) and $2 (landowner). § The planting and sleeving of a 3m pole in hill country is valued at $6 a pole. Cost is split $4 (MPI) and $2 (landowner). § Cost of 3m pole, no sleeve, landowner planted is $18 ($4 MPI, $4 NRC, $4 landowner + $6 landowner (in-kind)). § Cost of 3m pole, sleeve, landowner planted is $24 ($8 MPI, $4 NRC, $6 landowner + $6 landowner (in-kind)). § Cost of 3m pole, sleeve, contractor planted is $24 ($12 MPI, $4 NRC, $8 landowner). § Treatment is limited by the production potential of the NRC nurseries. § Majority (98%) of poles will be grown at NRC nurseries. § No funding for Year 1 as planting would be undertaken in Year 2-4.	§ Year 1 – No planting § Year 2 – 5,000 poles § Year 3 – 10,000 poles § Year 4 – 15,000 poles Total 30,000 trees
Reversion (including Retirement)	§ Retiring HEL can often be the most effective method to reduce the risk of erosion, particularly in Northland where natural seed supply is generally plentiful. § Rate ($1,250 per ha) provided to landowners for the reversion or retirement of Highly Erodible Land. § Recognises the value of ecosystem services of retiring or regenerating HEL such as improved soil conservation, water quality, biodiversity carbon sequestration etc. § If regeneration is not seen to be naturally occurring following an annual inspection an assisted planting programme will be put in place.	§ Year 1 – 100 hectares § Year 2 – 180 hectares § Year 3 – 250 hectares § Year 4 – 320 hectares
Fencing (Reversion/retirement areas or new forest)	§ Fencing to exclude stock access enables the retirement and reversion of HEL. § Fencing HEL often involves steep terrain and restricted access for machinery which reduces the uptake by landowners. Providing a subsidy will improve uptake of fencing and therefore retiring HEL. § Rate (up to $12/m) provided to landowners for the fencing of reversion/retirement areas or new forest. § Based on a rate of $16/m, which is common for fences in steep terrain in Northland.	§ Year 1 – $362,000 MPI $84,000, NRC $187,500, Landowners $90,500 At least 22km fencing § Year 2 – $352,000 MPI $132,000, NRC $132,000, Landowners $88,000 At least 22km fencing § Year 3 – $392,667

	§ Landowners receive 75% subsidy (up to $12/m) and the landowner contributes at least 25% of the cost (at least $4/m). § If the fence costs more than $16/m, the landowner would need to pick up this additional cost. Alternatively, if the fence is less than $16/m, the landowner will receive a 75% subsidy of the lower fence rate. § Must include HEL.	MPI $192,000, NRC $102,500, Landowners $98,617 At least 24km fencing § Year 4 – $402,667 MPI $252,000, NRC $50,000, Landowners $100,667 At least 25km fencing
Riparian Fencing (Riparian reversion/stream bank erosion)	§ Streambank erosion is a huge issue in Northland, in lowland and upland areas. § Fencing and planting the riparian margin is the most effective treatment in reducing streambank erosion. § Rate (up to $4.50/m) provided to landowners for the fencing of riparian reversion areas or areas susceptible to streambank erosion. § Based on a rate of $6/m, which is common for these types of fences in Northland. § Landowners receive 75% subsidy (up to $4.50/m) and the landowner contributes at least 25% of the cost (at least $1.50/m). § If the fence costs more than $6/m, the landowner would need to pick up this additional cost. Alternatively, if the fence is less than $6/m, the landowner will receive a 75% subsidy of the lower fence rate.	§ Year 1 – $386,667 MPI $90,000, NRC $200,000, Landowners $96,667 At least 64km fencing § Year 2 – $357,333 MPI $135,000, NRC $133,000, Landowners $ 89,333 At least 59km fencing § Year 3 – $373,333 MPI $180,000, NRC $100,000, Landowners $93,333 At least 62km fencing § Year 4 – $366,667 MPI $225,000, NRC $ 50,000, Landowners $91,667 At least 61km fencing
Riparian Planting	§ Subsidies for trees and planting trees in riparian reversion areas and areas susceptible to streambank erosion. § Subsidy of $2.50 per tree and $2.50 for planting (per tree). § Envisaged that riparian trees will be planted by a mix of landowners and contractors. § Several years of previous FEPs by the NRC land management team has funded hundreds of kilometres of riparian fencing providing plenty of potential planting sites. § No funding for Year 1 as planting would be undertaken in Year 2-4.	§ Year 1 – No planting § Year 2 – 39,000 trees § Year 3 – 49,000 trees § Year 4 – 54,000 trees Total 142,000 trees
Water Reticulation (Hill Country)	§ Water reticulation can often be the barrier to fencing on hill country farms and has been raised as an issue by hill country landowners over the past few years when recommending fencing to retire HEL, gullies and headwater catchments. § Rate (up to $10K per farm) provided to landowners for the installation of water	§ Year 1 – $75,809 MPI $50,000, NRC $25,809 § Year 2 – $77,662 MPI $50,000, NRC $27,662 § Year 3 – $129,574

	reticulation to allow for the retirement/reversion of Highly Erodible Land. § Often expensive, the $10K cap per farm will be considered on a per farm basis. § Landowners will contribute at least 50% of costs. However, there cash contributions have not been included in this project as cost estimates are too difficult. § Relatively low cost to the project $250K over 4 years, but would provide bigger gains in terms of associated fencing, land retirement and potential space planting and new forest.	MPI $75,000, NRC $54,574 § Year 4 – $133,927 MPI $75,000, NRC $58,927
Farm Environment Plans (FEPs)	§ Completion of Farm Environment Plans (FEPs) for farms containing Highly Erodible Land. § Total of at least 508 FEPs covering at least 127,000 ha over the 4-year project § Delivered through 4 Land Management Advisors (LMAs) funded through the MPI HCEF. § NRC will provide 6 x LMAs in Year 1, 7 x LMAs in Year 2 and 8 x LMAs in Years 3 and 4, which reflects the increase in resources approved in the Long-Term Plan.	§ Year 1 – 112 FEPs covering 28,000ha 4 x LMAs (MPI) + 6 x LMAs (NRC) § Year 2 – 124 FEPs covering 31,000ha 4 x LMAs (MPI) + 7 x LMAs (NRC) § Year 3 – 136 FEPs covering 34,000ha 4 x LMAs (MPI) + 8 x LMAs (NRC) § Year 4 – 136 FEPs covering 34,000ha 4 x LMAs (MPI) + 8 x LMAs (NRC)
Capacity Development	§ Build the capacity of contractors to plant poplar/willow poles and riparian trees for landowners. § Included to provide an option for landowners who don't have the ability or time to do the planting. § Recognised as an ongoing issue throughout Northland and particularly with aging landowners. § Budget to provide training days and workshops for contractors. Upskill in all aspects of pole planting, including how and where to plant. § In Years 3 and 4, there will be option to include training on maintenance of poles, including pruning. § Budgets for the actual planting built in to budgets for Space Planting and Riparian Planting activities.	§ $15,000 for Years 1, 2 and 3. § Projected contractor planting: Year 2 – 2,500 poles + 15,000 riparian trees Year 3 – 6,000 poles + 25,000 riparian trees Year 4 – 10,000 poles + 30,000 riparian trees
Stakeholder Engagement	§ Funding to increase stakeholder engagement. § Initially, focussed on developing a communications plan and getting the word out to landowners and other stakeholders.	Year 1 – $25,000 Year 2 – $25,000 Year 3 – $25,000

	§ Envisaged that promotional materials will be developed. § Opportunity to hold field days and farm workshops, particularly at high priority, at-risk catchments or working with active farm groups.	Year 4 – $25,000 Total $100,000
Research / Trials (Coastal erosion buffers research project)	§ Research project investigating the extent of coastal erosion in Northland, particularly in our harbour environments and the potential mitigation options. § Evidence of some significant localised coastal erosion, directly to sensitive areas, particularly in the Kaipara Harbour. § Recognises that mitigation methods for coastal erosion are often completely different to hill country erosion treatments. § Hoping to collaborate and partner the work being undertaken by local Consultants Tane's Trees Trust who are investigating the conversion of exotic coastal buffers to indigenous species in the upper North Island (Sustainable Farming Fund project). § 4-year project to ensure time for potential pilot trials and required growing seasons.	Year 1 – $10,000 Year 2 – $15,000 Year 3 – $15,000 Year 4 – $15,000 Total $55,000
Research / Trials (Mature poplar/willow research project)	§ Research project on the management of mature poplar/willow trees in Northland. § Potentially large emerging issue as poplar and willows that were planted 40-60 years, were not maintained well and are now becoming a hazard and landowners are after options on how to manage them. § Will progress from the initial work undertaken in the Kaipara Hill Country Erosion Project (funded by MPI) § Research to include investigating the potential value-added products from the harvesting of using mature poplar/willow trees. § Will also look at how succession plans can be developed to begin implementing second rotation soil conservation plantings. § 4-year project to ensure time required to undergo harvest trials, chipping and milling, which from previous experiences are time consuming.	Year 1 – $20,000 Year 2 – $25,000 Year 3 – $25,000 Year 4 – $25,000 Total $95,000

<u>Tree Planting Outcomes</u>

The planting of trees is at the heart of the whole project and NRC's SHARP programme. By working directly with landowners, we aim to promote and empower landowners to successfully take advantage of the many incentives included in SHARP and to utilise direct funding from Te Uru Rākau programmes, partnership funding and incentives of carbon and ETS programmes. While, the tree planting treatments included in this project will result in a modest number of trees planted (2.062M) under the One Billion Trees principles of

"right tree right place", the ability of programme SHARP to identify potential HEL for tree planting and to link in with other tree planting initiatives will be significant.

3 Contribution to economic and social sustainability

(Criteria 4)

Demonstrate how your project will contribute to economic and social sustainability for the region.
Explain why the project is beyond the capacity of local government.

The project is about developing resilient landscapes, that protect and enhance people's livelihoods and maintains productive land within a framework of increasing environmental constraints.

The scale of the problem (articulated above) is large and has been exacerbated by decades of neglect and the limited soil conservation resources available to landowners. This has resulted in a lack of farm-based knowledge, inactivity and poor understanding of disciplines in soil conservation and in general, a level of ignorance that there is a problem at all.

The solutions proposed are expensive and long term, requiring a leap in faith and a step-up in expertise for many landowners. It is thought that without good advice and financial appraisal of different land use options, progress will be slow without appropriate external advice, funding and support.

SHARP will create the required skills locally, by linking nurseries with landowners, and training up local contractors to plant poles and trees. Importantly for Northland, SHARP will work closely with local iwi/hapū groups, forestry collectives, agencies, agricultural sectors, timber processors and communities to develop "cradle to career" and "seed to timber" long term work programmes. Regional afforestation and reforestation strategies are being developed now in preparation for the partnership funds. The HCEF programme will be a useful component (but only a small part) of these regional approaches as the whole picture is beyond local government initiatives (ratepayers) to achieve economic and social sustainability for the region.

4 Ability to deliver

(Criteria 5)

Describe how the project will be managed. Include project management, financial management, governance structure, and technical skills.

For example, provide information on:

- the Council committee/s the project would report to;
- advisory groups involved;
- how the progress and success of the program will be monitored and how any potential progress slippage will be monitored and managed;
- how you will manage the project funds if this application is successful;
- the project team's track record;
- the procurement of goods and services.

Provide details of stakeholder consultation and evidence of support from the local authority, farmers and the wider community.

You must include details of your project team, including their names, roles, experience and whether their involvement on the project is confirmed or not.

Note: **a breakdown of the financial and in-kind support for the proposal is to be provided in the project budget (see Section Five below).**

HCEF funding, over and above our ambitious Long Term Plan, will allow us to consolidate our NRC programmes and align with the next 4 years of NZ Government initiatives linked to the 1 Billion Trees

Programme, including: 1) direct funding package from Te Uru Rākau 2) the proposed ETS package and 3) the imminent partnership funding package.

The Sustainable Hill country And Regional Priorities (SHARP) 2019-2023 regional HCEF project will build off the work undertaken with existing NRC programmes and the successful Kaipara Hill Country Erosion Project (co-funded by MPI). In addition, the HCEF Boost Year project (2018/19) will result in building the capacity and capability of NRC to deliver the SHARP programme.

Proposed Project Team Membership

- Proposed Project Sponsor: Duncan Kervell
  NRC Land Programme Manager and Deputy Group Manager, 20 + years of forestry, land management and conservation project management experience.
  Master in Forest Management and Bachelor of Science in Soil Science. Active member of Land Manager Groups and Chairperson of Manaaki Whenua/Landcare Research sediment and erosion Technical Advisory Group.
- Proposed Project Manager: Paul Sorensen
  Land Management Advisor - Hill Country, 10+ years' experience in private and local government sectors in soil science and land management.
  Master of Science (Physical Geography). Project manager of the previous Kaipara Hill Country Erosion Project, active member of National Land Monitoring Forum.
- 4 LMAs (soil conservation and afforestation) - sponsored by MPI HCEF Years 1-4.
- Michael Mitchell: Land Management Advisor - Hill Country, 13 years' agricultural experience and 3 years' local government. Bachelor of Science (Environmental Management). Key member of the previous Kaipara Hill Country Erosion Project.
- Wayne Teal, Land Management Advisor - Soil Conservation.
  Bachelor of Environment Science. 10 years' local government experience. Manager of the NRC poplar/willow nursery.
- Other land management team staff (except where FTEs are sponsored by other external funds i.e. MfE freshwater improvement funds to ensure no double funding). Due to the consolidation of existing land management operations under the regional soil conservation project (HCEF 2019-2023) a majority of the (15 plus staff) of the NRC Land Management team will assist the project:

Overall, it is our intent through the SHARP project to develop a regional afforestation and soil conservation extension service in the Northland region. Any afforestation initiatives and research must be viewed at a regional scale; therefore, we intend to partner with landowners, mana whenua, iwi and hapū based forestry collectives, industry sectors and district councils. This 4-year period allows us to develop research, deliver work programmes and develop a regionally specific package to deliver our afforestation and soil conservation services.

From our previous PGF application (March 2018) we had strong support from NRC councillors, Northland RMA foresters group, and catchment working groups. General support has been sought again and working partnerships will be created with the project commences (see Appendix B).

All members of the recently formed, Northland Region Forest Strategy group (including Te Tai Tokerau Maori Forest Collective Incorporated) have been informed of the content and nature of this application and it has been agreed that it is very useful and outcomes will be shared with the regional forest strategy. Other groups of interest in this project will work with the Integrated Kaipara Harbour Management Group, District

Councils, Farm Forestry Forest Association, Living Waters Partnership, agricultural sector partners such as Beef and Lamb NZ and Dairy NZ.

We will monitor the programme via interim reports from staff and maintain strict financial checks on milestones and reporting back to MPI.

The financial information for milestone reporting will be derived from the council financial system and can report weekly and all financial items are fully traceable and auditable. This system will be used to manage the project funds and report any slippage or irregularities, variance or overspend. We have used this same system successfully with the current Kaipara Hill Country Erosion Project.

Activity reports and GIS data will be provided on each milestone to MPI during the project. Internal reporting will be achieved monthly via CEO reports to governance and senior council staff. The governance will be based on council current structure which includes full council, the Natural Resources Working Party and priority catchment working groups.

NRC has a procurement policy and delegated authority protocols for spending amounts and staff accountability to which we will adhere to.

5 Value for money

(Criteria 6)

Provide details on the overall value of the outcomes of the project – whether economic, environmental and/or social. The level of non-HCEF funding and in-kind contributions will also be assessed relative to the project outcomes.

Provide details of how you intend to monitor and assess the survival rates of trees and plants planted in the project.

For example: Have you considered alternative options when setting your strategy? Have you been through a council procurement process?

NRC, through recent annual plans and the recently approved Long Term Plan (2018-2028), has been successful in raising a step-up in operational funds to help fund landowners to achieve good farming practices for improving water quality and soil conservation. NRC has demonstrated significant investment in establishing, running and supporting soil conservation tree nurseries. It is recognised the supply of planting materials is a keystone component to sustainable land management services in Northland.

NRC is in a position to invest significant co-funding (cash and in-kind $5.089M) into this project through associated initiatives, staff resources and project management, partnerships and regional contacts and know-how (being the holders of the regional soil conservation disciplines) and supply and delivery of planting materials. It is the intent through supplying significant cash and in-kind funding to consolidate and circle our numerous land management activities around this project, and in doing so aligning and targeting our outcomes.

Tree planting and soil conservation prescriptions and targeted success rates will be written into planting agreements/contracts with landowners and monitored annually (or more frequently depending on the demands and skills of landowners).

The success of planting/regeneration/retirement regimes is dependent on good observation skills, continual follow up and adaptive management depending on changing risks (e.g. poor regeneration rates, biosecurity issues, climate related planting failures). Cost effective monitoring and project success tracking will be done (including the use of drones by trained NRC staff) for monitoring and planning, promotion of best practice afforestation documentation (2018 HCEP boost year), digital GIS mapping and updatable photo and cartography-based afforestation plans and by providing farmers with georeferenced photo points of establishment.

6 Risk

(Criteria 7)
Identify any risks associated with the project, as well as any technical / delivery risks. How will these risks be mitigated?

Provide confirmation of your project's seedling supply.

Provide details of any Conflicts of Interest you have identified and how these are being mitigated.

Planting and establishing trees is inherently risky and the costs of failure have financial and relationship implications. These risks are acerbated as landowners often do not hold the technical know-how or time resources to manage large plantings. The risks associated with planting trees and establishing forest in Northland include:

- Animal pests (especially pukeko, goats, pigs and possums),
- Plant pests - including kikuyu grass
- Short planting season (June to mid-August)
- Dry springs and summer droughts

To mitigate these risks, we have emphasised in this project the importance of timely advice and assistance to landowners, assisting with the forest design and ensuring the right tree is planted in the right place.

The number of farmers willing to be engaged with the project is a small risk, especially if there was a reduction in commodity prices and finances were stretched. To mitigate this, the landowner contributions for treatments such as fencing and cost of poplar willow poles has been set relatively low at only 25-33%. To ensure significant engagement with landowners and other stakeholders this project will be building off the work undertaken in the HCEF Boost Year project (completed June 2019) and the milestones dedicated to this project to improve communications and promotion of the project and engage with landowners.

There is a risk that the estimation of costs and treatments areas are either too low or too high, given the details and criteria of the new MPI direct funding and partnership packages are yet to be released. This is particularly relevant to the forestry planting "top-up" rates, which rely on projects receiving the bulk of their funding from the new MPI direct funding package, which is yet to be released.

In general, to reduce the risk for this 4-year project NRC are currently undertaking a regional stock take of landowners engaged in planting, consultants, contractors, nurseries, seed collectors and suppliers and soil conservation material through the HCEF Boost Year project. This has been designed to increase our understanding and capability and therefore reduce the risks associated with this project.

The number of trees able to be supplied in time for plantings in this project is a risk, especially eco-sourced seeds for native plantings and the difficulty of meeting hapū/iwi kaitiaki principles for rohe sourced materials. Initial discussions with the nursery suppliers has already begun and this will be on-going to reduce the risk.

<u>Seeding supply discussions include</u>

- Nga Uri O Hau at Mangawhai– native nursery for Kaipara (forecast 1M riparian trees annually)
- Kauri Park Ltd at Kaiwaka– specialising in manuka, and have ability to supply huge numbers of eco-sourced plants
- Northland Forest Nursery Ltd in Kaikohe, specialising in *Pinus radiata* seedlings
- NRC soil conservation nurseries and small local growers (forecast over 30,000 poplar and willow poles annually by 2025.)

The conflicts of interest we envisage at this time is the potential for regional sector to undercut private sectors afforestation consultation services and nursery based planting advice services. We will know the

likely risk of this from the outcome of the HCEF Boost Year project in due course and will develop mitigations accordingly. Early indications suggest that conflict of interest is not likely and nurseries are keen on sharing expertise and need help with assisting landowners with afforestation designs.

7 Adoption and extension planning

(Criteria 8)
Demonstrate that project work can be disseminated through appropriate networks.

- NRC has developed a large number of FEPs (over 800 FEPs and covering over 170,000ha since 2012) and built solid relationships with some of the largest landowners in the region.
- From June 2018, NRC has been a key partner in the Northland Regional Forest Strategy Group, with leadership and representation of iwi and hapū partners in the Tai Tokerau Māori Forest Collective Incorporated. Representation also includes the wood processors association, selected NGOs, Northland Wood Council, local authorities and financial organisations. Feasibility plans, work plans and applications for PGF/ partnership funding are currently being developed.
- Information is disseminated via the NRC land management E-newsletter: Hills to Harbour – distributed to subscribed farms and stakeholders with relationships with NRC.
- Catchment working groups, farmer meetings and community field days and partner groups such Farm Forestry Association.
- NRC is intending to co-ordinate a regional afforestation networking group: aiming to pull together all agencies and parties interested in this space i.e. Trees that count, nursery interests, Million Metres, forestry companies, and other NGOs (i.e. Reconnecting Northland, Fish and Game) have been approached, with the intent to avoid any duplication.

NRC staff are involved in many projects and partnerships such as: Extension 350, The Red Meat Productive Partnership (RMPP), the regional sectors (RMG) and Land Manager Group (LMG), The New Zealand Association for Resource Management (NZARM), Beef and Lamb environmental focus farms, Living Waters partnerships (Fonterra and DOC), a working MOU with Department of Conservation, the development of FEP certification via NZIPIM.

NRC is currently co-ordinating the regional response and priorities to the Good Farming Practice: National Action Plan for water quality.

NRC thorough consultation with the other HCEF regional councils (HCEF Boost Year project milestone), NZARM, Land Managers Group (LMG) and National Land Monitoring Forum will be meeting and learning from each other experiences, especially with regard to operational techniques and approaches, and making sure research topics are not overlapping. A strategic aim of LMG is to send staff on short secondments between relevant councils.

ADDITIONAL INFORMATION

Please also provide details of the following considerations in relation to your project:

Māori Development

Demonstrate your project's relevance to Māori Development and Māori engagement. For example: provide details of your engagement with iwi and other Māori stakeholders, the capability within your project team to engage with local Māori ; how many Māori landowners will benefit from the project's outcomes; and in general how your project aligns to environmental, economic and social sustainability affecting Māori .

In Northland 32.4% of the population are Māori (2013 census), this population density is highest in the Far North District (44 %) and varies across the region.

The NRC land management team has been working closely with Māori and multiple-owned lands such as Poutō Topu A Trust, Omapere Taraire E & Rangihamama X3A Ahu Whenua Trust and Oromahoe Trust, to name just a few. NRC, through the biodiversity and land management programmes, has experienced a willingness to engage, on both sides, and work positively with our regional Māori stakeholders, and the skills of collaboration have been demonstrated through successful projects.

In many projects, NRC has been partnering with many iwi and hapū and marae groups through forest health projects e.g. Warawara forest. NRC has made recent gains via the MfE FIF projects and working alongside iwi and hapū partners to develop Mātauranga Māori approaches and governance for management of dune lakes and freshwater systems via farm plans and restoration programmes.

This year, NRC has collaborated with Te Tai Tokerau Māori Forestry Collective Incorporated, as well as others, to develop the Regional Forestry Strategy Project. This regional strategy will shape the regional programme that is being developed in advance of the partnership funding to meet the One BT programme, once the criteria of the partnership funding is released. It is also likely to shape how the largest iwi hapū forest owners interact with government funding packages for One BT into the future.

The HECF 2018 Boost year has a milestone to" Build capacity to engage and support iwi/hapū involved with forestry initiative" we have already started this process by working alongside Ngai Tokito iwi to workshop what a forest partnership strategy looks like and demonstrating the biophysical modelling and expertise that NRC has, and how we can be useful.

NRC has been working member of the Kaipara Moana Negotiations Reference Group (Kaipara Uri) and Kaipara Moana Working Party (regional, unitary and district Councils) over the past 24 months, providing information and costings for restoration models and will being business planning for the restoration package for the Kaipara Catchments and align with treaty settlement and co-governance partners post agreement.

Impact on wider systems and reporting

Provide details on how your project may contribute to GHG, water quality and other system-wide metrics. Will its outputs be used to report across different initiatives and funds? For example, emissions offsetting from reduction in stock levels, carbon sequestration from tree planting, etc.

Promotion of an optimised mosaic of land use in the landscape, where landowners move resourcing into their most productive land from grazing of steep and unproductive land, which is then changed to more appropriate land uses (e.g. retirement or forestry) is the guiding principle of sustainable land management.

In this way, we can reduce the impact of the most negative aspects of hill country management by planting, allowing natural regeneration, and by fencing off gullies while seeking to maximise profits to increase the sustainability of farm systems on the highest class of land.

In doing so we can increase native and exotic tree cover in the region, allowing the quantification of carbon sequestration by the trees (through modelling) based on the number and type of trees planted and area of HEL taken out of grazing. This conversion of eroding pasture land to forest will (in time) correlate with improving trends in water quality (sediment, phosphorus and *E. coli*).

An increase in profits at the farm gate, should also be aligned to reduced stock numbers as systems become more efficient and ideally also see an improvement in farmer welfare.

Due to the significant cash co-funding from the NRC Environment Fund (75% of general water quality funding) and in-kind Land management programmes (staff time and vehicles) we will align the metrics of the NRC Long-Term Plan KPIs (Table 2) for ease of reporting and to demonstrate the benefits of partnership with HCEF and how progress is being made.

Table 2: NRC Long-Term Plan Key Performance Indicators (KPIs) for the Land Management Team

KPI	Methodology	Metrics
Area hectares (ha) of land being actively managed under a sustainable farm environment plan.	The area (ha) of farm plans is determined by the boundary of the ownership and collected by GIS.	Increase 25,000 ha per annum
Area (ha) of highly erodible land being actively managed under a farm environment plan.	Area of land based on SedNetNZ model mapped threshold of =>250 tonnes/km2/yr within a farm boundary	Maintain or increase (from baseline data)
Number of subsidised poplar poles provided for erosion-prone land by the Flyger Road nursery.	The number of poles, irrespective of size, sold annually directly from, or via, the Flyger Road nursery.	2018/19: 6K 2019/20: 7K 2020/21: 8K 2027/28: 20K
Kilometres of waterway margins protected to reduce sediment, nutrient run-off and general contamination of water, funded by the Environment Fund.	Utilising the estimated distance (GIS) for the Efund applications from the efund (including lakes, wetland and Coastal fencing) reports, to provide an annual distance of water way margin protected.	Increase (from baseline data)

Other Sources of Funding

Provide details of any other funding you have applied for or intend to apply for that is aligned to the work you are undertaking as part of this application.

Please include projects where your involvement is either as an applicant or as a key stakeholder.

- MfE FIF – Northern Wairoa Project: NRC applicant and project managers, includes 9 iwi /hapū and agency partners and other stakeholders.
- MfE FIF: Dune Lake Project: NRC applicant and project managers, multiple iwi /hapū partners and other stakeholders.
- MPI HCEF Boost Year (2018/19): NRC project managers and other regional stakeholders regarding afforestation and reforestation and consultants

- MfE Community Environmental Fund: Hatea project. NRC applicants and faciliatory managers for multiple council and community groups.

MBIE: Envirolink; For assistance with science projects. NRC propose the projects and approved CRI and science providers and academic institutions have contracts with MBIE.

Ministry for Primary Industries
Manatū Ahu Matua

SECTION FOUR: FUNDING AND MILESTONES

List all significant events that will lead to the successful delivery of your project (i.e. completion of the project's outputs or objectives) in chronological order. List no more than 4 milestones per year.)

(**Copy and paste the milestone table below for each milestone**.)

Note that funding payments will be made upon successful completion of a milestone. Evidence of milestone completion will be required, so please include succinct, measurable deliverables / activities for each initiative within your milestone.

Please provide all figures in GST exclusive terms, and ensure that the payment dates match your planned cash flow for the programme (refer Section 5 – Project Budget).

Milestone Number	1						
Milestone Short Description	Applied Research and Landowner Engagement						
Milestone Due Date	30 April 2020						
Proposed Planting Season	N/A						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**
Research / Trials **(Coastal erosion buffers research project)**	Project plan, including details of consultants engaged to undertake the research.	$10,000					$10,000
Research / Trials **(Mature poplar/willow research project)**	Project plan, including details of consultants engaged to undertake the research.	$20,000					$20,000
Stakeholder Engagement	Communications plan.	$25,000					$25,000

Ministry for Primary Industries
Manatū Ahu Matua

	Examples of promotion materials.						
TOTAL		**$55,000**	**$**	**$**	**$**	**$**	**$55,000**
Risks / Dependencies	**Research projects are dependent on the availability and expertise of consultants. This has been mitigated by developing research projects that build of existing research so it is known the consultants have the capability. The coastal erosion research builds off research Tane's Tree Trust are undertaking through the Sustainable Farming Fund and they are assisting with the HCEF Boost Year project. The mature poplar/willow research is building off work undertaken over the past 4-years through the Kaipara Hill Country Erosion Project. By spreading the research over 4 years and planning well in advance, it ensures the consultants will have the capacity to complete the research.** **There is a small risk that weather events such as droughts and floods may limit the amount of on the ground works or trials that can be undertaken.**						

Milestone Number	2						
Milestone Short Description	Farm Environment Plans and Land Treatments						
Milestone Due Date	26 June 2020						
Proposed Planting Season	N/A						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**
Farm Plans **112 new Farm Environment Plans completed (and/or covering 28,000 ha).**	Activity report. GIS shapefile of farm boundaries. Farm Environment Plan example.	$430,000		$600,000			$1,030,000

Reversion (incl. Retirement) (100ha)	Activity report. GIS shapefile of areas.	$62,500	$62,500				$125,000
Fencing **(Reversion/retirement areas or new forest)**	Activity report. GIS shapefile of fencelines.	$84,000	$187,500		$90,500		$362,000
Capacity Development	Details of contractors engaged for July/August 2020 planting season. Training schedules and attendee lists.	$15,000					$15,000
Other (Water Reticulation) **(Hill Country)**	Activity report.	$50,000	$25,809				$75,809
Riparian Fencing **(Riparian reversion/stream bank erosion)**	Activity report. GIS shapefile of fencelines.	$90,000	$200,000		$96,667		$386,667
TOTAL		**$731,500**	**$475,809**	**$600,000**	**$187,167**	**$**	**$1,994,476**
Risks / Dependencies	**The number of Farm Environment Plans completed is dependent on the 4 additional Land Management Advisors (including a project manager) beginning at the start of the project. This risk will be mitigated by starting the recruitment process early.** **There is a small risk of not having the landowner buy in to undertake all the treatments. This will be mitigated through the work undertaken in the HCEF Boost Year (2018/19) which involves the development of a communications and engagement plan and also Milestone 1 which involves improving stakeholder engagement.**						

	There is also a risk of not finding enough suitable local contractors to train and engage for the upcoming planting season. Engaging contractors for this type of planting is new to NRC so there is an inherent risk. Again, it is envisaged this can be mitigated through the results of the HCEF Boost Year and Milestone 1, which can initiate talks with potential contractors early.

Milestone Number	3						
Milestone Short Description	Farm Environment Plans and Tree Planting Land Treatments						
Milestone Due Date	18 December 2020						
Proposed Planting Season	July/August 2020						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**
Farm Plans **62 new Farm Environment Plans completed (and/or covering 15,500 ha).**	Activity report. GIS shapefile of farm boundaries. Farm Environment Plan example.	$215,000		$350,000			$565,000
Forest Planting **90ha exotic & 90ha native.**	Activity report. GIS shapefile of planting areas and species. Example of Afforestation Planting Plan	$114,000	$57,000				$171,000
Space Planting **5,000 poplar/willow poles**	Activity report. GIS shapefile of planting areas. Example of soil	$46,000	$20,000		$33,000	$15,000	$114,000

Ministry for Primary Industries
Manatū Ahu Matua

	conservation planting plan.						
Riparian Planting **39,000 trees planted in riparian reversion/streambank erosion areas.**	Activity report. GIS shapefile of planting areas. Example of riparian planting plan.	$100,000	$70,000			$25,000	$195,000
TOTAL		**$475,000**	**$147,000**	**$350,000**	**$33,000**	**$40,000**	**$1,045,000**
Risks / Dependencies	**The number of Farm Environment Plans completed is dependent on the 4 additional Land Management Advisors (including a project manager) beginning at the start of the project. This risk will be mitigated by starting the recruitment process early.** **There is a small risk of not having the landowner buy in to undertake all the treatments. This will be mitigated through the work undertaken in the HCEF Boost Year (2018/19) which involves the development of a communications and engagement plan and also Milestone 1 which involves improving stakeholder engagement.** **There is a risk of natural weather events such as drought or storms damaging or reducing the survival rates of trees planted. This will be mitigated as much as possible by planting the right tree in the right place. Annual monitoring checks will be undertaken to monitor the success of tree plantings the year before.**						

Milestone Number	4						
Milestone Short Description	Applied Research and Landowner Engagement						
Milestone Due Date	30 April 2021						
Proposed Planting Season	N/A						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**

Ministry for Primary Industries
Manatū Ahu Matua

Research / Trials **(Coastal erosion buffers research project)**	Project activity report.	$15,000					$15,000
Research / Trials **(Mature poplar/willow research project)**	Project activity report.	$25,000					$25,000
Stakeholder Engagement	Activity report. Examples of promotion materials. Programmes of any workshops or field days.	$25,000					$25,000
TOTAL		**$65,000**	**$**	**$**	**$**	**$**	**$65,000**
Risks / Dependencies	**Research projects are dependent on the availability and expertise of consultants. This has been mitigated by developing research projects that build of existing research so it is known the consultants have the capability. The coastal erosion research builds off research Tane's Tree Trust are undertaking through the Sustainable Farming Fund and they are assisting with the HCEF Boost Year project. The mature poplar/willow research is building off work undertaken over the past 4-years through the Kaipara Hill Country Erosion Project. By spreading the research over 4 years and planning well in advance, it ensures the consultants will have the capacity to complete the research.** **There is a small risk that weather events such as droughts and floods may limit the amount of on the ground works or trials that can be undertaken.**						

Milestone Number	5
Milestone Short Description	Farm Environment Plans and Land Treatments

Ministry for Primary Industries
Manatū Ahu Matua

Milestone Due Date	30 June 2021						
Proposed Planting Season	N/A						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**
Farm Plans **62 new Farm Environment Plans completed (and/or covering 15,500 ha).**	Activity report. GIS shapefile of farm boundaries. Farm Environment Plan example.	$215,000		$350,000			$565,000
Reversion (incl. Retirement) (180ha)	Activity report. GIS shapefile of areas.	$125,000	$100,000				$225,000
Fencing **(Reversion/retirement areas or new forest)**	Activity report. GIS shapefile of fencelines.	$132,000	$132,000		$88,000		$352,000
Capacity Development	Details of contractors engaged for July/August 2021 planting season. Training schedules and attendee lists.	$15,000					$15,000
Other (Water Reticulation) **(Hill Country)**	Activity report.	$50,000	$27,662				$77,662

Ministry for Primary Industries
Manatū Ahu Matua

Riparian Fencing **(Riparian reversion/stream bank erosion)**	Activity report. GIS shapefile of fencelines.	$135,000	$133,000		$89,333		$357,333
TOTAL		**$672,000**	**$392,662**	**$350,000**	**$177,333**		**$1,591,995**
Risks / Dependencies	**The number of Farm Environment Plans completed is dependent on the employment of all Land Management Advisors (including a project manager). This risk will be mitigated by starting the recruitment process early and ensuring any LMA positions are left vacant for a minimal amount of time.** **There is a small risk of not having the landowner buy in to undertake all the treatments. This will be mitigated through the work undertaken in the HCEF Boost Year (2018/19) which involves the development of a communications and engagement plan and also Milestone 1 and 4 which involves improving stakeholder engagement.** **There is also a risk of not finding enough suitable local contractors to train and engage for the upcoming planting season. Engaging contractors for this type of planting is new to NRC so there is an inherent risk. Again, it is envisaged this can be mitigated through the results of the HCEF Boost Year and Milestone 1 and 4, which can initiate talks with potential contractors early.**						

Milestone Number	6						
Milestone Short Description	Farm Environment Plans and Tree Planting Land Treatments						
Milestone Due Date	15 December 2021						
Proposed Planting Season	July/August 2021						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**
Farm Plans	Activity report. GIS shapefile of farm boundaries. Farm	$215,000		$400,000			$615,000

68 new Farm Environment Plans completed (and/or covering 17,000 ha).	Environment Plan example.						
Forest Planting **120ha exotic & 150ha native.**	Activity report. GIS shapefile of planting areas and species. Example of Afforestation Planting Plan	$176,000	$88,000				$264,000
Space Planting **10,000 poplar/willow poles**	Activity report. GIS shapefile of planting areas. Example of soil conservation planting plan.	$96,000	$40,000		$68,000	$24,000	$228,000
Riparian Planting **49,000 trees planted in riparian reversion/streambank erosion areas.**	Activity report. GIS shapefile of planting areas. Example of riparian planting plan.	$150,000	$70,000			$25,000	$245,000
TOTAL		**$637,000**	**$198,000**	**$400,000**	**$68,000**	**$49,000**	**$1,352,000**
Risks / Dependencies	**The number of Farm Environment Plans completed is dependent on the 4 additional Land Management Advisors (including a project manager) beginning at the start of the project. This risk will be mitigated by starting the recruitment process early.** **There is a small risk of not having the landowner buy in to undertake all the treatments. This will be mitigated through the work undertaken in the HCEF Boost Year (2018/19) which involves the development of a communications and engagement plan and also Milestone 1 and 4 which involves improving stakeholder engagement.**						

	There is a risk of natural weather events such as drought or storms damaging or reducing the survival rates of trees planted. This will be mitigated as much as possible by planting the right tree in the right place. Annual monitoring checks will be undertaken to monitor the success of tree plantings the year before.

Milestone Number	7						
Milestone Short Description	Applied Research and Landowner Engagement						
Milestone Due Date	30 April 2022						
Proposed Planting Season	N/A						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**
Research / Trials **(Coastal erosion buffers research project)**	Project activity report.	$15,000					$15,000
Research / Trials **(Mature poplar/willow research project)**	Project activity report.	$25,000					$25,000
Stakeholder Engagement	Activity report. Examples of promotion materials. Programmes of any workshops or field days.	$25,000					$25,000
TOTAL		**$65,000**	**$**	**$**	**$**	**$**	**$65,000**

Ministry for Primary Industries
Manatū Ahu Matua

Risks / Dependencies	**Research projects are dependent on the availability and expertise of consultants. This has been mitigated by developing research projects that build of existing research so it is known the consultants have the capability. The coastal erosion research builds off research Tane's Tree Trust are undertaking through the Sustainable Farming Fund and they are assisting with the HCEF Boost Year project. The mature poplar/willow research is building off work undertaken over the past 4-years through the Kaipara Hill Country Erosion Project. By spreading the research over 4 years and planning well in advance, it ensures the consultants will have the capacity to complete the research.** **There is a small risk that weather events such as droughts and floods may limit the amount of on the ground works or trials that can be undertaken.**

Milestone Number	8						
Milestone Short Description	Farm Environment Plans and Land Treatments						
Milestone Due Date	30 June 2022						
Proposed Planting Season	N/A						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**
Farm Plans **68 new Farm Environment Plans completed (and/or covering 17,000 ha).**	Activity report. GIS shapefile of farm boundaries. Farm Environment Plan example.	$215,000		$400,000			$615,000
Reversion (incl. Retirement) (250ha)	Activity report. GIS shapefile of areas.	$187,500	$125,000				$312,500
Fencing	Activity report. GIS shapefile of fencelines.	$192,000	$102,500		$98,166		$392,666

(Reversion/retirement areas or new forest)							
Capacity Development	Details of contractors engaged for July/August 2022 planting season. Training schedules and attendee lists.	$15,000					$15,000
Other (Water Reticulation) (Hill Country)	Activity report.	$75,000	$54,574				$129,574
Riparian Fencing (Riparian reversion/stream bank erosion)	Activity report. GIS shapefile of fencelines.	$180,000	$100,000		$93,333		$373,333
TOTAL		**$864,500**	**$382,074**	**$400,000**	**$191,499**	**$**	**$1,838,073**
Risks / Dependencies	The number of Farm Environment Plans completed is dependent on the employment of all Land Management Advisors (including a project manager). This risk will be mitigated by starting the recruitment process early and ensuring any LMA positions are left vacant for a minimal amount of time. There is a small risk of not having the landowner buy in to undertake all the treatments. This will be mitigated through the work undertaken in the HCEF Boost Year (2018/19) which involves the development of a communications and engagement plan and also Milestone 1, 4 and 7, which involves improving stakeholder engagement. There is also a risk of not finding enough suitable local contractors to train and engage for the upcoming planting season. Engaging contractors for this type of planting is new to NRC so there is an inherent risk. Again, it is envisaged this can be mitigated through the results of the HCEF Boost Year and Milestone 1, 4 and 7 which can initiate talks with potential contractors early.						

Ministry for Primary Industries
Manatū Ahu Matua

Milestone Number	9						
Milestone Short Description	Farm Environment Plans and Tree Planting Land Treatments						
Milestone Due Date	15 December 2022						
Proposed Planting Season	July/August 2022						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**
Farm Plans **68 new Farm Environment Plans completed (and/or covering 17,000 ha).**	Activity report. GIS shapefile of farm boundaries. Farm Environment Plan example.	$215,000		$400,000			$615,000
Forest Planting **150ha exotic & 300ha native.**	Activity report. GIS shapefile of planting areas and species. Example of Afforestation Planting Plan	$310,000	$155,000				$465,000
Space Planting **15,000 poplar/willow poles.**	Activity report. GIS shapefile of planting areas. Example of soil conservation planting plan.	$150,000	$60,000		$105,000	$30,000	$345,000
Riparian Planting	Activity report. GIS shapefile of planting	$175,000	$70,000			$25,000	$270,000

Ministry for Primary Industries
Manatū Ahu Matua

54,000 trees planted in riparian reversion/streambank erosion areas.	areas. Example of riparian planting plan.						
TOTAL		$850,000	$285,000	$400,000	$105,000	$55,000	$1,695,000
Risks / Dependencies	The number of Farm Environment Plans completed is dependent on the 4 additional Land Management Advisors (including a project manager) beginning at the start of the project. This risk will be mitigated by starting the recruitment process early. There is a small risk of not having the landowner buy in to undertake all the treatments. This will be mitigated through the work undertaken in the HCEF Boost Year (2018/19) which involves the development of a communications and engagement plan and also Milestone 1, 4 and 7 which involves improving stakeholder engagement. There is a risk of natural weather events such as drought or storms damaging or reducing the survival rates of trees planted. This will be mitigated as much as possible by planting the right tree in the right place. Annual monitoring checks will be undertaken to monitor the success of tree plantings the year before.						

Milestone Number	10						
Milestone Short Description	Applied Research and Landowner Engagement						
Milestone Due Date	30 April 2023						
Proposed Planting Season	N/A						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**
Research / Trials **(Coastal erosion buffers research project)**	Final project report.	$15,000					$15,000

Ministry for Primary Industries
Manatū Ahu Matua

Research / Trials **(Mature poplar/willow research project)**	Final project report.	$25,000					$25,000
Stakeholder Engagement	Activity report. Examples of promotion materials. Programmes of any workshops or field days.	$25,000					$25,000
TOTAL		**$65,000**	**$**	**$**	**$**	**$**	**$65,000**
Risks / Dependencies	**Research projects are dependent on the availability and expertise of consultants. This has been mitigated by developing research projects that build of existing research so it is known the consultants have the capability. The coastal erosion research builds off research Tane's Tree Trust are undertaking through the Sustainable Farming Fund and they are assisting with the HCEF Boost Year project. The mature poplar/willow research is building off work undertaken over the past 4-years through the Kaipara Hill Country Erosion Project. By spreading the research over 4 years and planning well in advance, it ensures the consultants will have the capacity to complete the research.** **There is a small risk that weather events such as droughts and floods may limit the amount of on the ground works or trials that can be undertaken.**						

Milestone Number	11						
Milestone Short Description	Farm Environment Plans and Land Treatments						
Milestone Due Date	30 June 2023						
Proposed Planting Season	N/A						
Funding	**Evidence of Completion**	**MPI amount Cash $**	**Regional Council Cash $**	**Regional Council In-Kind $**	**Landowner Cash $**	**Landowner In-Kind $**	**TOTAL $**

Farm Plans **68 new Farm Environment Plans completed (and/or covering 17,000 ha).**	Activity report. GIS shapefile of farm boundaries. Farm Environment Plan example.	$215,000		$400,000			$615,000
Reversion (incl. Retirement) (320ha)	Activity report. GIS shapefile of areas.	$250,000	$150,000				$400,000
Fencing **(Reversion/retirement areas or new forest)**	Activity report. GIS shapefile of fencelines.	$252,000	$50,000		$100,667		$402,667
Other (Water Reticulation) **(Hill Country)**	Activity report.	$75,000	$58,927				$133,927
Riparian Fencing **(Riparian reversion/stream bank erosion)**	Activity report. GIS shapefile of fencelines.	$225,000	$50,000		$91,667		$366,667
TOTAL		**$1,017,000**	**$308,927**	**$400,000**	**$192,334**	**$**	**$1,918,261**
Risks / Dependencies	**The number of Farm Environment Plans completed is dependent on the employment of all Land Management Advisors (including a project manager). This risk will be mitigated by starting the recruitment process early and ensuring any LMA positions are left vacant for a minimal amount of time.** **There is a small risk of not having the landowner buy in to undertake all the treatments. This will be mitigated through the work undertaken in the HCEF Boost Year (2018/19) which involves the development of a communications and engagement plan and also Milestone 1, 4, 7 and 10 which involves improving stakeholder engagement.**						

	There is also a risk of not finding enough suitable local contractors to train and engage for the upcoming planting season. Engaging contractors for this type of planting is new to NRC so there is an inherent risk. Again, it is envisaged this can be mitigated through the results of the HCEF Boost Year and Milestone 1, 4, 7 and 10 which can initiate talks with potential contractors early.

Ministry for Primary Industries
Manatū Ahu Matua

Completing the Milestone Table

Milestones Short Description	Describe the major milestones for your project. Be clear and concise. Please ensure the milestone title is focussed and reflects the deliverable descriptions.
Proposed Planting Season	Please provide the season for which you plan to plant the trees you have applied for.
Evidence of Completion	Consider including some examples like photos, invoices, workshop attendance registers and photos, inspection reports, feasibility reports, etc.
Due Date	For each milestone provide a completion date, timed with planned HCEF payments.
Deliverables / Activities	Include succinct, measurable deliverables / activities for each initiative within your milestone. E.g. farm plans, stakeholder engagement initiatives, feasibility reports, tree planting, etc. What is entered here is expected to be delivered.
Funding	Provide an estimated cost for completing each milestone. Totals for each financial year must equal the amount requested in the *"Total Funding Requested"* section of the Project Overview of the application form.
Risks / Dependencies	Include brief details of any risks or dependencies which could affect the delivery of the milestone.

Milestones and activities

Milestones are major stages or outputs of a project and are the key to achieving the overall objective of the project. The milestone table will become the main basis for contracting the project deliverables, so must include sufficient detail to enable HCEF to monitor progress and substantiate payments. Milestones should be specific, measurable, achievement-focused and time-bound.

With each milestone a success measure or evidence of successful completion must be detailed. Once your project has demonstrated successful delivery of the milestone and evidence of the success, then MPI is able to make the associated payment. This is upon submission of the appropriate documentation to MPI.

Ministry for Primary Industries
Manatū Ahu Matua

SECTION FIVE: PROJECT BUDGET

All applicants must complete a detailed project budget table that accounts for both cash and in-kind contributions.

The Project Budget table icon below links to an Excel spreadsheet. Please complete this template and submit with your completed application form. The Project Budget table should reflect and reconcile with the funding and deliverables included in the Milestone tables (in Section Four above).

Additional detailed cost breakdown can be supplied to demonstrate specific programme elements.

Note: Applicants must identify all other Government funds secured or being applied for that relate to the proposal. Duplication of funding on the same land or for the same work is not permitted.

All figures supplied must be exclusive of GST.

HCEF Project Budget Table.xlsx

Ministry for Primary Industries
Manatū Ahu Matua

DECLARATION

APPLICATION CONFIRMATION

Name of Applicant: Duncan Kervell **Date: 26/10/2018**

By completing and submitting this application, the Applicant certifies and acknowledges that:

- the signatory is legally authorised to submit this application on behalf of the Applicant.;
- all information provided is up to date, correct and complete;
- the project is believed to be eligible for a 2019 – 2023 Hill Country Erosion Fund grant;
- no part of the application area has been registered for the Afforestation Grant Scheme, Erosion Control Funding Programme, the Permanent Forest Sink Initiative, Emissions Trading Scheme, or the Primary Growth Partnership;
- if a grant is given, a contract will be entered between the Applicant/Grantee and the Ministry for Primary Industries (MPI);
- summary information about the application and any resulting grant (including applicant name, project title, and a summary of the proposal, its progress and results) may be made publicly available;
- the information contained in this application may be used to inform New Zealand's national and international reporting and accounting under the United Nations Framework Convention on Climate Change and relevant international agreements;
- MPI may collect information about your organisation from other parties, and may liaise with local and national organisations about this application;
- information contained in this application may be stored in an electronic database controlled and administered by MPI;
- the assessment of projects will be undertaken by MPI in its sole discretion, and MPI has final decision-making authority in this process.

Please email this application to: funding@mpi.govt.nz by 3pm Friday 26 October 2018.

Put the Project Title in the 'Subject' line of your email. Late applications will not be eligible.
For any further queries please contact Emma Hockly, Senior Investment Advisor HCEF; 04 894 3481

Ministry for Primary Industries
Manatū Ahu Matua

APPENDIX 1: BACKGROUND TO THE FUND

The Purpose of the Hill Country Erosion Fund

The Hill Country Erosion Fund (HCEF) was established by the government to provide leadership and targeted support to communities that need to protect erosion-prone hill country. It provides grants for regional council initiatives that protect erosion prone hill country through the implementation of sustainable land management practices.

The programme contributes to the One Billion Tree Programme, and in 2018 the HCE programme has been expanded in scope to include mitigating erosion-prone land in alpine and coastal areas – supporting proposals where the key treatment will be tree planting and appropriate species for natural vegetative cover. MPI has also further defined the objectives of the programme to focus on:

- sustainable land management across NZ;
- more trees in the ground.

In practical terms this means that we are open to receiving applications from new regions where the focus is on building capability and capacity.

A total of $34 million (GST exclusive) in grants is available for the next four years, contracting over 2019-2023. Only Regional councils and unitary authorities can apply for this funding.

The programme is a partnership between erosion-prone landowners, MPI and regional councils. A Hill Country Erosion Fund grant will not cover the full cost of a project. Regional councils and landowners (combined) are also expected to provide significant financial support to the proposed project.

Funding rounds are contestable. This means that your proposal will be competing with other proposals for limited funds, and there is no guarantee your proposal will be approved. The relative merits of each proposal are considered and funding recommendations are made by an Independent Advisory Panel.

For more information on the programme, please refer to MPI's website:

http://www.mpi.govt.nz/funding-and-programmes/forestry/sustainable-land-management-and-hill-country-erosion-programme/

What the grant can be used for

The primary use of HCEF grants is to support regional initiatives that aim to:

- protect unstable or potentially unstable land;
- protect stream beds;
- support forestry planting and reversion of targeted highly erodible land
- support community catchment facilitation groups;
- support riparian planting;

- plan or implement erosion protection programmes;
- educate owners of land that is erodible; and
- provide resources for protection programmes.

Additionally, grants can be used, in some circumstances, for projects that may have secondary outcomes that involve:

- commercial forestry;
- lower catchment infrastructure (roads, stop banks);
- water quality improvement.

What the Grant cannot be used for

Grants cannot be used for projects that focus on:

- the purchase of land;
- retrospective costs;
- activities more appropriately funded by other funding bodies or organisations;
- local or central government fees or charges;
- participation in statutory processes, litigation or resource inventory work; and
- Erosion Control Funding Programme (ECFP) target land.

Who can apply for a grant?

Regional councils and unitary authorities may submit applications for funding. Community groups and landowners are not eligible to apply to the fund, but can participate in regional initiatives that are supported by the fund.

Ministry for Primary Industries
Manatū Ahu Matua

APPENDIX 2: APPLICATION

Before making an application

Before making an application, check that your project is eligible for funding against the eligibility criteria at the beginning of this form. If you have any questions or queries you should contact funding@mpi.govt.nz to discuss your proposal.

Important Dates

The key dates for the 2019 - 2023 HCEF round are as follows:

Fund round opens
Fund round draft applications due
Fund round closes
MPI internal SMEs and Investment Advisers review applications
Applications are provided to advisory panel members for Review
Assessment panel meeting held in central Wellington
Preparation of Recommendation Paper
Minister announces funding
Applicants notified of outcomes
Successful projects contracted

Ministry for Primary Industries
Manatū Ahu Matua

APPENDIX 3: ASSESSMENT

The assessment of all applications will follow these two steps:

1. Applications are initially assessed internally by MPI for completeness and eligibility, and then by MPI subject matter experts;
2. An **Independent Advisory Panel** will **evaluate** the application with particular focus on the definition and significance of the problem, how the programme will be implemented, and consideration of alternatives, the level of support, prior record of delivery in the scheme, and how the proposal relates to local and central government policies and rules.

The assessment will be based on the information provided in your application form. The panel will use the assessment criteria framework below, to judge whether the project is desirable, viable and achievable. MPI staff may collect further commentary from independent sources to provide additional context.

Assessment Criteria

#	Criteria	Description
1	**Significance of the problem or opportunity**	Projects need to describe how significant the problem/opportunity is to the region. Importance and relative priority to the sector and/or region. Links to strategic plans or policy objectives (if applicable) will be taken into account.
2	**Contribution to the 1billion tree initiative**	Projects need to clearly demonstrate how many trees will be planted as a result of MPI investment.
3	**Contribution to environmental sustainability**	Projects must demonstrate how they will contribute to environmental sustainability for the region.
4	**Contribution to economic and social sustainability**	Projects must demonstrate how they will contribute to economic and social sustainability for the region.
5	**Ability to deliver**	Project management, financial management and technical skills plus a sound methodology are needed. MPI must have confidence that the project team can deliver on the proposed project.
6	**Value for money**	Projects need to demonstrate a good return on investment. The overall value of the outcomes of the successful project — whether economic, environmental, and/ or social — will be taken into consideration. The level of non-HCEF funding and in-kind contributions will be assessed relative to the project outcomes.
7	**Risk**	Is the risk involved in the project acceptable? Identify any risks posed by the project as well as any technical and/or delivery risks and how such risks might be mitigated. MPI must be satisfied that the level of residual risk is acceptable and that the funding sought is appropriate for this level of risk.
8	**Adoption and Extension Planning**	The proposal needs to demonstrate that project work can be disseminated through appropriate networks.

APPENDIX 4: CONTRACTING

An HCEF investment adviser will contact the appropriate council staff in order to negotiate a formal contract.

Intellectual Property

MPI will not own any intellectual property (IP) developed, discovered or created during the course of undertaking HCEF funded projects, including (but not limited to) any copyright in final reports and documents, but will require an unfettered licence to use that IP (without having to pay any additional fees). This provides greater flexibility to MPI to ensure the IP is used to maximise benefits for New Zealand land users. It does not alter the HCEF's fundamental/default policy of making HCEF information available as widely as possible within New Zealand's primary industries. It ensures that the public good generated from the use of public funds through HCEF is achieved.

In recognition of the public good objective of the fund, the MPI contracts include an IP clause requiring a Guarantee to provide a licence which allows MPI and the New Zealand state sector to use, copy and distribute any IP developed, discovered or created during the course the project on a non-exclusive, royalty free basis.

The Applicant Group must make any such IP available on request, and at no charge (except for such reasonable costs as may be approved in writing by MPI).

NB: If there is a compelling reason to restrict IP ownership or access (i.e. to provide exclusivity to the applicant Group or a third party), the applicant should discuss this situation with the HCEF investment adviser at contracting, or as soon as the situation is recognised.

Reporting Requirements

MPI will require evidence of the successful completion of each milestone, and claims for payment must be supported by this evidence.

Claims for payments should be lodged according to the agreed dates within the contract (i.e. the milestone table) as invoices against milestones and certified correct by both the project manager and the project's financial manager.

Milestone Reports must be completed, in a format approved or supplied by MPI, which will capture details on budget, evidence of success, project risks, events and project movement for each milestone's due date.

Additionally, regular reporting will be required as requested by MPI on the key facts and figures related to your project. In particular the type of treatments, number of ha, number of trees, stocking rates and species.

Final will be made when the HCEF receives a satisfactory Project Completion Report of achievements and accounts.

The council must keep correct accounts for performance validation and audit purposes. MPI-funded projects can be randomly selected for performance validation by an auditor. The auditor will request the project's associated reporting and financial records to assess the project's financial management and milestone progress. MPI may also ask for a copy of the accounts to be supplied with any payment request.

Ministry for Primary Industries
Manatū Ahu Matua

APPENDIX 5: OTHER IMPORTANT INFORMATION

The following information should be considered when making an application.

In-Kind Contributions

In-kind contributions are materials, equipment or services given to the project for free. These would normally come from the community, farmers or foresters involved in the project, councils and sector bodies.

For a contribution to count as "in-kind", the contributor should incur actual and real costs resulting from their direct involvement in the project. This does not include undertaking activities that form part of their normal day-to-day duties (i.e. doing something that would be done anyway).

Official Information Act

All information provided to the Ministry for Primary Industries is official information and may be subject to a request made under the Official Information Act 1982.

If a request is made under that Act for information you have provided in this application, the Ministry for Primary Industries will consider any such request, taking into account its obligations under the Official Information Act 1982 and any other applicable legislation

Acknowledgement of funding

MPI must be acknowledged as a source of funding in all publications and publicity regarding grant funded projects. MPI may specify the form and content of such acknowledgement. The MPI logo should also be used where appropriate. This will be provided to funded projects when requested.

Disclaimer

While reasonable efforts have been made to ensure the information in this publication is accurate, the Ministry for Primary Industries does not accept any responsibility or liability for error of fact, omission, interpretation or opinion that may be present, nor for the consequences of any decisions based on this information.

Communications and engagement strategy for

Flood protection 2018/19

Note: See individual communications plans for Awanui and Taumarere

Vision

To progressively reduce the flood risk in order to protect the people, property and infrastructure in vulnerable communities. This involves taking a region-wide overview to achieve the best outcomes for Northland and consulting with the affected communities to determine what levels of protection can be provided and how these can be delivered in the most cost-effective way. This includes effective prioritisation of flood protection and controlled interventions based on an updated region-wide overview of flood risk.

Council's Infrastructure Strategy sets out the vision and workplan for flood protection for the next 30 years.

Background

River flooding provides the highest natural hazard risk to the Northland region because of the extensive development on floodplains and the regions exposure to high intensity rainfall events. River flooding affects many of Northland main centres including Whangarei, Dargaville, Kaitaia, Kaeo, Kerikeri-Waipapa and many of the smaller townships.

The Northland flood scheme infrastructure currently comprises three main flood management schemes: The Awanui flood scheme ($11,118,670); Kaeo-Whangaroa flood scheme ($882,778); and the Hopua te Nihotetea detention dam in Whangarei ($10,735,055). These three schemes have a combined asset value of $22.7M.

River management plans which identify the risk and mitigation options for the 26 river catchments which pose the greatest threat to life, buildings, road access, infrastructure and agriculture have been completed and the 30-year strategy and implementation programme is underway. In addition to existing funding for maintenance and improvements, council approved $15M in the recent 2018-2028 Long Term Plan to complete implementation. Total $19.2 capex or $54M capex and opex for next 30 years.

Communication outcomes

The outcomes for this communication strategy are as follows, as informed by the priorities set out in council's infrastructure strategy and the Long Term Plan 2018-2028.

- The Kaitāia/Awanui community, and other affected communities, understand and support the implementation of the flood infrastructure strategy and works.
- Affected landowners are fully informed of council's process and workplan and the options relating to their land.
- The Taumarere community, including mana whenua and affected landowners, have actively engaged with council to work out the best approach for reducing the impacts of flooding in the area.
- Ratepayers understand the importance and value of the planned works to reduce the risk and impacts of flooding.
- Ratepayers are informed about the costs, including the 70/30 funding model.

Communications approach

- We will work closely with key stakeholders, existing working groups and representatives from the affected communities to keep them informed, take onboard their feedback and address any issues that arise.
- We will engage with key stakeholders to tell their stories and assist them to become key influencers and project champions within their communities.
- We will use a mix of targeted and general communications channels and tools to get the right information to the right people at the right time.
- Our engagement with affected hapu and marae will be planned and appropriate, informed by matauranga Maori and where possible within the timeframes and location identified by mana whenua.

Key messages

General messaging	· River flooding affects many of Northland main centres including Whangarei, Dargaville, Kaitaia, Kaeo, Kerikeri-Waipapa and many of the smaller townships. · Council's 30-year infrastructure strategy aims to reduce flooding in Northland's 26 river catchments which pose the greatest threat to life, buildings, road access, infrastructure and agriculture.

	· Costs to implement the strategy over the course of 30 years are estimated at just under $54M ($29M operational and $25M capex). · Based on feedback from the public, the proposed plan to fund the flood works through a 50/50 split was adjusted and will now be funded by a 70/30 split, with 70% funding from the general region-side rates and $30% by the affected communities through targeted rates. This reflects the overall benefit for the region as a whole and reduces the burden of rates on smaller communities. · Northland's three main flood management schemes are the: Awanui flood scheme (valued at $11,118,670); Kaeo-Whangaroa flood scheme (valued at $882,778); and the Hopua te Nihotetea detention dam in Whangarei (valued at $10,735,055). These three schemes have a combined asset value of $22.7M. · Works include building new infrastructure to protect communities; improving and maintaining existing stop and river banks; bridge maintenance; managing water flow by building or extending spillways and/or rerouting rivers and streams to minimise the impact when they are in flood. · This involves taking a region-wide overview to achieve the best outcomes for Northland and consulting with the affected communities to determine what levels of protection can be provided and how these can be delivered in the most cost-effective way. · Council will provide regular updates to the relevant communities as the work progresses and will engage with key stakeholders including mana whenua and affected landowners to work out the best approach for reducing the impacts of flooding in their area.
Awanui $15M | 2020-2027	· Council has recently approved a $15m staged upgrade to the Awanui flood scheme. This is the largest project the regional council has ever undertaken and will hugely improve the level of protection for in Kaitaia and surrounding areas. · The planned works will provide protection for a 1 in a 100-year event in Kaitaia township and a 1 in 20-year flood in surrounding areas through a combination of improvements over the next few years, including: o River bank stabilisation and further modification to the Whangatane spillway to cope with additional flood flow. We will also be installing a series of new spillways to cut the amount of floodwater into the Tarawhataroa Stream from the Awanui River; o Work to lessen the risk and potential effects from the large slow-moving Bell's Hill slip falling into the nearby Awanui River also forms a critical part of the upgrade; o Repairing and strengthening at risk sections of stop and river banks, including behind the Te Ahu centre (getting underway in 2018); o Work is also underway to convert the recently purchased former Firth concrete site (across the river from the Bell's Hill slip) into an additional spillway to help carry more floodwater if the river blocks due to a slip from Bell's Hill.

	· Detailed design work for the Awanui works are underway and will be completed in the next 18 months. · Council will continue to work closely with the Awanui River Working group and will provide regular updates to the community as the project progresses.
Taumarere - Kawakawa $2.9M – tbc	· The proposed new scheme would help reduce the impact of flooding for Otiria, Moerewa and, to a lesser extent, Kawakawa. The $2.9M of proposed works includes $400,000 of stream benching in certain places; a $2.5M spillway near Otiria is being considered further down the track. · The proposal was withdrawn, as a result of public feedback during the consultation process, to allow for community consultation and for further engineering assessments to be completed.
Kaeo-Whangaroa $400,000 | 2019-2021 $750,000 | 2024-2028	· The Kaeo-Whangaroa flood schemes have been constructed in the last five years and the assets are relatively new. · Recent maintenance has been done on the main Kaeo stopbank to top up the crest level following initial settlement. We expect that only limited maintenance will be required in the future. · New capital expenditure is planned to extend the Kaeo-Whangaroa flood scheme over the next ten years.
Panguru $440,000 | 2018-2020	· The development of vital flood works at Panguru was scheduled for 2023, however based on community feedback, council has brought forward these works which are underway. · The work will involve realigning 1km of stopbank and widening the channel to increase the capacity of the stream in times of high flow. Council will also work with FNDC to improve access along the West Coast Rd during flood events. · The cost of the works is $440,000 and will be funded 100% by the flood infrastructure rate.
Kerikeri-Waipapa $340,00 | 2018-2020	· Implement stream channel widening for the Waipapa industrial estate.

Key stakeholders

AUDIENCE	PRIORITY	INFORM / ENGAGE / PARTNER	CHANNELS	OUTCOMES
Councillors	High	Inform, Engage	Council meetings, workshops and working parties.	Councillors are kept updated with progress via the relevant councillor representatives. Staff provide regular updates on progress to council.
Awanui River Working Group Spokesperson, Mike Finlayson (Chair)	High Highly engaged	Inform, engage, partner, champion	Regular updates at meetings, or direct email if time sensitive to: · Test messages and/or letters to landowners · Email any relevant media releases to working group · Section on website for floods, email link if required · Share comms material that may be useful, eg FAQs, info sheets. · Involve in any public meetings or events.	Members attend meetings and are engaged in discussion around solutions relating to their flood issues, feel they have been listened to, and support the options that are developed. Members feed information through their networks and the groups they represent. They are the go to people for their communities and present fair and accurate information on the projects. Members have the opportunity to be the voice of the projects and be involved in the telling of stories.
Awanui affected landowners	High	Inform, engage	Letters to landowners – preliminary design. Talk to those directly affected (6ish) Detailed design in 12 – 18 months.	Need to inform and socialise the details of the project with landowners, with more engagement required for affected landowners, in particular those where there may be a negative impact on their land. Involve key landowners and tell their stories (taking one for the team). Affected landowners are engaged in discussion around solutions relating to their flood issues, feel they have been listened to, and support the options that are developed.

AUDIENCE	PRIORITY	INFORM / ENGAGE / PARTNER	CHANNELS	OUTCOMES
Far North District Council (FNDC)	High	Inform, Partner	Regular updates at Mayors and Chairs meetings and CEO meetings. Presentation to council, or at Strategic Forums (NFT). Use joint channels to communicate any shared updates.	FNDC is aware of the work we are planning and we work and communicate with each other as required. No surprises approach to joint or co-dependent projects. Clr Stratford is key contact and influencer.
Kaitaia-Awanui Community	Med/High	Inform	General messaging via MRs, social media, radio etc Updates via working party representatives Information and displays at local events, eg A & P shows.	The community are engaged in discussion around solutions relating to their flood issues, feel they have been listened to, and support the options that are developed. The community are aware of the 30/70 funding split. The community are able to provide feedback and seek further information as required.
CDEM	Med	Inform	Keep updated on the project.	No surprises approach to flood and emergency management.
Tangata whenua / mana whenua	Med	Inform	Represented on the committee General updates through council channels TTMAC	Mana whenua are aware of the works happening in their areas and the effects on the awa and the benefits to affected Māori owned property.
DoC	Med	Inform	Represented on the committee	No surprises approach to flood and emergency management on DoC owned or managed land.
Taumarere River Working Group Justin – Chair	Med	Engage, participate, partner	Committee meetings and public meetings. Direct email, face to face and phone contact.	Members attend meetings and are engaged in discussion around solutions relating to their flood

AUDIENCE	PRIORITY	INFORM / ENGAGE / PARTNER	CHANNELS	OUTCOMES
				issues, feel they have been listened to, and support the options that are developed. Members feed information through their networks and the groups they represent. They are the go to people for their communities and present fair and accurate information on the projects. Members have the opportunity to be the voice of the projects and be involved in the telling of stories.
Kelly Stratford – FNDC Clr	High	Engage, participate, partner	Member of Working Party and key influencer. Active FB page Highly engaged with community	Clr Stratford is aware of the work we are planning. We communicate with each other as required. No surprises approach to joint or co-dependent (regional and district council) communications.
Otiria Marae cttee	High	Engage, participation	Invitation and support from committee to hold a meeting at the marae. Ngati Hine Festival 2019	The Trust is engaged in discussions around solutions relating to its flood issues, feel it has been listened to, and supports the options that are developed.
Taumarere-Kawakawa Community	Med/High	Inform, Engage	Committee meetings Public meetings Information and displays at local events, eg A & P shows. Local media, including print and radio	The Trust is engaged in discussions around solutions relating to its flood issues, feel it has been listened to, and supports the options that are developed.
Hundertwasser Park Trust	High	Inform, engage	Trust meetings, emails, face to face	The Trust is engaged in discussions around solutions relating to its flood issues, feel it has been listened to, and supports the options that are developed.
BOI Vintage Railway Trust	High	Inform	Trust meetings, emails, face to face	The Trust is engaged in discussions around solutions relating to its flood issues, feel it has

AUDIENCE	PRIORITY	INFORM / ENGAGE / PARTNER	CHANNELS	OUTCOMES
				been listened to, and supports the options that are developed.
Twin Coast Cycleway Trust	High	Inform	Trust meetings, emails, face to face	The Trust is engaged in discussions around solutions relating to its flood issues, feel it has been listened to, and supports the options that are developed.
Kaitaia community	Med	Inform	General messaging Updates on specific works at key milestones Overall cost and 70/30 funding split?	Community is aware of the works, is aware of the size of the project and investment in the area and the level of protection the works will provide once completed.
Kerikeri-Waipapa Working Group	Med	Inform	Updates at meetings as required. General messaging Updates on specific works at key milestones Overall cost and 70/30 funding split?	Members attend meetings and are engaged in discussion around solutions relating to their flood issues, feel they have been listened to, and support the options that are developed. Members feed information through their networks and the groups they represent. They are the 'go to' people for their communities and present fair and accurate information on the projects. Members have the opportunity to be the voice of the projects and be involved in the telling of stories.
Kerikeri-Waipapa community	Low	Inform	General messaging Information and displays at local events, eg A & P shows. Updates on specific works at key milestones	Community is aware of the works, aware of the size of the project and investment in the area and the level of protection the works will provide once completed.
Iwi and hapu representatives	Med	Inform	Represented on the working group	Members attend meetings and are engaged in discussion around solutions relating to their flood

AUDIENCE	PRIORITY	INFORM / ENGAGE / PARTNER	CHANNELS	OUTCOMES
				issues, feel they have been listened to, and support the options that are developed. Members feed information through their networks and the groups they represent. They are the 'go to' people for their communities and present fair and accurate information on the projects. Members have the opportunity to be the voice of the projects and be involved in the telling of stories.
Living waters	Low	Inform	Attend meetings regularly	
Kaeo-Whangaroa community	Low	Inform		Community is aware of the works, aware of the size of the project and investment in the area and the level of protection the works will provide once completed.
Kaeo-Whangaroa Flood working group	Low	Inform	Updates at meetings as required. General messaging Updates on specific works at key milestones Overall cost and 70/30 funding split?	Members attend meetings and are engaged in discussion around solutions relating to their flood issues, feel they have been listened to, and support the options that are developed. Members feed information through their networks and the groups they represent. They are the 'go to' people for their communities and present fair and accurate information on the projects. Members have the opportunity to be the voice of the projects and be involved in the telling of stories.

Risks

Risk	Mitigation	Messages
Communities don't see the value for money they are getting for their rates. General ratepayers are not happy to contribute.	Publicise the scope of the works and why they are essential. Publicise the scope of the works and why they are essential. Stress the overall benefits and reasonable costs if spread over a larger rating base. Outline the negative effects for all of Northland if we experience a significant flood event.	Feedback to council supported the 70/30 split. Spreading the (70%) cost across all ratepayers is very low, whereas if the rate is targeted it would be unaffordable. There is wider benefit for Northlanders and visitors to the region – not only to those who are paying targeted rate. The communities involved pay the general rate and an additional 30% of the cost of the works. A catastrophic flooding event would result in much greater costs to the ratepayers of Northland as well as taxpayers and could have a lasting negative effect on our economy. Small communities need support or the works will be unaffordable.
Awanui infrastructure fails before the upgrades are complete	Publicise the scope of the works and timeframes.	General improvements are continuing to improve as part of the 30-year infrastructure plan, but council are investing even more to do more and do it faster. We are working to improve the resilience of our communities.
Major flood event	Communicate works and timeframes to communities	We are undertaking – undertake general maintenance as planned and are bringing forward works where possible. This is a big ongoing programme of works and will be undertaken over the next 30 years as planning and funding permits.
Taumarere communities may have expectations that work will go ahead earlier than planned.	Communicate the process and timeframes in order to manage expectations.	Feedback during the consultation process called for more discussion and input from the communities, so we want to engage with locals to get their views and support for the works before going ahead.

Actions

PROJECT	ACTIVITY	TACTICS	WHEN	WHO
General	Flood information · Overview of flooding in Northland, the Infrastructure Strategy and implementation plan and costs. Include the current and future risks of not doing works? · Highlight the key works required in Awanui/Kaitaia and Bells Hill slip; Kaeo; Panguru; Kerikeri-Waipapa; and Taumarere/Otiria. · Promote the value of the flood works for rates, including the 70/30 split.	· Create user-friendly information sheet/poster, to include general overview, costs and details of specific schemes and implementation plans. · Attend relevant events to inform affected communities of flood works	1 Nov 1 Feb 2019 Feb – Mar 2019	Comms Rivers
	Keep elected members updated. Provide update at December Strategic Workshop (NRC hosting)	· Presentation on infrastructure strategy and implementation plan for floods	Dec 2018	Joe
Direct contact	Build up database of email addresses to enable direct contact with Far North communities	· Gather email addresses when sending letters, at events and meetings etc · Provide electronic updates via email · Publicise relevant events and meetings	Ongoing	Comms Rivers
FNDC	Keep FNDC council and relevant staff up to date Representatives on relevant working groups and projects	· Items and presentations to council · Council representatives	Quarterly updates to council	NRC clrs Rivers FNDC clrs

PROJECT	ACTIVITY	TACTICS	WHEN	WHO
	Share information through FNDC channels where appropriate	· Meetings with relevant staff regarding specific projects · FNDC to share relevant comms and information on flood works through their channels	6 - 12 mthly updates to Chairs/Mayors meetings Working party minutes Share info as required.	
Taumarere – Kawakawa	Develop comms and engagement plans for Taumarere-Kawakawa flood works.	· Chair of working party · Working party meetings · Direct contact with members	1 Nov 2018	Suz, Matt, Joe
Awanui-Kaitaia	Develop comms and engagement plans for Awanui-Kaitaia flood works.	· Chair of working party · Working party meetings · Direct contact with members	1 Nov 2018	Suz, Matt, Joe
Panguru	Publicise work (brought forward) in Panguru. Advise 70/30 split.	· Media release · Social media posts	1 Dec 2018	Matt, Joe
Kaeo	Update working party and key stakeholders Update community on works as part of general communications,	· Working Party meetings · Media releases, events	Feb – Mar 2019	

Communications and engagement strategy for Water 2018/19

Background

Having plenty of clean freshwater is something we all want. We swim in it, drink it and are culturally connected to it. The productivity of our land, our agriculture and wider economy depends on it.

As a regional council, much of the work we do relates to managing our fresh and coastal water – from landowner advice and support, to making rules, doing research, monitoring water quality and quantity, working with schools and more.

Freshwater has been in the spotlight for some time now. Growing public concern about the state of New Zealand's waterways and increasing policy direction flowing down from central government means water will remain a priority focus for council going forward.

We all have a part to play to protect and improve water and collectively strike a balance that delivers the best outcomes for Northland. Together with our communities, we are committed to working together to look after our precious water, both for now and for future generations.

Objectives

Understanding our water

We will work to understand what it takes to best manage our freshwater resources through science and research, mātauranga Māori and monitoring our environment.

- We will make our research and monitoring available and easily accessible to our community.
- We will support and highlight mātauranga Māori approaches to understanding our freshwater resources.

Managing our water

We will implement national policy for water, develop and implement regional policy, and regulate and enforce the rules to manage our current and future water resources.

- We will work with our communities and tangata whenua to ensure their values, uses and aspirations for water are reflected in our policies and programmes.
- We will help our water users and communities understand what they need to do to meet our regional rules for water quality and quantity.

Working with our people

We will work with stakeholders and our community to implement water management improvements that are informed by science, on land and water.

- We will work with catchment groups, industry groups and other partners to create better water quality and quantity outcomes for Northland.
- We will support and promote the work that landowners are doing to care for water.

Education and information

We will engage with the wider community to educate and inspire people to play a part in caring for water, build understanding of water management in Northland, and demonstrate the value of the work we do.

- We will grow engagement and participation of schools to help improve Northland's water quality through the Enviroschools programme.
- We will educate ratepayers across the region recognise the importance and value of what we do in the water management space.

Key messages

Managing freshwater is a top priority

- We do heaps of stuff to care for Northland's water and we're always looking at how we can do it better.
- It's our biggest area of work and, following a public feedback process on council's Long Term Plan, we're investing an extra $5.7 million into caring for our water over the next three years.
- We've got a long way to go, but the journey's well underway and great mahi is happening right across the region.
- Improving water quality takes time. Much of the good work happening today won't be reflected in our water quality results for a number of years – it's a long-term investment.

Working together

- Lots of people and organisations – including us at the regional council – care deeply about improving Northland's water.
- We're working together to ensure our precious water resources are sustainably used and protected, both now and for future generations.
- Partnerships, with agencies, community groups and individuals, help to ensure an integrated, collaborative approach to water management across the region.
- The work we do is based on sound science and reflects our communities' uses, values and aspirations for water in Northland.
- We all have a part to play in improving our water quality.

Risks

Risk	Mitigation
Communities don't see the value for money they are getting for their rates.	Maintain regular updates to inform people of the work that is happening, and why. Engage with community groups and the public so they are part of the water quality conversation, planning and actions.
Central government rules and policies may change.	Be aware of central government planning in advance to allow time to develop our response. Be adaptable. Ensure internal staff kept informed.
People have unrealistic expectations of the pace/degree of improvement to water quality expect improvements to happen faster	Messaging to manage expectations. (Improving water quality takes time. Much of the good work happening today won't be reflected in our water quality results for a number of years – it's a long-term investment.)
Increasing the profile for water-related work and issues makes us vulnerable to criticism and an increase in negative comments, particularly on social media.	Be open to all feedback. Be properly prepared when going out with campaigns. Ensure we're responding in a genuine and timely way. Be aware and accepting of the fact that we will be criticised, aim at increasing trust through increasing the publics knowledge around water and the work we and our partners do.
Water is a complex issue and the general public are not privy to the level of knowledge that we, as experts, hold.	Respond with factual, science based answers, but remain 'human and approachable'. Use plain language. Don't be defensive or overly bureaucratic.
There is a high level of interest and high sensitivity around water, water quality and ownership.	Monitoring and awareness of public sentiment and planning our communications and approach as required. Thoughtful and proactive preparation in advance to address sensitivities and risk.

Activities

Programme/activity	Communication objective	Audience	Tools Delivery method	Timeline	Lead
Understanding our water					
We will make our research and monitoring available and easily accessible to our community.					
Summer swimming campaign	Customise LAWA campaign material for local use (if it's provided in a timely fashion)	LAWA TLAs Public	Website Social media Media release	Dec 18 – Mar 19	Tracey (comms) Pania (SOE)
Publishing environmental data online	Reviewing our strategic approach to publishing data online (much of which is water-related)	Various	Steering group to develop new strategic approach	Dec 18 – Jun 19	Tracey (comms) Jean-Charles, Ricky, Jason
Communications protocols for cyanobacteria events	Ensure clear roles, processes and messaging is in place in the event of an algal bloom, and build public confidence in our response and communication when it happens.	Partner agencies Internal NRC staff Media Public	Internal channels – Express Information on website Protocol document and posters Media release/s	Nov 2018	Suz (comms) Ali McHugh, Jean-Charles
We will support and highlight mātauranga Māori approaches to understanding our freshwater resources.					
Telling the story of our awa	Telling the story of the awa with a focus on the mauri of the waterbody. Engaging hearts and minds through use of first person narrative. Pilot with Wairohia stream; roll-out to three further rivers over the coming year (one in each district).		Social media campaign including video and SM posts.	Sept 2018 (pilot); Jan 19 – Aug 19 (next three rivers)	Suz (comms)
Te Whairiki	Māori values and kaupapa are reflected through the approach, tone, use of te reo and visual images, in line with communication policies for Te Whairiki (under development).	NRC staff Public, All	All council communications	Sept – Oct	Suz (comms) Rachel R
Managing our water					
We will work with our communities and tangata whenua to ensure their values, uses and aspirations for water are reflected in our policies and programmes.					
'Where's your wai' campaign	Get a better picture of the freshwater spots people are using, to help inform the work we do to care for Northland's water.	Public, All	Social media Print Face to face engagement at markets Interactive online tool 'drop a pin'	Oct/Nov 18 consultation period	Tam (comms) Justin (policy)
'Essential Freshwater' work programme	Develop community engagement approaches as required to meet upcoming policy requirements coming through the Government's Essential Freshwater work programme.	TBC	TBC. Develop community engagement plan/s as required.	TBC	Tam (comms)
We will help our water users and communities understand what they need to do to meet our regional rules for water quality and quantity.					
Water takes data collection project	Improving the system for how people report their water takes (bringing it online); communicating the new system to people that will use it.	People who take water	Online/website Targeted communications	Nov – Feb 19	Debbie (comms) Sandrine

Programme/activity	Communication objective	Audience	Tools Delivery method	Timeline	Lead
Working with our people					
We will work with catchment groups, industry groups and other partners to create better water quality and quantity outcomes for Northland.					
FIF Northern Wairoa	Providing communications advice and support to the project team. Build and maintain strong trusting relationships with partners and key stakeholders.	Project team MFE Mana whenua Northern Wairoa communities	Develop communication protocols for group Develop a communications plan	Dec 2018 – Mar 2109	Suz (comms) Imogen (Land)
FIF lakes project	Providing communications advice and support to the project Build and maintain strong trusting relationships with partners and key stakeholders.	Project team MFE Water scentists Tangata whenua	Communication plans developed for Dune Lakes projects: incl. protocols and tools for kaiwhakahaere	Dec 2018 – Mar 2109	Suz (comms) Will (biodiversity) Ashlee (biosecurity)
Catchment networking events	Following success of Waitangi catchment networking event, roll out similar event/s in other catchment/s, starting with Doubtless Bay (TBC)	Landowners	Events Promotional activity to get people along	TBC	Kim (TBC)
Otuihau Working group	Build and maintain strong trusting relationships with partners and key stakeholders. Support and assist with promotion and delivery of events and activities		Social media Events Signage Promotional activity	Ongoing	Jalissa (comms) Lorna
We will support and promote the work that landowners are doing to care for water in or region.					
New hill country erosion funding (TBC)	(If funding approved) Build profile for and uptake of what we can offer to landowners with the expansion of our hill country erosion programme.	Landowners Public, All	Engagement plan to be developed once project funding secured	Feb – Mar 19	Tam/Ali (comms) Duncan
Environment Fund	Promote the work being done to improve water quality for Northland with support of our Environment Fund.	Public, All	Land management e-news Environment awards Social media	Ongoing	Ali (comms) Lorna
NRC Environment Awards	Recognising and celebrating the success of the work communities are doing around land management / water quality	Landowners Partners Wider Northland community	Awards itself Promotional activity to get entrants e.g. via land management officer relationships, e-newsletter Promotional activity to publicise winners e.g. social media, media release, e-news live updates etc.	May 2019	Tash (comms) Kim
Ballance Farm Environment Awards sponsorship	Showcase excellent land management practices through sponsorship of the Water Quality Enhancement Award	Landowners Partners Wider Northland community	Promotional activity to publicise winners e.g. social media, media release, e-news live updates etc.	Mar-May 19	Tash (comms)
Host the 2019 NZ Association of Resource Management conference	Promote shared learning on resource management and showcase the work we do.	Regional councils	Assist with organisation and delivery of event Promote through networks and comms channels	Oct 2019	Kim (comms) Duncan

Programme/activity	Communication objective	Audience	Tools Delivery method	Timeline	Lead
Hills to harbour e-newsletter	Sharing and showcasing the work that landowners, communities and stakeholders are doing in the land and water space.	Landowners Stakeholders	E- newsletter	3-4 times a year	Ali (comms)
Education and information					
We will grow the engagement and active participation of schools to help improve Northland's water quality.					
Enviroschools programme	Better environmental outcomes for Northland through increased education, activity and leadership by Northland schools and young people taking part in the Enviroschools programme, including the WaiRestoration project and the water of life theme area.	Northland students and school communities Enviroschools programme members Councillors	Enviroschools facilitators and partners Events and training courses Publications Online: website and social media Enviroschools resources	Ongoing	Susan Lavinia
Environmental Leaders fund	Increase schools' participation and achievements in environmental activities and projects aligned with council's environmental objectives.	Northland students and school communities Councillors Public	Promotion of ELF funding and biosecurity resources through school networks and social media. Good news stories in print and online and school publications and promotions.	Annual	Kim, Susan
We will help ratepayers across the region recognise the importance and value of what we do in the water management space.					
Refresh and update water section of our website. Look at options for using digital tools to tell the water story.	Up to date, easy to find and user-friendly online information. Use of emerging technology to provide interactive user-friendly communication and engagement tools.	All	Website Newsletters and publications Digital tools and	Oct 2019 - ongoing	Ali, Debbie
Telling the stories of our awa	(see section under 'understanding our water')				Suz (comms)
River festival (TBC) – bringing together a range of water-related activities and events over a week-long period around World Rivers Day	Increase positive engagement with Northlanders in the water space. Assist Northlanders to express and achieve their aspirations for freshwater.	Mana whenua Local communities Schools/students Partners and volunteers	Events Community and partner participation.	Sept 19 (week around World Rivers Day)	Suz (comms), Kim, Susan.

Appendices: Stakeholder analysis

Stakeholder and industry groups	Activities, key stakeholders	Areas of interest	Priority
NRC Councillors Council staff Enviroschools	Leadership and governance Operational activities and management Environmental education and engagement	Achieve LTP objectives for land and water	High
Key Ministries and Ministers	MFE staff Hon David Clarke, Hon Eugenie Sage MPI staff Hon Damien O'Connor, Hon Shane Jones MBIE staff Ministers for Agriculture; Climate Change; Forestry.	Freshwater policy and legislation National land and water initiatives and campaigns Funding for Northland projects and campaigns	High
Ministers	Ministers for: Conservation; Health; Land Information; Local Government, Maori Development; Regional Economic Development; Fisheries.	Joined up objectives and activities across Northland Better outcomes for Northland land and water	Med
Catchment groups	Catchment management groups	Provide leadership on land and water management Ownership of activities in catchments Input into council decision making	High
Regional /national environmental and management groups	Living waters Whitebait connection LAWA NIWA DoC	Joined up objectives and activities across Northland Increase success of water projects and initiatives Better outcomes for Northland land and water	High
Tangata whenua	TTMAC and MTAG Iwi groups and representatives	Joined up objectives and activities across Northland	High

Stakeholder and industry groups	Activities, key stakeholders	Areas of interest	Priority
	Hapu and mana whenua Northland marae Iwi leaders group IKHMG Integrated Kaipara Harbour Management Group Te Oneroa a Tohe Beach Board	Input into council decision making Better outcomes for Northland land and water Provide leadership on land and water management Increase success of water projects and initiatives Ownership of activities by tangata whenua	
Industry or special interest groups	Dairy NZ, Fonterra and dairy farmers Forestry Agriculture and Horticulture groups	Shared environmental objectives, projects and initiatives Increased understanding and compliance with relevant policy and rules. Achieve a balance between economic, environmental and cultural opportunities and impacts Better outcomes for Northland land and water	High
Northland councils and politicians	Whangarei, Kaipara and Far North District councils and staff District Health Board and staff Rt Hon. Winston Peters Hon. Shane Jones Hon. Kelvin Davis Matt King; Willow Jean Prime; Dr Shane Reti	Partnerships, both operations and governance Activity happening in their districts Some joint projects	Med/High
Local and central government bodies	Regional and unitary councils District councils NZTA LGNZ, SOLGM Northland District Health Board		Med Low-Med Med Low Low

Stakeholder and industry groups	Activities, key stakeholders	Areas of interest	Priority
Northlanders	Northland ratepayers and residents Environmental groups and volunteers		Med

Key events

Event	Date	Location	Audience
Kaitaia A&P show	23 Feb 2019	Te Ahu Centre, Kaitaia	Farmers, rural landowners, marine boaties
Northland Agricultural Field Days	28 Feb – 2 Mar 2019	Dargaville	Farmers, rural landowners, urban
Ngati Hine Festival	8 – 9 Mar 2019	Otiria Marae	Tangata whenua
River Festivals – tbc	Sept 2019	Rivers x3	Local communities, partners, mana whenua

What we are doing

To pick up the pace on water quality improvement, we are increasing our resources so we can do more to:

Reduce sedimentation in waterways. This includes:

- more grants through the eFund for landowners to fence and plant waterways
- progressing council's soil conservation programmes and priority catchment management plans to do more on hill country erosion and highly erodible land
- expanding our Flyger Road poplar nursery and purchase and development of an additional poplar and willow nursery in the far north
- *Funding for afforestation grants, staff and resources*

Look after our lakes and wetlands. This includes:

- more action on the ground to protect Northland's precious dune lakes
- doubling the number of wetlands we monitor

Understand our water resources. This includes:

- more water quality monitoring to meet increased national standards
- increasing our hydrology work to better understand and manage water quantity

We have proposed new rules through the Proposed Regional Plan to better protect our waters. This includes:

- rules requiring livestock be excluded from certain waterbodies and the coast
- improved rules for dairy effluent
- Northern Wairoa project?

Research into the benefits of bio-active riparian buffers

The Institute of Environmental Science and Research (ESR) has prepared the attached draft costings for a potential trial site in Northland.

As a summary, establishing a 1ha trial (similar to what is being carried out in the Wairarapa and Waikato) would likely cost around $100K, of which approximately $70k would be for research related costs and the remainder for site establishment (planting, maintenance etc).

On-going discussions with ESR, Waikato and Greater Wellington Regional Councils are helping us identify where the gaps are in the existing trial work and what benefits an additional trial site in Northland may provide. This will likely be required to support any research funding applications.

We are also looking at existing projects and programs (i.e. E-fund / HCEF) to support site establishment work and engaging with potential partners to identify opportunities for collaboration.

We have been looking for sources of funding, however this has not been forthcoming. Funding may be challenging to secure if existing trials of this nature are already underway. However, we are looking for a point of difference that relates to the Northland environment.

	Task	Resources	Funding required from external source (yet to be identified)	Potential NRC contribution (funded through E-fund/HCE Boost?)
1	**Base line monitoring**	Soil chemistry - pore water		
		Soil chemistry - sediment		
		Soil biology - pore water		
		Soil biology - sediment		
		Total	**$17500**	
2	**Installation of monitoring equipment**	5 pore water samplers at each site (total 10 installed)		
		5 sediment traps at each site (total 10 installed)		
		Total	**$7200**	
3	**Demonstration plot planting**	plants		$15,500/ha
		planting		$7,830/ha
		one trip 2 x science staff	$4700	
		Total	**$4700**	$23330
4	**Demonstration plot maintenance**	maintenance		$5,376/ha
		One trip 1 x science staff	$2700	
		Total	**$2700**	$5376
5	**Demonstration plot monitoring**	Soil chemistry		
		Soil biology		
		water		
		Total	**$19000**	
6	Data collection and analysis	Data collection		
		Analysis		
		Total	**$8000**	
7	Data interpretation and communication	Communicate results to project collaborators and key stakeholders	$4500	
		Complete reporting requirements	$5000	
		Total	**$9500**	
		Project total	**$68,600**	**$28,706**

Natural Resources Working Party Agenda

Meeting to be held in the TBC
on Tuesday 4 December 2018, commencing at TBC

Please note: working parties and working groups carry NO formal decision-making delegations from council. The purpose of the working party/group is to carry out preparatory work and discussions prior to taking matters to the full council for formal consideration and decision-making. Working party/group meetings are open to the public to attend (unless there are specific grounds under LGOIMA for the public to be excluded).

MEMBERSHIP OF THE NATURAL RESOURCES WORKING PARTY

Chairman, Councillor Justin Blaikie

Councillor David Sinclair	Councillor Rick Stolwerk	Councillor Joce Yeoman
Councillor Bill Shepherd (Ex-Officio)	Non Elected Member from TTMAC	

Item **Page**