

Natural areas of Kaikohe Ecological District

Reconnaissance Survey Report for the
Protected Natural Areas Programme

NEW ZEALAND PROTECTED NATURAL AREAS PROGRAMME

Linda Conning and Nigel Miller

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Foreword

The Kaikohe Ecological District is a compact area between the Bay of Islands and Hokianga Harbour, and harbours a wealth of ecological values including

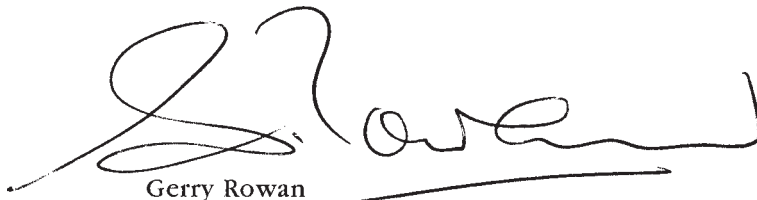
- a rare stand of dense old growth podocarp/kauri
- one of Northland's largest wetlands
- unique associations of volcanic geomorphology with lakes, wetlands and uncommon plants
- a suite of habitats containing the threatened North Island brown kiwi
- gumlands
- remnant puriri forest on volcanic soils
- remnant swamp forests and shrublands

as well as many other areas with significant conservation values.

Many of these areas are mere remnants of a formerly rich ecological heritage.

This survey provides information on the best of what remains and brings their significance into sharp relief.

Kaikohe Ecological District is an area of natural gems, and it is a challenge for landowners, protection agencies and all those with an interest in conservation to find ways to maintain and enhance their values.

A handwritten signature in black ink, appearing to read 'Gerry Rowan', with a horizontal line underneath it.

Gerry Rowan

Conservator - Northland

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Figure 1. Location map of Kaikohe Ecological District (Brook 1996).

Figure 2. Map of surveyed sites, Kaikohe Ecological District.
Land administered by Department of Conservation shown in green.

Abstract

The Kaikohe Ecological District is located between the Bay of Islands in the east and the Hokianga Harbour in the west and covers approximately 62,800 ha, 21% of which comprises natural areas described in this report.

A total of 84 natural areas of ecological significance were identified from a reconnaissance survey undertaken in 1994-95 together with information from existing databases.

The Kaikohe Ecological District contains several distinct features including the largest freshwater body in Northland (Lake Omapere), volcanic cones and basalt lava flows, and the geothermal and gumland heath area of Ngawha Springs, as well as several important wetlands.

The District contains a high diversity of vegetation types, including some areas rare nationally such as gumland, mature podocarp forest, volcanic broadleaf forest, swamp shrubland, and swamp forests. Manuka-kanuka shrubland, broadleaf-podocarp and secondary podocarp forest and are the most common vegetation types.

The protected natural areas network in this District is limited to 2001 ha, almost half of which comprises one site. Priority areas for protection include gumlands, wetlands, mature podocarp, kauri and volcanic broadleaf forests, as well as areas of kiwi habitat.

1. Introduction

1.1 THE PROTECTED NATURAL AREAS PROGRAMME

The Protected Natural Areas Programme (PNAP) was established in 1982 to implement s3 (b) of the Reserves Act 1977:

“Ensuring, as far as possible, the survival of all indigenous species of flora and fauna, both rare and commonplace, in their natural communities and habitats, and the preservation of representative examples of all classes of natural ecosystems and landscape which in the aggregate originally gave New Zealand its own recognisable character”.

The goal of the programme is:

“To identify and protect representative examples of the full range of indigenous biological and landscape features in New Zealand, and thus maintain the distinctive New Zealand character of the country” (Technical Advisory Group 1986).

The specific aim of the PNAP is to identify, by a process of field survey and evaluation, natural areas of ecological significance throughout New Zealand

which are not well represented in existing protected natural areas, and to retain the greatest possible diversity of landform and vegetation patterns consistent with what was originally present. To achieve this, representative biological and landscape features that are common or extensive within an Ecological District are considered for protection, as well as those features which are special or unique.

As knowledge and information about the presence and distribution of fauna and flora such as invertebrates and bryophytes is limited, the protection of the full range of habitat types is important to maintaining the diversity of lesser known species.

This report differs from previous PNAP reports in that it is based mainly on a reconnaissance survey and existing published and unpublished data, and includes descriptions of most natural areas within the Ecological District boundaries.

The natural areas described have been evaluated according to two levels of significance based on specified criteria (see Section 2), and are not confined to Recommended Areas for Protection (RAPs), as defined in previous PNAP reports.

This approach was adopted so that the survey report better meets the broader information requirements of the Department of Conservation arising from the Resource Management Act 1991 (RMA) and the Convention on Biological Diversity (1992).

The Purpose and Principles of the RMA are set out in Part II of that Act and include:

- safeguarding the life-supporting capacity of air, water, soil, and ecosystems;
- the preservation of natural character of the coastal environment, wetlands and lakes, and rivers and their margins;
- the protection of outstanding natural features and landscapes;
- the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna;
- intrinsic values of ecosystems;
- maintenance and enhancement of the quality of the environment.

The Convention on Biological Diversity (1992), under the auspices of the United Nations Environment Programme, has promoted the concepts of biodiversity and ecosystems.

These concepts are reflected in this report in the number of sites, their size, and the emphasis on buffers and linkages in the identification and assessment of sites.

1.2 ECOLOGICAL REGIONS AND DISTRICTS

New Zealand's physical environment is very diverse, and this is reflected in the diversity of indigenous plant and animal communities. In recognition of the biogeographic differences between various parts of New Zealand, a classification of Ecological Regions and Districts has been established (McEwen 1987).

An Ecological District is a local part of New Zealand where the topographical, geological, climatic, soil and biological features, including the broad cultural pattern, produce a characteristic landscape and range of biological communities. Ecological Districts are grouped together into a series of Ecological Regions on the basis of shared general ecological and geological characteristics. In some cases, a single very distinctive Ecological District is given the status of ecological region to emphasise its uniqueness (Technical Advisory Group 1986).

The New Zealand Biological Resources Centre co-ordinated the mapping of the country into more than 260 districts in 1982. Ecological Regions and Districts in northern New Zealand have recently been redefined to more accurately classify ecological variation within the Northland and Auckland areas (Brook 1996).

The PNAP uses the division of Ecological Districts as a framework throughout the country for determining ecological significance, including representativeness.

1.3 CONTENTS OF THIS REPORT

This report presents the findings of a reconnaissance PNAP survey of Kaikohe Ecological District. It includes maps and brief descriptions of most of the indigenous natural areas within the Ecological District, together with an analysis of the main vegetation types and information on threatened species and other taxa of scientific interest.

The natural areas described have been assessed according to ecological criteria outlined in Section 2.4.

Soil descriptions are given only for sites listed in Arand et al. (1993) as being of regional, national or international importance (see Appendix 8.3).

1.4 KAIKOHE ECOLOGICAL DISTRICT

The Kaikohe Ecological District covers 62,800 ha to the south of Puketi Forest, with Lake Omapere located roughly in the centre of the District. It stretches from the Waima River in the west to Pakaraka in the east, and includes the upper catchments of the Waitangi River. In the south it includes the Punakitere Valley to Lake Tauanui. The underlying geology of Mangakahia Complex sedimentary and basaltic volcanic rock types is typical of the District.

Apart from Lake Omapere itself, the largest freshwater body in Northland, there are many ecological features of note within this Ecological District. To the south

and east of Lake Omapere, volcanic cones and basalt lava flows have produced some of the best examples of volcanic broadleaf forest in the Region, which are important for the sustenance of kukupa, as well as for their representative values.

Where water flow has been impeded, remnants of swamp forest and wetland can sometimes be found.

The geothermal and gumland heaths of Ngawha Springs are unique within the Region, as are several of the volcanic broadleaf forest remnants on the eastern side of the District.

In the west, Pukewharariki Forest and its associated outliers contain some of the best examples of mixed podocarp/kauri/broadleaf forest remaining in private ownership in Northland. Other forest remnants and exotic plantations form large contiguous forested mosaics.

The District is one of the Northland strongholds for the NI brown kiwi.

Of the natural areas identified, 51% is forest, 34% shrubland, 1.5% is swamp forest and swamp shrubland, 3.5% wetland, and 10% lakes or open water, totalling 13,790 ha.

2. Methodology

2.1 GENERAL APPROACH

Information on the composition, extent and ecological values of indigenous natural areas within the northern portion of the Northland Conservancy was obtained during reconnaissance surveys using rapid semi-quantitative methods carried out in 12 Ecological Districts between 1994 and 1996. Field work was carried out mainly by three Department of Conservation staff and co-ordinated in the Whangarei Office of the Northland Conservancy. The survey of Kaikohe Ecological District was part of that larger study.

Natural areas were identified from topographic maps, existing databases, published and unpublished reports, aerial photographs and field and aerial observations. Areas were identified without regard for tenure. Consequently many natural areas which are administered by the Department of Conservation as well as other protected areas were also surveyed using the same methodology. This provided a consistent approach to determine representativeness of unprotected natural areas.

Each site was mapped and described. Having evaluated the sites (see Criteria, section 2.4), they were grouped according to one of two levels of ecological significance (see section 4). Scientific names of species for which common names have been used are given in Appendix 8.4 (Fauna) and Appendix 8.5 (Flora).

In writing this report, extensive use was made of information from existing biological databases such as the Sites of Special Biological Interest (SSBI) database, Rare Plants Database, Freshwater Fisheries Database, Amphibians and Reptiles Database, Bio-sites, the New Zealand Geopreservation Inventories, published information, and Department of Conservation internal reports. The SSBI database in the Northland Conservancy was the source of a considerable amount of information, particularly concerning fauna. Herbarium records from Auckland Institute and Museum and Landcare Research, Lincoln, were also consulted. Geographical and geological information was gained from existing published and unpublished maps.

Although few sites were surveyed in detail, a large amount of data was collected, considerably expanding the information base for the Ecological District.

2.2 CONSULTATION WITH LANDOWNERS

Because of the magnitude and geographic range of the surveys being undertaken (nine full and three part Ecological Districts to be completed in a two-year period), personal contact with all landowners was not possible.

Therefore all ratepayers were advised by way of a mailed leaflet (Appendix 8.2) informing them of the programme and the reason for it. The leaflet was signed by the Northland Conservator of the Department of Conservation, Northland Conservancy, and provided contacts for further information. A press release on the survey methodology and photograph of the survey team was featured in the local newspapers (see Appendix 8.2).

In many instances permission for access was sought from landowners either by telephone or direct visit, and was generally given. In very few cases was access refused.

Consultation with Ngāpuhi runanga was undertaken by the Conservancy Manager Protection at meetings attended at Kaikohe.

2.3 DATA ACQUISITION AND ANALYSIS

A rapid, reconnaissance field survey was carried out to record and map the ecological and geomorphological characteristics, habitat type, and canopy vegetation of each identified natural area. Most of this work was carried out from roads or high points using telescopes and binoculars.

Where the opportunity arose, e.g. at a landowner's request, some sites were inspected in more detail and transects within the habitat were undertaken, while a few isolated sites were identified and described from aerial survey and photographs. Information on some sites in the latter category remains limited, and it is likely that some ecological units have not been recorded.

Natural areas were mapped using five broad categories of habitat types: forest, shrubland, wetland, duneland, and estuary (see Appendix 8.6).

At each site, the composition and relative abundance of canopy plant species was estimated and recorded on the field survey sheet (see Appendix 8.1) in the following four categories: greater than 50% cover was defined as “abundant”; 20–50% as “common”; 5–20% as “frequent”; and less than 5% as “occasional”.

Canopy composition based on percentage cover abundance is widely considered to be a valuable approach for description of forest stands. This technique and variations of it, for description of canopy composition, is well established and used throughout the world (see for example Kershaw & Looney 1985; Mueller-Dombois & Ellenberg 1974) as well as within New Zealand (see for example Atkinson 1962, 1985; Leathwick & Rogers 1996; Park & Walls 1978). The specific technique for vegetation description at each site is based on the approach set out in Myers et al. (1987).

This semi-quantitative method was favoured because of the time constraints for the field survey, the extensive areas to be covered, and because it could be applied to all vegetation types, with ground cover plant species or substrate being recorded in non-forest habitats. More detailed, and therefore more time-consuming and expensive methods, would not necessarily provide more useful information for assessing representativeness. The disadvantage of this survey approach is that it did not provide a great deal of information on the distribution of uncommon and threatened species or of understorey species.

Classification of canopy vegetation types was done by a combination of manual sorting and computer analysis using TWINSpan (Hill 1979). TWINSpan is a multivariate analysis programme for two-way classification of site and species data. It provides an indicator species analysis at each partitioning of data during classification, and displays the final result in an ordered two-way species-by-site table.

In the present study, TWINSpan was used to classify sites according to canopy vegetation composition, as determined from field surveys. Abundance categories of canopy species were coded numerically in the data set as follows: 4 - Abundant (> 50% of the canopy); 3 - Common (20–50%); 2 - Frequent (5–20%); 1 - Occasional (<5%). Vegetation types were determined according to the “abundant” and “common” categories. In many instances, no one species was classified as “abundant” but more than one species was “common”.

Site groupings determined in the analysis by TWINSpan enabled the identification of common and less common vegetation types within the District and to define the vegetation component of the ecological units.

Landform and geology were classified using information from published and unpublished maps, reports and topographical maps. This information was combined with vegetation types to determine ecological units defined by particular vegetation-geomorphological characteristics, e.g. kanuka forest on hillslope, raupo reedland in swamp. Most sites contain a range of ecological units.

Representativeness was assessed by determining the frequency of the different ecological units remaining in the Ecological District, Region, or nationally.

Because of resource constraints, the framework of land systems used in some PNA reports was not used in this survey or report.

Other relevant information such as fauna observations, threats and landowner information collected incidentally was also recorded on the survey sheet for each site. Once the field reconnaissance or survey had been completed, sites were numbered, and information from other databases, e.g. SSBI and threatened species information, was incorporated into the site descriptions.

Survey forms are held by the Department of Conservation, Northland Conservancy Office, Whangarei.

2.4 CRITERIA FOR ASSESSING HABITAT SIGNIFICANCE

The natural areas described in this report meet at least one of the following criteria:

- They are of predominantly indigenous character, by virtue of physical dominance or species composition.
- They provide habitat for a threatened indigenous plant or animal species.
- They include an indigenous vegetation community or ecological unit, in any condition, that is nationally uncommon or much reduced from its former extent.

The conservation values of these areas were then assessed using a two-level classification of habitat significance based on the PNAP ecological criteria of representativeness, rarity and special features, diversity and pattern, naturalness, habitat structure and characteristics important for the maintenance of ecosystems (buffer, linkage or corridor, size and shape).

The highest value areas (Level 1) are those which contain significant vegetation and/or significant habitats of indigenous fauna and are defined by the presence of one or more of the following ecological characteristics:

1. Contain or are regularly used by critical, endangered, vulnerable, declining, recovering, or naturally uncommon taxa (i.e. species and subspecies), or taxa of indeterminate threatened status nationally.
2. Contain or are regularly used by indigenous or endemic taxa that are threatened, rare, or of local occurrence in Northland or in the Ecological District.
3. Contain the best representative examples in the Ecological District of a particular ecological unit or combination of ecological units.
4. Have high diversity of taxa or habitat types for the Ecological District.
5. Form ecological buffers, linkages, or corridors to other areas of significant vegetation or significant habitats of indigenous fauna.
6. Contain habitat types that are rare or threatened in the Ecological District or regionally or nationally.
7. Support good populations of taxa which are endemic to Northland or Northland-Auckland.
8. Are important for indigenous or endemic migratory taxa.

9. Cover a large geographic area relative to other similar habitat types within the Ecological District.

Level 2 sites are natural areas that support populations of indigenous flora and fauna not identified as meeting the criteria for Level 1. They are sites which:

- contain common indigenous species,
- may be small and isolated from other habitats,
- may contain a high proportion of pest species,
- may be structurally modified, e.g. forest understorey grazed,
- have not been surveyed sufficiently to determine whether they meet the criteria for Level 1 sites.

Categories of species rarity and threat are based on Molloy & Davis (1994), and de Lange et al. (1999) (see Appendix 8.3).

2.5 UPDATING OF DATA

Natural ecosystems and habitats are dynamic, both physically and biologically. Some areas are less stable than others, e.g. wetlands, which are particularly susceptible to changes in groundwater hydrology whilst others change more gradually, e.g. forest. The status and composition of species also changes over time, and this could result in changes to the value of some habitats.

Human-induced activities and changes, both within or adjoining significant natural areas, can rapidly speed up the processes of change. Fire, followed by the invasion of adventive weeds, can dramatically modify shrublands. Drainage of adjoining land can alter the water tables of wetlands thus lowering the quality of the habitat and facilitating the establishment of weeds. Ongoing piecemeal destruction or modification of habitats and sustained grazing of bush remnants will, in the long term, completely eliminate some habitats.

It would be desirable to obtain more detailed information on many of the sites identified within this report, to gain a fuller appreciation of the values present. The natural areas identified in this survey will require regular monitoring to note changes in both species and habitat composition and condition.

3. Ecological character

3.1 TOPOGRAPHY/GEOLOGY

The Kaikohe Ecological District adjoins the head of the Hokianga Harbour, rises to 360 m in elevation, and comprises moderately dissected to rolling hill country of allochthonous Cretaceous-Paleogene Mangakahia Complex and Motatau Complex sedimentary rock units, mantled by upper Neogene Kerikeri Volcanics.

Mangakahia Complex sandstone, mudstone and siliceous mudstone outcrop over much of the western part of the District. At Pukewharariki, the sandstone is bluff-forming. There are also small areas of Motatau Complex bluff-forming calcareous mudstone and sandy limestone in the Waihou Valley, and of glauconitic sandstone and muddy limestone near Pouerua.

The Kerikeri Volcanics include eroded and deeply weathered basaltic flow remnants, and younger blocky basaltic lava flows and scoria cones. There is also a rhyolite dome north of Kaikohe, and an active geothermal field and associated freshwater wetlands at Ngawha Springs.

Wetlands ponded by Kerikeri Volcanics lava flows are common, and include the 1200 ha Lake Omapere and 100 ha Lake Owhareiti. There are extensive Quaternary alluvial deposits along the valleys of the Whakanekeneke, Utakura, Waitangi, and Waiaruhe Rivers.

3.2 CLIMATE

The Kaikohe Ecological District has a mild, humid and generally windy climate, winds being predominantly from the south-west.

Weather information is from the Kaikohe weather station (204 m asl).

The average rainfall is 1766 mm per year, with most rainfall occurring during winter (42.5 % of the annual rainfall occurs between May and August). The driest months are January and November, averaging 5% and 6% of the annual rainfall respectively. Dry spells (period of 15 days or more having less than 1 mm of rain per day) may occur during summer and early autumn.

The District is also subject to periodic cyclonic storms in late summer and early autumn which bring heavy rainfall and may have widespread effects such as floods, slips and windfalls. Heavy rainfall also occurs when northeasterly flows arise between ridges of high pressure to the east and troughs over the Tasman Sea.

The mean annual temperature is 14.7°C. January and February are the warmest months with the mean temperature being 19°C, and July is the coldest month (10°C). Daily temperature variations are minor, with few extremes of temperature or frosts.

The District has about 2000 hours of bright sunshine per year.

(Source: Moir et al. 1986)

3.3 VEGETATION

Botanical nomenclature in this report follows Allen (1961), Moore & Edgar (1970), Healy & Edgar (1980), Webb et al. (1988), and Druce (1992). A full list of common names used in the text with their botanical reference is to be found in Appendix 8.5.

3.3.1 Historical

The gumland vegetation at Ngawha formerly supported kauri (*Agathis australis*) forest, destroyed by fires hundreds of years before European settlement, with small swampy areas of sedge and fern (Clunie 1983).

It is likely that kauri was also dominant on the present gumlands at Aratoro and Punakitere.

Broadleaf forest formerly covered the volcanic flats east of Lake Omapere, with swamp forest on low-lying land.

The hill country in the west of the District was forested with mature kauri “as far as my eye could reach” near the shores of the Hokianga (Ensign McCrea from the sailing ship *Dromedary* in 1820, as recorded in Sale 1978).

3.3.2 Broad pattern

In the west of the District, regenerating shrublands cover broken hill country, with pockets of broadleaf-podocarp forest occurring in gullies, and kauri on higher ground.

Remnants of broadleaf-podocarp forest occur on volcanic soils east of Lake Omapere, and manuka (*Leptospermum scoparium*) and sedges dominate the gumlands south of Kaikohe. Significant wetlands remain south and east of Kaikohe.

The volcanic broadleaf forest, with its combination of puriri (*Vitex lucens*) and taraire (*Beilschmiedia tarairi*), is preferred by the threatened kukupa (*Hemiphaga novaeseelandiae*), and is very important for maintaining local kukupa populations, having a sustained fruiting potential. This forest type is one of the most productive, in terms of density of individuals utilising them, for the threatened kukupa in Northland. Puriri and taraire are pivotal species for kukupa in other parts of Northland, the two species collectively contributing to over 75% of the observed diet in winter (taraire), spring (both) and summer (puriri) (Pierce & Graham 1995).

3.3.3 Main vegetation types

Sbrublands

Manuka and kanuka

Manuka is dominant as a canopy species on 14 sites, and occurs on both basalt lava flows, as well as on sandstone or mudstone, frequently on margins of bush, wetland or stream, or as a linkage between forest remnants, often in areas of frequent disturbance. Its significance in this Ecological District is mainly derived from these linking and buffering functions, but it may also be a habitat for NI brown kiwi.

Within this type, gorse (*Ulex europaeus*), totara (*Podocarpus totara*) and mamaku (*Cyathea medullaris*) may occur frequently or occasionally, with tanekaha (*Phyllocladus trichomanoides*), towai (*Weinmannia silvicola*), and kahikatea (*Dacrycarpus dacrydioides*) sometimes occurring as scattered emergents.

Manuka and kanuka (*Kunzea ericoides*) occur as co-dominants in four large sites, again with a major linking function.

Gorse and mingimingi (*Leucopogon fasciculatus*) may be scattered throughout. At some sites, gorse is co-dominant. Scattered totara, kahikatea, cabbage tree (*Cordyline australis*), and puriri may be present.

These types occur throughout the District, but are more extensive in the west, probably because of the pattern of land development.

Co-dominance with other species

At Motukiore, in the west of the District, mahoe (*Melicactus ramiflorus*) is co-dominant in a more diverse canopy with frequent kowhai (*Sophora microphylla*), cabbage tree, and lacebark (*Hoberia populnea*), as well as gorse and occasional nikau (*Rhopalostylis sapida*). At Pukewharariki, cabbage tree is co-dominant with manuka and towai with nikau frequent.

Bracken (*Pteridium esculentum*) is co-dominant at Waikaramu Rd, with frequent hangehange (*Geniostoma rupestre*) and occasional gorse.

South of Kaikohe, mamangi (*Coprosma arborea*) and towai are co-dominant. Exotics (*Acacia* and *Hakea*) are co-dominant on the Whakarungangana gumfield.

Gumlands

A highly distinctive and predominantly indigenous vegetation type occurs on acidic strongly podzolised soils associated with a hardened upper silica pan which forms a barrier to root growth, air and moisture. Species occurring in this habitat type are tolerant of very harsh environmental conditions, and many, such as species of fern, sundew, orchid and sedge, are seldom present in any other habitat type. Manuka is the most dominant species in this habitat, but sedges of the *Baumea* and *Schoenus* genera and tangle fern (*Gleichenia dicarpa*) are locally dominant. Acid peat bogs form where drainage is impeded, and are usually dominated by *Baumea* species.

Ecological units occurring on gumland soils in the Kaikohe Ecological District include:

- Manuka shrubland with associated species being mingimingi, kumerahou (*Pomaderris kumerabo*), bracken, *Dracophyllum lessonianum*, *Dianella*, *Schoenus tendo*, and tangle fern. Gorse and prickly hakea (*Hakea sericea*) may occur to varying degrees.
- Manuka-*Gleichenia* shrubland in which *Dracophyllum lessonianum* is frequent.
- Manuka-*Baumea-Schoenus* shrub-sedgeland in which *Baumea teretifolia* and *Schoenus brevifolius* are intermixed with manuka and frequent *Dracophyllum lessonianum*, *Dianella*, *Tetraria capillaris*, *Epacris pauciflora*, and *Lepidosperma australe*.
- *Baumea-Schoenus-Gleichenia* sedgeland with associated species being *Epacris*, *Tetraria*, manuka and *Dracophyllum*.
- Manuka-*Baumea-Gleichenia* shrubland.

- *Gleichenia* fernland with *Baumea teretifolia* and *Dracophyllum*.
- Peat bogs dominated by *Baumea* species including locally dominant swards of *B. complanata* on damp substrates in disturbed areas (L. Forester pers. comm. 2000).

Broadleaf forest

Secondary manuka-kanuka forest

Nine sites contain forest types in which either manuka or kanuka or both are co-dominant species. In all but two sites, towai is also co-dominant, with taraire being the co-dominant in the remaining two areas. Rimu, kahikatea, taraire and tanekaha may occur frequently.

A variety of other species occur in the canopy including totara, tawa (*Beilschmiedia tawa*), puriri, titoki (*Alectryon excelsus*), kawaka (*Libocedrus plumosa*) and nikau, with kauri, northern rata (*Metrosideros robusta*), and pukatea (*Laurelia novae-zealandiae*) being occasional emergents.

Taraire forest occurs at eight sites, mainly in the central part of the District, on both volcanic and sandstone and mudstone substrates. None of the sites occurring on volcanic soils are protected.

Puriri, totara, towai, rewarewa (*Knightsia excelsa*), kahikatea, and tanekaha may be frequent, with tawa, pukatea, kohekohe (*Dysoxylum spectabile*), nikau, rimu, and northern rata all likely to be present.

Taraire-karaka forest occurs at only one site, Mihi Rd.

Taraire-puriri forest occurs at 12 sites throughout the District, although the majority are centred on the volcanic substrates.

On the sandstone and mudstone, totara, towai and rewarewa occur frequently. On the volcanics, rewarewa is likely to be frequent, and totara present. A variety of other canopy species occur on both types, including rimu, northern rata, pukatea, kawaka, miro (*Prumnopitys ferruginea*), tawa, kohekohe, kauri, kowhai, titoki, matai (*P. taxifolia*), and karaka.

Taraire-puriri-towai forest occurs at one site, Otamarangi Stream.

Towai forest occurs at ten sites, also on a variety of substrates. Taraire, rewarewa, puriri, and totara are likely to be frequent, with other canopy species including rimu, tawa, manuka, kanuka, kauri, pukatea, northern rata, and kahikatea.

Towai-taraire forest also occurs at ten sites, mostly in the west of the District, all of which are different from the sites where towai forest occurs. Two sites coincide with sites where taraire forest occurs, and three coincide with areas where taraire-puriri forest occurs.

Totara, puriri and rewarewa occur frequently in most of the towai-taraire sites. Kanuka, tanekaha, rimu, kahikatea, tawa, nikau, and mamaku are frequent at some sites.

Other species present are similar to taraire-puriri forest except for hinau (*Elaeocarpus dentata*), mangeao (*Litsea calicaris*), monoao (*Halocarpus kirkii*), and tanekaha replacing the lowland species of kowhai and titoki.

Towai-tawa forest occurs at only one site, Scott's Rd Bush, and towai-rewarewa forest occurs only at Pukewharariki.

Puriri forest

This type is found only in Northland and near Pukekohe. In this District it occurs at four sites, all in the Waimate North area, and is limited to small remnants. Taraire, rewarewa, totara, rimu, kahikatea, and karaka are present.

Kowhai

Kowhai occurs as a co-dominant with other species in small pockets at three sites:

- with puriri and karaka at Horeke,
- with puriri at Waihoanga,
- with kanuka at Rurunga Stream.

Titoki

Titoki occurs as a co-dominant with other species in small pockets at four sites in the east of the District:

- with puriri and taraire at Taumataraire,
- with puriri at Pouerua,
- with taraire and mahoe at Kahutoto,
- with karaka and mahoe at Kahutoto.

Broadleaf-podocarp forest

Secondary manuka-kanuka-totara forest

This type occurs at nine sites mainly in the west and south of the District on Mangakahia sedimentary soils and associated with alluvium, and riparian and wetland margins. Kahikatea is usually frequent, and towai and puriri occasional. Tanekaha is frequent on the hill country in the west.

Secondary manuka-kanuka-totara-tanekaha forest

Tanekaha is co-dominant with these species at six sites which are also in the west of the District. Associated species include rimu, kahikatea, towai, puriri, rewarewa, kauri, and northern rata.

Secondary manuka-kanuka-tanekaha forest occurs at two sites in the north-west of the District with frequent totara and towai and occasional whau (*Entelea arborescens*).

Secondary kanuka-tanekaha-towai forest and manuka-kanuka-towai-kauri forest each occur at one site near Utukura in the west of the District, and kanuka-totara-taraire forest occurs at one site in the far west of the District.

Secondary manuka-kanuka-totara-kahikatea forest occurs at six sites mainly in the west of the District on Mangakahia sedimentary-derived soils. Within this type, tanekaha is frequent. Associated species include puriri, rimu, rewarewa, and taraire. Kanuka-kahikatea forest occurs atnKaipeha Swamp.

Taraire-totara forest occurs at four sites in the centre of the District with frequent puriri and towai.

Kanuka is co-dominant with this type at Rakautao Bush south of Ngawha.

Taraire-kahikatea forest is found at Horeke in the west, and with puriri also a co-dominant at Donaldson's Rd, and totara co-dominant at Motukiore and Scotts

Rd. Nikau is co-dominant with this type at Horeke. Rewarewa, manuka, kanuka and towai may be frequent within these sites.

Totara-taraire-puriri forest occurs at five sites across the District. Rewarewa and towai may be frequent. Totara-puriri forest occurs at Wehirua Rd, with frequent taraire. Puriri-totara-kahikatea forest occurs at Horeke, Waitaheke and Okokako.

Towai-totara forest, and variations of it, occur at eight sites, mainly in the central part of the District. Puriri, manuka, kanuka, tanekaha and kahikatea may be frequent within this type.

Manuka is co-dominant at Te Toke Stream, and kanuka at Rakautao Bush south of Ngawha. Rewarewa also occurs as a co-dominant at Rakautao. Kahikatea is co-dominant at Scotts Rd and Reservoir Bush, and taraire is co-dominant at Hui te Werawera in the headwaters of the Waitangi River.

Towai-tanekaha forest occurs at three sites in the west (Guthrie's Block, Wairere Stream and Pukewhao Forest Mosaic).

Podocarp forest

Most of the podocarp forest in this District is secondary in nature. However, at Pukewharariki, a unique stand of mature rimu-totara-miro-kahikatea forest remains. This is more fully described in site report P05/024.

Secondary totara forest occurs at 13 sites in the central area of the District. Puriri, taraire, kahikatea and rewarewa may be frequent.

Secondary kahikatea forest occurs on 24 sites throughout the District, although some of these ecological units are very small, being either pockets within a larger area of indigenous vegetation, or remnants. Seven sites are on alluvium, generally with totara occurring frequently, and puriri and pukatea may also be associated with this type.

Seven sites occur on sedimentary rock types. Totara, towai, taraire, puriri, and nikau may be frequent. Rimu and pukatea may also be present.

The remainder of the sites occur on basalt lava flows or talus. Totara, rewarewa, and puriri are usually present.

Kahikatea-totara forest occurs at 15 sites, mainly in the central part of the District. Puriri, taraire, nikau, rimu and towai may be frequent. Kauri, pukatea, northern rata, rewarewa, kowhai, and kohuhu (*Pittosporum tenuifolium*) may also be present. Tanekaha is co-dominant at Cooks TV Block. An area of totara-rimu forest occurs at Waikaramu Rd.

Tanekaha

Vigorous tanekaha regeneration occurs in the Cooks Airstrip Block, with manuka/kanuka and totara.

Kauri

Although once widespread, dense kauri dominance is now uncommon in the Ecological District.

Mature kauri are present as scattered trees in forest throughout the District, but occurs as secondary growth in isolated clumps at Mangatoa Stream Bush, Monument Bush, Waihoanga Rd Bush and Te Toke Stream.

Kauri is co-dominant with kawaka in a small area of mature primary forest at Pukewharariki.

Elsewhere kauri is co-dominant in secondary forest:

- with towai at Waihoanga Rd Bush and Titihuatahu,
- with towai and manuka/kanuka at Whitecliffs,
- with rimu at Scotts Rd (a minute area),
- with tanekaha at Moehau,
- with tanekaha, taraire and totara at Carrs/Waimahe Stream.

Swamp shrubland and forest

Swamp shrubland occurs on six sites associated with significant wetlands in the District, five of which contain manuka as a key component. They include:

- manuka dominant with frequent flax (*Phormium tenax*) and occasional cabbage tree, at Lake Omapere [Note that this site was largely destroyed by land development in 1997].
- manuka-*Coprosma propinqua* dominant with frequent cabbage tree and *Baumea articulata*, and occasional kahikatea at Te Keene Stream Swamp (P05/064).
- manuka-kohuhu-putaputaweta (*Carpodetus serratus*) with frequent cabbage tree and kahikatea at Punakitere Valley.
- manuka-cabbage tree-*Carex* sp. with frequent *Juncus* sp. and occasional swamp maire (*Syzygium maire*) at Okaka Rd.
- manuka-*Baumea* association with occasional puriri and swamp maire at Kaipeha Swamp.

The remaining area is *Coprosma propinqua*-*C. rigida*-*Bolboschoenus* sp. with frequent *Carex* sp. and umbrella sedge and occasional swamp maire, cabbage tree, kahikatea, putaputaweta, and *Muehlenbeckia australis*.

Swamp forests

These are extremely rare due to past development of the fertile sites on which they tend to occur. Sites such as this, which are frequently waterlogged during winter and dry in summer, provide a limiting set of physical conditions which give rise to a unique assemblage of flora and fauna, some of which, such as swamp maire, cannot survive under any other conditions.

Swamp forest occurs at nine sites, in eight of which kahikatea is prominent.

These types include:

- kahikatea dominance at Te Keene Stream Swamp (P05/064),
- kahikatea-pukatea at Lake Omapere and Waingaruru Swamp,
- kahikatea-cabbage tree at Kaipeha Swamp,
- kahikatea-cabbage tree-swamp maire at Ngawha Swamp and Youngs Kahikatea Remnant,
- kahikatea-kanuka with frequent pukatea and cabbage tree with occasional swamp maire at Maraeroa Swamp.

The remaining type is kowhai-*Coprosma propinqua*-*Gabnia* with *Cyperus ustulatus*. Kahikatea, manuka, flax, broom (*Carmichaelia australis*), *Muehlenbeckia complexa*, and pampas (*Cortaderia selloana*) are also present.

Wetlands

Twenty three wetlands have been surveyed in the Kaikohe Ecological District, all of which are fertile or semi-fertile in nature.

- (i) Open water occurs at six sites, with Lakes Omapere, Owhareiti and Tauanui being the largest.
- (ii) Raupo (*Typha orientalis*) reedland occurs in abundance at 13 sites. Cabbage tree, flax, *Carex* sp., manuka, kahikatea, *Coprosma propinqua* and crack willow (*Salix fragilis*) occur frequently or occasionally at eight sites.

Raupo occurs in association with other species at several sites:

- with *Calystegia* at Motukiorie,
- with *Carex* at Okaka Rd,
- with *Baumea* at Horeke Rd and Rakautao,
- with each of toetoe (*Cortaderia fulvida*), flax, and cabbage tree, respectively, at Waingaruru Stream.

- (iii) Flax occurs as a dominant in a tiny remnant near Lake Omapere.
- (iv) Manuka-flax with frequent raupo and occasional cabbage tree occurs at Kaipeha swamp.
- (v) *Baumea* sedgeland occurs at Kaipeha swamp.
- (vi) *Juncus* rushland occurs on the margins of Lake Omapere.
- (vii) *Eleocharis sphacelata* sedgeland occurs at Lake Owhareiti, Tautoro wetland and Waiare Rd Pond.
- (viii) *Apodasmia similis* sedgeland occurs in the Maraeroa Swamps, with frequent raupo and occasional cabbage tree.
- (ix) *Carex* sedgeland occurs in the Tautoro wetland with occasional umbrella sedge, *Juncus* and *Baumea* sp.
- (x) Crack willow treeland occurs at Pakaraka in the Kahutoto and Te Keene Stream Swamps.

3.3.4 Species of botanical interest

The botanical values of most of the sites in this Ecological District outside of the areas administered by the Department of Conservation or protected under covenant are not well known.

The exceptions are the assemblages on the volcanic geomorphology at Pouerua, Kahutoto Stream and Lake Tauanui, where coastal species such as *Coprosma macrocarpa* and wharangi (*Melicytus ternata*) are to be found.

The fern ally *Isoetes* aff. *kirkii*, found in Lake Omapere, is of restricted distribution in the North Island with the nearest location being some Rotorua lakes (Champion & Rowe 1996).

The bladderwort *Utricularia delicatula*, found at Ngawha, is of restricted distribution in Northland.

Species uncommon in Northland to be found in this Ecological District include:

- nettle (*Urtica incisa*) - Pouerua Cone,
- black maire (*Nestegis cunninghamii*) - Waikuku Rd,
- whau - Pukewhao Forest Mosaic and Pouerua Bush,
- *Blechnum vulcanicum* (Pouerua Bush).

3.3.5 Threatened plant species

(See Appendix 8.3 for Categories of Threat)

Baumea complanata - Declining

A sedge with strap-like leaves growing from a fan-shaped base which grows in damp to seasonally dry areas among manuka, often near lakes and streams (Wilson & Given 1989), but appears to favour damper substrates. It can form dominant swards in disturbed areas but is generally overtopped in heath conditions (L. Forester pers. comm. 2000). It was formerly found from Waikato north but is currently restricted to Ngawha, Taheke, Waipoua and Te Paki.

Caladenia atradenia - Naturally Uncommon - Sparse

A tall, hairy, dark reddish-green orchid, with a strongly hooded dorsal sepal. New Zealand plants appear to have only two rows of calli on the labellum, as opposed to four rows in the Australian *C. iridescens*. Distribution is from Kaitaia to Auckland, Bay of Plenty, Wellington and north-west Nelson (St George et al. 1996). In this District it is known from Aratoro (L. Forester pers. comm.).

Colensoa physaloides - Declining

A distinctive blue-flowered, shrubby lobeliaceous plant with hydrangea-like foliage. It is a monotypic genus, endemic to Northland, some of its offshore islands and Rakitu Island, east of Great Barrier Island (P. de Lange pers. comm. 1996). It is found scattered through forest areas, generally beside streams and tracksides, and on talus slopes. Vulnerable to browsing, it is absent from areas where goats or stock roam. In this District it is known from Aratoro.

Isoetes aff. kirkii - Critically Endangered-Taxonomically Indeterminate

This aquatic plant grows in mud, submerged in 50 cm or more of water, and is an endemic quillwort consisting of tufted, linear, undivided leaves with swollen bases (Brownsey & Smith-Dodsworth 1989). The northern form has flabellate leaves and may be a distinct taxon. It is currently known only from Lake Omapere (L. Forester pers. comm. 2000).

Korthalsella salicornioides - Naturally Uncommon-Sparse

A dwarf mistletoe usually parasitic on manuka and kanuka (Poole & Adams 1990), found on manuka at Ngawha.

Peperomia tetraphylla - Naturally Uncommon-Sparse

A small succulent herb with branches pubescent at the nodes, often a low epiphyte. It is very uncommon in Northland (L. Forester pers. comm. 1997) and is generally found in the East Cape-Bay of Plenty area and also occurs in Australia and Polynesia (Allan 1961). Known from only one site in this

Ecological District (on volcanic rocks), with single records also from Ahipara and Whangaroa Ecological Districts.

Pittosporum pimeleoides* subsp. *pimeleoides - Naturally Uncommon-Sparse

A small shrub growing to 2 m with slender branches and narrow-oblong leaves crowded at tips or whorled (Poole & Adams 1990), is found growing on dry and fairly open ridge sites, usually with mingimingi under tanekaha and kauri. Known only from north of Auckland and now known mostly from north of Whangarei (Wilson & Given 1989). Found in forest south of Ngawha Springs.

Sicyos australis - Vulnerable

Commonly known as the native cucumber, this scrambler is much reduced from its former extent, restricted mostly to offshore islands from the Three Kings to the Bay of Plenty, also the Kermadecs, Lord Howe, and Norfolk Islands (Smith-Dodsworth 1991). It is found in this District at Pakaraka with the only other mainland records at Te Paki and one site in the Whangaruru Ecological District (I. Forester pers. comm. 2000).

Thelymitra malvina - Range Restricted

This sun orchid (with “pink whiskers”) is found on gumland soils, generally in proximity of old kauri stumps. In this District it is known from Ngawha, and it is also found at Lake Ohia and in Australia.

Thelypteris confluens - Vulnerable

A recent (year 2000) record for this marsh fern is from a swamp in the Ngawha area. Once widespread, this fern is now confined to swamps north of Auckland and in the Bay of Plenty, usually found in open areas amongst reeds and long grass (Brownsey & Smith-Dodsworth 1989).

Todea barbara Vulnerable

A fern with leathery fronds found on dry sites within gumland vegetation, and also known from Australia (Wilson & Given 1989). In this Ecological District it is known from Ngawha.

Species previously recorded in the Ecological District but which have not been recorded for some time and may be extinct within the Ecological District

A number of threatened species known from similar habitats in other districts are likely to be present, particularly in the gumland habitats, but have not been recorded. They include: *Lycopodiella serpentina* (Vulnerable), one of the smallest club mosses, found on open sites on gumland soils amongst *Gleichenia* and sundews; *Phylloglossum drummondii* (Endangered), a fern ally restricted in New Zealand to low, open manuka north of Auckland, growing with sedges on seasonally damp gumland sites; and also the yellow-green mistletoe *Ileostylus micranthus* (Declining).

3.4 FAUNA

Information on fauna in this report has been compiled from SSWI and SSBI data bases, as well as from field observations during this survey. The status of individual species is derived from Bell (1986), and Molloy & Davis (1994) (see Appendix 8.3. Bell's "Threatened" equates to "Vulnerable"). Nomenclature follows Heather & Robertson (1996) for birds and Gill & Whitaker (1996) for reptiles.

A comprehensive discussion and checklist of fauna, particularly invertebrates, is beyond the scope of the present study. However, it is recognised that the invertebrate fauna, both common, e.g. tree weta, and less common, e.g. *Peripatus* and the forest ringlet butterfly (*Dodonidia helmsii*) are a significant facet of indigenous ecosystems. With the present state of knowledge of these species, the protection of the whole range of habitat types is considered important to ensure populations of invertebrates are maintained.

The individual site descriptions detail known significant fauna only. Most of the common bird species of Northland, both indigenous and introduced, are to be found in the District. A checklist of common fauna recorded is included in Appendix 8.4.

3.4.1 Threatened bird species

NZ dabchick *Poliiocephalus rufpectus*

Endemic Category C

Recorded from on Lake Owhareiti (on which Australasian little grebe (*Tachybaptus novae-hollandiae*) is more frequently reported).

NI brown kiwi *Apteryx australis mantelli*

Threatened endemic Category A

Kiwi are found throughout the District, especially east, north and west of Kaikohe in forest and shrubland, including remnants in farmland. Threats include dogs, small predators, and habitat loss.

Kukupu (NZ pigeon) *Hemiphaga novaeseelandiae novaeseelandiae*

Threatened endemic Category B

Found throughout the District, this species potentially thrives in the fertile volcanic broadleaf-podocarp forest in the vicinity of Kaikohe. Threats include possums, rats, and other predators (including humans). Predator control programmes undertaken by some landowners have reportedly produced a positive recruitment response.

NI kaka *Nestor meridionalis septentrionalis*

Threatened endemic Category B

Thought to have been present historically. Anecdotal reports of sightings south of Kaikohe are thought to be vagrants, rather than reflecting resident populations, which are now restricted in Northland to the Hen and Chicken Islands and Bream Head (Ray Pierce pers. comm.). Predators, especially mustelids, are thought to be the main threat on the mainland.

Australasian bittern *Botaurus poiciloptilus*

Threatened Category O

Recorded from the larger wetlands in the District, and possibly utilises smaller wetlands as well. The main threat is habitat destruction.

Brown teal *Anas chlorotis*

Endemic Category C

Once widespread in swampy streams and tidal estuaries, only a small number of birds remain in the wild outside of Great Barrier Island. A small released and managed population exists in the Puketi Rd area. Predators are the main threat.

3.4.2 Bird species of regional and district significance

These are not considered nationally threatened but are rare in both the Ecological Region and District.

NI fernbird *Bowdleria punctata vealeae*

Regionally threatened endemic found in the major sedge habitats in the District.

Pied tit *Petroica macrocephala toitoi*

Populations have been restricted by habitat fragmentation generally to large mature forested areas.

Found at Aratoro and Pukewharariki.

Banded rail *Rallus philippensis assimilis*

A species which was once widespread and for which Northland is its national stronghold.

Found at Waingaruru Stream Swamp.

Spotless crane *Porzana tabuensis plumbea*

A species with restricted distribution, confined on the mainland largely to dense reed beds, especially raupo, and found at a variety of wetland sites throughout the District.

3.4.3 Threatened and regionally significant snails

Kauri snail *Paryphanta busbyi busbyi*

Threatened endemic Category C

Found throughout the District.

Liarea turriculata waipoua

Endemic to northern Northland in the west from Kaitaia to Waipoua.

Found at Pukewharariki.

Liarea turriculata turriculata

Endemic to northern Northland in the east from Kaitaia to Warkworth.

Other Northland endemic snails include “Golden phenacohelix”, *Fectola charopiformis*, and *Rytida dunniae*.

3.4.4 Threatened fish

Banded kokopu *Galaxias fasciatus* Category C

Northland mudfish *Neobanna beleios* Category A (provisional)

Recent studies of mudfish from Ngawha, Oromahoe, and Kerikeri Airport show these populations are physically and genetically different from *Neobanna diversus* (black mudfish - a Category C species found in coastal and lowland peaty sites of Pleistocene era such as Kaimaumu, Hauraki Plain, and Waikato). As a new species of restricted distribution, it is likely to become a Category A species (V. Kerr pers. comm. 2000).

3.4.5 Regionally significant lizards

Ornate skink *Cyclodina ornata*

In Northland this species is uncommon on the mainland and generally found only on offshore islands. Found at Pukewharariki.

3.5 THREATS

Habitats on margins or in successional stages are under threat from afforestation and the invasion of exotic species such as gorse and pampas. Other areas are being incrementally degraded by grazing. The fertile wetlands, swamp shrubland and forests are under threat from drainage and land development.

In the more mature forested areas possums, goats, pigs and cattle constitute the main threat. (A list of introduced mammals is in Appendix 8.4.)

Apart from eliminating or reducing human-related threats, forest areas need to be managed to control animal pests and more open habitats managed for plant pests, to ensure long-term viability of the natural habitats.