Natural areas of Puketi Ecological District

Reconnaissance survey report for the Protected Natural Areas Programme

NEW ZEALAND PROTECTED NATURAL AREAS PROGRAMME NO. 40

Linda Conning and Fraser Moors

Published by
Department of Conservation
P.O. Box 10-420
Wellington, New Zealand

ISSN 0112-9252
ISBN 0-478-21757-9

Cataloguing-in-Publication data
Conning, Linda
Natural areas of Puketi Ecological District : Reconnaissance survey report for the Protected Natural Areas Programme/ Linda Conning and Fraser Moors. Whangarei, N.Z. : Dept. of Conservation, {Northland Conservancy},1998.
1 v. ; 30 cm. (New Zealand Protected Natural Areas Programme, 0112-9252 ; no. 40.)
Includes bibliographical references.
ISBN 0478217579
1. Ecological surveys--New Zealand--Northland Region. 2. Natural areas--New Zealand--Northland Region. 3. Puketi Ecological District (N.Z.). I. Moors, Fraser. II. New Zealand. Dept. of Conservation. Northland Conservancy. III. Title. IV. Series: New Zealand Protected Natural Areas Programme (Series) ; no. 40.
574.99313 20
zbn98-061681

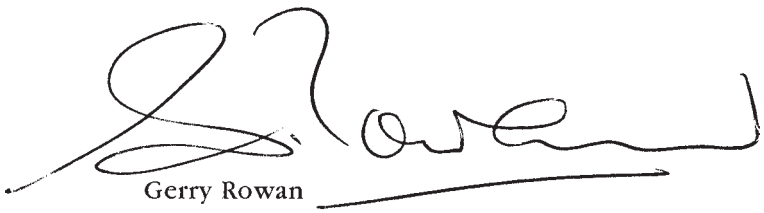
Foreword

Kauri forests of grandeur stud the high plateau and steep ridges of Puketi, providing the distinctive nature of this district. However, kauri is not the only gem of this forest, which is rich with a diversity of native plant and animal species.

The largely undisturbed habitat of Puketi Forest has favoured the freshwater ecosystems and their fauna. Other fauna of the district has fared less well, with kiwi, kukupa and kokako, in various stages of decline. The status of the short-tailed bat populations of the district is less well-known.

Effective protection for these and other species goes beyond the physical protection of their habitat, and demands active management.

A very large proportion of this relatively small Ecological District is covered in indigenous vegetation, most of which is linked to the Puketi-Omahuta Conservation Forests. Such large, unfragmented areas of vegetation are now uncommon in Northland and offer an opportunity to support a larger number of species and for dynamic natural processes to occur on a scale not possible where habitats are fragmented.



Gerry Rowan

Conservator - Northland

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LAND ADMINISTERED BY DEPARTMENT OF CONSERVATION SHOWN IN GREEN.

Abstract

The Puketi Ecological District is a comparatively small district centred around the Puketi-Omahuta Conservation Forest. Most of the district comprises the upper catchments of several drainage systems. The district is characterised by broad ridges over 300 m above sea level studded with kauri which fall steeply into narrow gullies, with streams often descending over high waterfalls.

Natural areas of ecological significance were identified from a reconnaissance survey undertaken in 1994–95 as part of the Protected Natural Areas Programme, together with information from existing databases.

The district contains a high diversity of vegetation types and plant species, including some which are rare in Northland. Broadleaf-podocarp forest and manuka-kanuka-towai shrubland and secondary forest are the most common vegetation types, with kauri forest providing distinctiveness to the ecological district. Wetlands are scarce.

There are very few habitats in this district that are not contiguous or almost contiguous with Puketi-Omahuta. Consequently there are only 6 identified sites, most being very large. The size, contiguity and diversity of vegetation contribute to the ecological value of the sites.

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 for maintaining the diversity of lesser known species.

This report differs from previous PNAP reports in that it is based mainly on reconnaissance survey reports 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 size of many of the sites identified and surveyed in the fieldwork, 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, as well as 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 Puketi 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.

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

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

1.4 PUKETI ECOLOGICAL DISTRICT

The Puketi Ecological District covers approximately 24,000 ha. It is centred on the Puketi-Omahuta Conservation Forests located north of Kaikohe between Hokianga Ecological District to the west and Kerikeri Ecological District to the east and adjoins the Maungataniwha Ecological District to the north.

The district includes upper catchments of the Waihou and Mangamuka rivers, which drain into the Hokianga Harbour. The northern flanks of the district form the upper catchments of the Waiare and Omaunu Streams which drain to the Whangaroa Harbour. The district has few wetlands.

The majority of the district (approximately 92%) consists of indigenous vegetation, much of which is dense tall forest containing several unusual forest

types including a kauri/hard beech association, and a number of locally endemic species. Puketi-Omahuta contains outstanding examples of low altitude kauri forest. It is an exceptionally diverse habitat floristically, with more than 360 indigenous vascular plants.

Extensive areas of logged and regenerating forest, which are mostly contiguous with each other, link habitats with little modification forming a very large tract of indigenous vegetation in an Ecological Region where habitats have been severely fragmented. Although a considerable part of the area is already protected in the Puketi-Omahuta Conservation Forest, the increased habitat provided by the larger contiguous area is of great value for maintaining and enhancing biodiversity. For example, pied tit, widespread to the south, but confined north of Waikato-Coromandel to large forest tracts, thrive in this Ecological District.

The threatened North Island brown kiwi, whose habitat has also been reduced and fragmented, can be found in most parts of the district.

After various reports in the late 1970s and early 1980s, the Wildlife Service found at least 100 kokako in the Waipapa catchment (Anderson 1984). However, since then the population has collapsed to only one known breeding pair and several single birds (S. McManus pers. comm.).

The presence of a short-tailed bat colony near the forest sanctuary at Omahuta is noteworthy, with short-tailed bats being recorded to date in Northland only at Puketi-Omahuta and Warawara. This Category A threatened species has been identified as a pollinator of *Dactylanthus taylorii*, also listed as endangered, and its pollen was found within bat droppings at a bat roost in 1975. Anecdotal evidence suggests that *Dactylanthus* was present in Omahuta in the 1980s, but no plants have been located in recent years (L. Forester pers. comm. 1996).

The Waipapa River catchment (a tributary of the Waihou) drains most of the Puketi Forest and is considered by the authors to be one of the least modified freshwater ecosystems in Northland, with almost the entire catchment under native vegetation. Twelve species of native fish as well as a native mussel, freshwater crayfish, limpet and shrimp are known from the district.

2. Methodology

2.1 GENERAL APPROACH

To obtain information on the composition, extent and ecological values of indigenous natural areas within the northern sector of the Northland Conservancy, reconnaissance surveys using rapid semi-quantitative methods were 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 Puketi 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 meth-odology. This provided a consistent approach to determine represent-ativeness of unprotected natural areas.

Each site was mapped and described. Having evaluated the sites (see Criteria 2.4 below), 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 4 (Fauna) and Appendix 5 (Flora).

In the writing of 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, Geopreservation and Soils 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.

2.2 CONSULTATION WITH LANDOWNERS

Because of the magnitude and geographic range of the surveys being undertaken (9 full and 3 part Ecological Districts to be completed in a 2 year period), personal contact with all landowners was not possible. Therefore, all ratepayers were advised by mail by way of a leaflet (Appendix 2) informing them of the programme and the reason for it. The leaflet was signed by the Regional 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 issued and featured in the local newspapers (see Appendix 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 iwi was undertaken by the Conservancy Manager (Protection) with the Whaingaroa and Ngapuhi runanga at meetings and hui attended at Kaeo and 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. The district was covered in a methodical fashion based on geography, i.e. moving north to south and east to west. Where large mosaics occurred, several days were spent accessing the areas from several points.

Where the opportunity arose, e.g. at a landowner's request, some sites were inspected in more detail and transects within the habitat 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 three broad categories of habitat types: forest, shrubland, and wetland (See Appendix 6, Glossary).

At each site, the composition and relative abundance of canopy plant species was recorded on the field survey sheet (see Appendix 1) in the following four categories: greater than 50% cover was defined as "abundant"; 20–50% cover as "common"; 5–20% cover as "frequent"; and less than 5% cover 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 and 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 and 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.

Because the low number of habitat sites in this district does not give a large enough sample to get an effective vegetation classification from the TWINSPAN programme (a two-way indicator species analysis programme), vegetation typing was done manually. Canopy species whose percentage cover was defined as "abundant" or "common" (see above) was used 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 manuka shrubland on hillslope, kauri forest on ridge. 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 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 or rare taxa (i.e. species and subspecies), or taxa of indeterminate threatened status nationally (see Appendix 6);
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.

There are no Level 2 sites included in this report.

2.5 UPDATING OF DATA

Natural ecosystems and habitats are dynamic and are forever changing, both physically and biologically. Some areas are more dynamic 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 will, in the long term, completely eliminate some habitats.

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

The main features of the Puketi Ecological District have been summarised in Section 1.4. This part of the report details the physical characteristics of the district, together with vegetation types and fauna.

3.1 TOPOGRAPHY/GEOLOGY

A northwest- to southeast-trending horst of Paleozoic-Mesozoic Waipapa Terrane greywacke is capped by thin eroded sequences of Eocene Te Kuiti Group glauconitic sandstone and calcareous mudstone, and allochthonous Cretaceous-Paleocene Mangakahia Complex mudstone. There are also erosional remnants of upper Neogene Kerikeri Volcanics basalt flows along Mokau Ridge Road. The Waipapa horst rises to 540 m in elevation, has deeply incised steep-sided valleys and flattish ridge tops, and is bisected by the Mangapa-Waipapa river valleys (Brook 1996).

3.2 CLIMATE

The Puketi Ecological District lies between 20 and 540 m above sea level (asl), most areas being between 100 and 400 m asl.

It has a mild, humid climate, with frequent winds predominantly from the south west.

The mean annual rainfall ranges from 1600 mm per annum at Omahuta on the northwestern side (approximately 100 m asl) to 2300 mm at Puketi Head-quarters, which reflects the high altitude of that site (347 m asl), where moisture laden winds rise and condense.

Data from the Kaikohe weather station (180 m asl) indicate that most rainfall occurs during winter (44% of the annual rainfall occurs between May and August). The driest months are November and January, each averaging 5% and 6% of the annual rainfall, respectively. Dry spells (period of 15 days or more having less than 1mm of rain per day) can occur at this time of the year.

The district is also subject to periodic cyclonic storms in late summer and early autumn which bring heavy rainfall and can cause widespread effects such as slips on the steep terrain and windthrow of trees. 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 15°C. February is the warmest month, with the mean temperature being 19°C and July is the coldest month (mean of 11°C). However, with the temperature of the air decreasing at higher elevations, at about 500 m the mean annual temperature is 12°C, ranging from mean of 17°C during January to 10°C during July.

Daily temperature variations are minor, with few extremes of temperature or frosts.

The district has about 2000 hours of bright sunshine per year, reduced to about 1700 hours in the higher areas (Moir et al. 1986).

3.3 VEGETATION

Botanical nomenclature in this report follows the *Flora of New Zealand* Vols 1-4 (see Bibliography). A full list of common names used in the text with their botanical reference is to be found in Appendix 5.

3.3.1 Historical

In the past, the area dominated by kauri forest was much greater, extending towards Kerikeri. At Omahuta, the majority of the large kauri was milled between World War II and 1979.

Fires following logging have resulted in extensive secondary growth. However, some of the acid bogs and gumland vegetation may have existed on poorly drained plateau areas for some considerable time. This was probably the main wetland type in this Ecological District and it is likely that it has never been widespread. There are very few wetlands today.

Outside of the reserve, the forest was first cut over for timber, then later cleared for agriculture, during the nineteenth and early twentieth centuries. Much of this land has been reverting to indigenous shrubland and secondary forest.

In the 1950s and 60s large areas along Mokau Ridge and at Omahuta were cleared for exotic forestry.

3.3.2 Broad pattern

The District contains a sequence of native forest, from the Waihou Valley, which is close to sea level, to the highest point, which is over 500 m asl.

Taraire is generally the dominant forest species at lower altitudes where puriri is locally common. An altitudinal gradient is apparent above 300 metres, when towai becomes the dominant canopy species with Hall's totara and miro whilst taraire becomes uncommon or rare. Kauri is dominant primarily on ridges, and kawaka, and podocarps such as monoao, and silver pine are largely confined to higher altitudes.

Makamaka, uncommon in other parts of the Ecological Region, is abundant on forest margins in higher areas.

3.3.3 Vegetation types

This section is based largely on Willetts (1985) and Willetts & Forester (1985).

The main vegetation types are:

Kauri forest

Dense mature kauri usually occurs on ridge tops, well drained slopes and knolls, in two slightly different associations:

(i) Kauri emergent or forming a dense canopy over Hall's totara, miro, rimu, tanekaha, monoao (*Halocarpus kirkii*), kawaka (*Libocedrus plumosa*) and, rarely, silver pine (*Manoao colensoi*). Northern rata is uncommon. (This type contains a high proportion of podocarps relative to other areas in Northland, the best example of which is the Onekura kauri stand which contains rimu, tanekaha, miro, Hall's totara, toatoa, kawaka, monoao and silver pine.)

The subcanopy consists of tawari or tawa, *Quintinia serrata*, mairehau, toatoa and *Corokia buddleoides.* Rewarewa, towai, hinau, heketara and neinei are also present.

The shrub layer usually contains dense *Gahnia xanthocarpa*, *Astelia trinervia*, *Metrosideros albiflora, Dicksonia lanata* "North", kiekie, kanono, towai and bush lawyer.

Where the shrub layer is more open, filmy ferns are abundant in the ground layer.

(ii) On drier sites kauri is emergent over towai, tawa, tawari, and rewarewa as well as the podocarps described above.

The understorey consists of heketara, makamaka, mingimingi, kanono, five finger, pate, hangehange and Kirk's tree daisy. The shrub layer may be similar to Type (i) described above.

(iii) Regenerating kauri forest. On the lower sections of ridges, kauri up to 70 cm dbh is abundant, with emergent rimu and miro and scattered mature kauri. Miro is frequent in an open canopy, and tawa, toru and pole podocarps are occasional.

Kirk's tree daisy, mingimingi, kauri, tanekaha, rewarewa and lancewood form the subcanopy.

Kirk's tree daisy is abundant in the shrub layer, and *Gahnia xanthocarpa* is frequent.

Astelia trinervia, Coprosma lucida, ponga, hangehange, sapling kauri and *Dicksonia lanata* "North" occur occasionally. In open areas, *Lycopodium, Gahnia*, kiekie, *Blechnum fraseri* and filmy ferns form a ground layer.

Broadleaf - podocarp - kauri forest

This vegetation type is also found mainly on ridges and leading spurs and is an intermediate type between kauri dominant and broadleaf-podocarp forest.

The canopy consists of Hall's totara, towai, tawa and rewarewa with scattered emergent kauri, rimu, kahikatea and northern rata.

The subcanopy is dominated by mingimingi and rewarewa with a similar understorey to that found on kauri dominated ridges.

Kauri - hard beech association

Kauri rickers and hard beech are dominant, with frequent emergent larger kauri and occasional emergent tanekaha, northern rata and Hall's totara on three ridges in the Pukekohe stream catchment.

In the subcanopy, tawa, makamaka, ponga and kanono are common whilst Kirk's tree daisy, and large-leaf mahoe are abundant shrubs. *Astelia trinervia*, *Blechnum fraseri* and kiekie form a fairly open ground layer.

Broadleaf - podocarp forest

This is the most extensive forest type in the Ecological District.

Towai is dominant on hillsides and ridges and taraire dominant in valleys, with rimu, northern rata and occasional pukatea and other podocarps emergent. Rewarewa is common, and swamp maire may be frequent in wet areas.

Below 300 m puriri and kohekohe occur frequently. Above this height, tawa, kohuhu and hinau are frequent.

In the subcanopy kohekohe, nikau, tree ferns, kanono and large-leaf mahoe are common, with kiekie often dense on hillsides. In some areas makamaka, kohekohe and large-leaf mahoe are abundant.

Blechnum fraseri, bush rice grass, hook sedge and hairy shield fern are common in the understorey and gully fern and parataniwha is abundant in damp areas.

Podocarp forest

Willetts (1985) details 4 podocarp sub-types:

(i) Matai-kahikatea with large rimu and totara (Camp Creek).

(ii)Large rimu with frequent Hall's totara above 300 m (Mangahorehore).

(iii)Pukatea and miro frequent emergents over northern rata, rimu, Hall's totara and occasional kahikatea (damp south-facing slope).

The understorey of these three sub-types is similar to the main broadleaf-podocarp type described above.

(iv) Small miro and Hall's totara dominant on ridge tops, occasionally with rimu and monoao. The understorey tends to be similar to kauri forest type (i) described above.

Secondary podocarp forest

Small stands of dense pole podocarps occur on broad ridges and plateaus in the central part of the district. Rimu is most often dominant with tanekaha and Hall's totara and occasional rata, manuka and scattered kauri which is sometimes locally abundant. Tanekaha may be locally dominant, with frequent kauri or totara.

Near the lower reaches of the Waihoanga Stream and near the junction of Waiare and Mokau Ridges Roads, secondary kahikatea occurs on flats or damper areas, where pukatea, totara and puriri may be frequent.

Manuka - kanuka - towai shrubland and secondary forest

These successional stages occur in a variety of sites and often form mosaics with other vegetation types.

(i) Secondary Manuka forest with *Dracophyllum lessonianum*, rewarewa and *Hakea* and scattered kauri, rimu and tanekaha.

In the understorey towai, mingimingi, *Dracophyllum lessonianum* and Hall's totara saplings are common with occasional cabbage tree, bush cabbage tree, shining karamu, bracken, tangle fern, kanono and *Gahnia pauciflora.*

In dry areas clubmoss, *Schizaea fistulosa, Drosera* and orchids occur in the ground layer or *Juncus* and *Baumea* species in wet areas.

Occasionally kanuka or towai are dominant. Manuka-kanuka with occasional totara, rewarewa, rimu, kauri and hinau occur on regenerating ridge sites.

(ii) Secondary manuka forest with more frequent podocarps than (i) including miro, kohuhu, hinau and toru with an understorey of Kirk's tree daisy, toru, kauri grass and ponga.

(iii) Manuka dominant shrubland with occasional emergent rewarewa. Other species associated are *Hebe stricta*, bush cabbage tree, tree ferns, Kirk's tree daisy, hangehange, mingimingi, bracken, kiokio, club mosses, umbrella and tangle ferns.

(iv) Manuka shrubland on swampy sites contains an understorey of *Baumea, Schoenus tendo, Juncus gregiflorus*, kiokio and *Isopelis reticularis*.

(v) Manuka gumland shrubland with tangle fern, *Epacris pauciflora* and *Schoenus brevifolius*. This is a regionally restricted vegetation type.

(vi) Manuka of low height occurs on frequently cleared sites.

(vii) Towai-manuka shrubland in which kahikatea or totara may be frequent. Toru, rewarewa, nikau, mamaku, rimu and kauri are associated species.

(viii) Towai shrubland occurs on ridges. Associated species are rimu, rewarewa, kauri, hinau and lancewood.

(ix) Towai (and/or Heketara) Secondary Forest on broad ridge tops with occasional emergent podocarps, kauri and northern rata. Rimu and hinau also occur. Sometimes tanekaha, manuka or kanuka occur frequently.

The subcanopy consists of heketara, mingimingi, kanono, karamu and mapou. In the shrub layer Kirk's tree daisy, hangehange, kiokio and *Gahnia* are common.

(x) Towai-manuka secondary forest in which kahikatea, kauri or mamaku may be frequent and associated species are kauri, rimu, rata, tanekaha, rewarewa and puriri.

3.3.4 Species of botanical interest

Puketi is the northern limit for *Brachyglottis myrianthos* (which is generally confined to Coromandel) and *Grammitis rawlingsii* (see below).

The hard beech (*Nothofagus truncata)* at Omahuta is the second most northerly occurrence of this species (Berghan Point is the northern limit). Its occurrence with kauri is an unusual vegetation association.

Puketi endemics include the undescribed *Dracophyllum* "Puketi" (considered to be Category I by Molloy & Davis 1994), and *Davallia* "Puketi" (A. P. Druce, unpublished information 1992). The undescribed *Cortaderia "*Puketi" (Druce 1992) may have a wider distribution (L. J. Forester, E. K. Cameron, P. J. de Lange pers.comm. 1996)

Other uncommon species present are:

- The filmy ferns *Hymenophyllum armstrongii, H. lyallii, H. atrovirens, H. cupressiforme and Trichomanes strictum.* Whilst these species have a wide distribution, all are uncommon or local.
- The endemic monotypic genus *Loxsoma cunninghamii* known from Thames to Kaitaia.

Species present which are common elsewhere but uncommon in Northland include:

- *Eleocarpus hookerianus* (pokaka), *Nestegis cunninghamii* (black maire), *Ascarina lucida* (hutu), *Neomyrtus pedunculata* (rohutu), *Metrosideros carminea*, *Schizaea bifida* and *Manoao colensoi* (silver pine).
- *Ackama rosifolia* (makamaka), a Northland endemic, is common in this ecological district.

3.3.5 Threatened plant species

(See Appendix 3 for Definition of Categories of Threat)

Dactylanthus taylorii Endangered - Possibly extinct in Northland

Parasitic on the roots of a variety of indigenous trees and shrubs and forming dark pockmarked ball-like structures below ground and scale-like leaves (Wilson & Given 1989). No plants have been located in recent years (L. Forester pers. comm. 1996). The main extant populations are in the central North Island (Jones 1995).

Colensoa physaloides - Local

A distinctive blue-flowered, shrubby lobeliaceous plant with hydrangea-like foliage. It is a monotypic genus, which is endemic to Northland, including some of its offshore islands as well as Rakitu Island, to the east of Great Barrier Island (P. de Lange pers. comm. 1996). It is found scattered throughout forest areas, generally beside stream and tracksides, and on talus slopes. Being vulnerable to browsing, it is usually removed where wild goats or stock are present.

***Davallia "*Puketi**" - Rare

An undescribed terrestrial fern growing on a creeping rhizome (Brownsey & Smith-Dodsworth 1989). It is considered closely related morphologically to *D.*

tasmanii which grows on the Three Kings Islands, and is probably best regarded as a subspecies of that taxon (P. de Lange pers. comm. 1996).

Grammitis rawlingsii - Rare

A small fern with stout, red-brown, often bent hairs near the sori. It is epiphytic on trees and roots in kauri forest (Brownsey & Smith-Dodsworth 1989) and known only from Puketi, Waipoua, Little Barrier Island and near Auckland. Puketi is currently its known northern limit (P. de Lange pers. comm. 1996).

Hebe acutiflora - Vulnerable

A North Island endemic plant found only at Puketi and Kerikeri in damp soil along streams flowing through kauri forest. Competition from abundant mistweed (*Ageratina riparia*) is a major threat to this species (Wilson & Given 1989).

Ileostylus micranthus - Local

A mistletoe with yellow-green flowers found throughout New Zealand and on Norfolk Island (Poole & Adams 1990). In Northland this species is extremely uncommon despite it having once been widespread in the area (P. de Lange pers. comm. 1996).

Marattia salicina - Vulnerable

King fern was once common in bush gullies from Taranaki north to Kaitaia (Brownsey & Smith-Dodsworth 1989) but in Northland is now reduced to a few scattered populations in middle and upper Northland (L. J. Forester pers. comm. 1996).

Pittosporum virgatum - Local

Confined to open ridge sites in scattered locations in Coromandel and North Auckland, this species has a distinct juvenile form in which the leaves and branchlets are densely hairy and leaves diverse in form, often lobed. Plants may flower while still in the semi-juvenile stage (Allan 1961).

3.4 FAUNA

Information on fauna in this report has been compiled from SSWI and SSBI data bases and from field observations during this survey. The status of individual species is derived from Bell (1986), and Molloy & Davis (1994). (See Appendix 3. Bell's "Threatened" equates to "Vulnerable").

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 bird species recorded is included in Appendix 4.

3.4.1 Threatened bird species

North Island brown kiwi ***Apteryx mantelli***

Endemic Category A

Kiwi are thought to be present throughout the District.

New Zealand pigeon ***Hemiphaga novaeseelandiae novaeseelandiae***

Endemic Category B

This species is subject to heavy hunting pressure in this District.

North Island kaka ***Nestor meridionalis septentrionalis***

Endemic Category C

Present in Puketi-Omahuta until the 1980s. Recent anecdotal reports of sightings are thought to be vagrants, rather than resident birds. Kaka populations which are now restricted in Northland to the Hen and Chicken Islands.

Red crowned parakeet ***Cyanoramphus novaezelandiae novaezelandiae***

Regionally threatened

Present in Puketi-Omahuta until the 1980s. Recent anecdotal reports of sightings are thought to be vagrants, rather than resident birds.

North Island kokako ***Callaeas cinerea wilsoni***

Endemic genus Category B

One of only two remaining populations in Northland, reduced from about 100 recorded birds in 1984 to only one known pair and several singles.

3.4.2 Other bird species of regional and district significance

Not considered threatened by Bell, or Molloy & Davis.

North Island fernbird ***Bowdleria punctata vealeae***

Regionally threatened endemic

Found in gumland vegetation at Puketi-Omahuta as well as in regenerating manuka on Waiare Rd.

Banded rail ***Rallus philippensis assimilis***

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

Recorded from near Puketi Forest HQ, it is likely that only small numbers occur in this Ecological District.

Pied tit ***Petroica macrocephala toitoi***

Although this species is widespread in the Ecological Region and is present in good numbers throughout Puketi-Omahuta and Mokau Ridge, as with the rest of

Nortland, populations have been generally restricted to large mature forested areas by habitat fragmentation.

3.4.3 Threatened mammals

Northern short-tailed bat *Mystacina tuberculata aupourica*

Threatened endemic Category A

To date this species is known in this district only from Puketi-Omahuta. The only other known Northland population is at Warawara.

The invertebrate *Mystacinoba zelandica* (bat fly), is found in association with short-tailed bat colonies.

Long-tailed bat *Chalinolobus tuberculata*

Threatened endemic Category B

Present in Puketi-Omahuta and widespread in Northland, but is nowhere common.

3.4.4 Threatened snails

Kauri snail *Paryphanta busbyi busbyi*

Threatened endemic Category C

Found throughout the Ecological District but populations have been restricted by habitat fragmentation.

3.4.5 Lizards/geckos

Northland green gecko *Naultinus grayii*

A Northland endemic, not presently considered threatened, found in shrubland areas.

3.4.6 Invertebrates

Northland tusked weta *Hemiandrus monstrosus*

Vulnerable Category C

Found near Puketi Forest HQ.

***Paratrochus* spp.**

Two species classified by Molloy & Davis as Category I from Family Staphylinidae sub-Family Osoriinae (rove beetles), *Paratrochus alifer* (Omahuta) and *P. flexuosus,* have been recorded from Puketi.

3.4.7 Aquatic fauna

The Waipapa River and its tributaries constitute one of the least modified freshwater systems in Northland and contain a wide diversity of species including 12 species of indigenous fish (see Appendix 4) as well as endemic invertebrates such as the freshwater mussel *Hyridella menziesii*, freshwater

crayfish *Parenephrops planifons*, freshwater limpet *Latia neritoides* and the freshwater shrimp *Paratya curvirostrus*.

Lamprey (*Geotria australis*), a widespread species for which there are few records from Northland, has been recorded here as well as two fish species, koaro (*Galaxias brevipennis)* and banded kokopu *(G. fasciatus*), which are Category C threatened species.

3.5 THREATS

Major infestations of invasive weeds such as African club moss (*Selaginella kraussiana*), mistweed (*Ageratina riparia)* and Mexican devilweed (*A. adenophora*), together with a large number of other introduced species, pose a considerable threat to the native vegetation of the habitats in this District. Stream margins and open rock/bluff areas are most at risk.

In the mature forested areas, possums, goats, pigs, rodents and mustelids constitute the main threat to vegetation, and wildlife, horses, cattle and feral dogs are also a problem locally.

Over recent years the population of New Zealand pigeon in Puketi-Omahuta has been severely depleted from the combined effects of predation, competition and heavy poaching pressure (Pierce et al. 1993, A. Walker pers. comm.). Kiwi populations have also declined in this area, probably due to predation by dogs, small predators and possibly pigs. Kokako numbers have plummeted to possibly an irretrievably low population, a result of predation by introduced predators, including possums (R. Pierce pers. comm. 1996).

Habitats on margins and in successional stages are being developed for farming and exotic forestry .

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

4. Site descriptions

Records of threatened flora and fauna have been sourced from herbaria and other databases mentioned in Section 2.1, the Kiwi Recovery Programme (for NI brown kiwi), or were direct observations by Department of Conservation staff during the course of this survey.

The status of all records was checked prior to inclusion in this report. All records included were deemed to be valid as from 1992 or more recent, unless otherwise stated.

Only significant fauna data have been included in these site reports. See Appendix 4 for common fauna in the Puketi Ecological District.

The percentage cover of ecological units has not been included in the site descriptions, as much of the information has been drawn from previous surveys and reports which did not record these data.

4.1 SCHEDULE OF SITES

	Name	Survey No.	Grid Ref.
Level 1 Sites			
	Puketi-Omahuta Forest	O05/142 P04 038	O05 680 600 P05 760 640 P04 890 700
	Omahuta Wetland	O05/141	O05 661 663
	Waiare Road Quarry	P05/100	P05 827 632
	Tangitu-Landcorp	P04/025	P04 732 707
	Waiare Shrubland	P04/041	P04 836 723
	Waiare Valley	P04/042	P04 934 487

PUKETI-OMAHUTA FOREST

Survey no.	O05/142, P04/038
Survey date	13 December 1994
Grid reference	O05 680 600, P05 760 640
Area	21,030 ha
Altitude	20–560 m asl

Ecological unit

(i) Manuka shrubland on ridges and hillslope.

(ii) Manuka shrubland on gumland.

(iii) Secondary manuka forest on hillslope and ridge.

(iv) Mamaku shrubland on steep hillslope.

(v) Secondary towai forest in gullies and on hillslope.

(vi) Towai shrubland on hillslope and ridge.

(vii) Towai-manuka shrubland on hillslope.

(viii) Secondary towai-manuka forest on hillslope.

(ix) Secondary heketara forest on broad ridge tops.

(x) Nikau-taraire forest on hillslope.

(xi) Secondary tanekaha forest on ridges.

(xii) Taraire forest on hillslope.

(xiii) Towai-taraire forest on hillslope.

(xiv) Towai forest on hillslope.

(xv) Secondary rimu forest on hillslope.

(xvi) Secondary kahikatea forest on flats.

(xvii) Secondary towai-totara forest on hillslope.

(xviii) Manuka-kanuka shrubland on hillslope.

(xix) Manuka-gorse scrub on hillslope.

(xx) Mature kauri forest on ridges and plateaus.

(xxi) Secondary kauri forest on ridges.

(xxii) Matai-kahikatea forest on river flat.

(xxiii) Rimu-Hall's totara forest on ridge.

(xxiv) Miro-Hall's totara forest on ridge.

(xxv) Pukatea-miro forest on slope.

(xxvi) Kauri-hard beech forest on ridge.

(xxvii) Hall's totara-towai-tawa-rewarewa forest on ridges and spurs.

Landform/geology

Dissected horst of Waipapa Group greywacke and minor basalt, capped by outliers of Te Kuiti Group calcareous mudstone and glauconitic sandstone, Mangakahia Complex mudstone and Kerikeri Volcanics basalt flows.

Vegetation

Type (i) manuka shrubland appears on the southern side of Omahuta with no other canopy species apart from occasional mamaku. At Mokau Ridge Rd, totara, rewarewa, rimu, kauri and hinau may occur scattered through the canopy.

Type (ii) manuka shrubland on gumland is of low height and occurs on Pirau ridge. Associated species are *Gleichenia, Epacris pauciflora* and *Schoenus brevifolius.*

Type (iii) secondary manuka forest occurs near Waiare Rd in the Waipapa River headwaters as well as south of Mangahorehore.

Type (iv) mamaku shrubland appears on the southern side of Omahuta, where that species is wholly dominant.

Type (v) secondary towai forest

Tanekaha, manuka and kanuka may be frequent and rimu, rewarewa, mamaku, kauri and totara may also be present.

Type (vi) towai shrubland is found on Mokau Ridge with occasional lancewood, rimu, rewarewa, kauri and hinau in the canopy.

Type (vii) towai-manuka shrubland occurs on the northern and eastern periphery of the area. Kahikatea and totara are frequent in the Taita Stream area with occasional nikau, mamaku, rimu and kauri. Elsewhere toru and rewarewa occur occasionally.

Type (viii) towai-manuka secondary forest is ubiquitous around the periphery of Omahuta. At the head of the Omaunu valley, kanuka is also present. Associated species are kahikatea, kauri and mamaku, which may be frequent. Northern rata, kauri, rimu, tanekaha, rewarewa and puriri are occasional in the canopy.

Type (ix) heketara dominant secondary forest can be found on broad ridge tops within the Pukekohe Stream Ecological Area.

Type (x) nikau-taraire forest dominates a hillslope to the north of the airstrip on Omahuta Forest Road. Associated with this is towai, which is frequent in the canopy.

Type (xi) secondary tanekaha forest is dominant on some ridges at Umawera with kauri occurring frequently. At Waihoanga, totara occurs in association with tanekaha, and puriri is frequent. Kohekohe, rewarewa, nikau and mamaku are also present in the canopy.

Type (xii) taraire forest occurs over large areas of Puketi-Omahuta Forest. Puriri, towai, totara and kahikatea are sometimes frequent. Northern rata and kahikatea are occasionally emergent in the canopy with rewarewa, rimu, tanekaha, kauri, pukatea, hinau, mamaku tree fern, tawa, and nikau also being present.

FIGURE 3. (ABOVE AND OPPOSITE) PUKETI-OMAHUTA FOREST, O05/142, P04/038.

EACH GRID IS 1000 M × 1000 M AND EQUALS 100 HA.

s = SHRUBLAND; f = FOREST.

Type (xiii) towai-taraire forest occurs mainly in Omahuta, Puketi-Mokau and on the southern side of the forest. Emergent rimu and rewarewa are frequent in the canopy, with mamaku tree fern, kahikatea, totara, rimu, kawaka, kauri, tanekaha, puriri, tawa, pukatea, miro and nikau all occasional in the canopy. Northern rata is an occasional emergent.

Type (xiv) towai forest is common over large areas of Puketi-Omahuta Forest. Associated species include tanekaha, kanuka-manuka, hinau and taraire, which are frequent. Rewarewa, kauri, mamaku tree fern, rimu, totara, pukatea, kahikatea, tawa, miro, narrow leaved maire and lancewood are all occasional in the canopy. Northern rata is an occasional emergent.

Towai dominant gullies on the western side of Omahuta contain frequent northern rata and occasional kohekohe, puriri, mamaku tree fern, tanekaha, totara, rewarewa and kauri.

Type (xv) secondary rimu forest appears at Jackson's Bridge, with tanekaha and manuka being frequent and kauri and northern rata occasional in the canopy. At Waihoanga both rimu and kauri occur with frequent northern rata and taraire, and at Onekura, Hall's totara occurs frequently.

Type (xvi) kahikatea forest dominates on flat ground at several areas around Puketi-Omahuta - east of the airstrip on Omahuta Road, at the eastern end of Mokau Ridge Rd, around the mouth of Camp Creek and along the Waihoanga Stream. Pukatea and/or totara are sometimes frequent in the canopy with miro, rimu, totara, puriri and northern rata occasionally present. In the southern part of Omahuta, puriri is co-dominant with kahikatea.

Type (xvii) secondary towai-totara forest occurs at Omaunu and contains frequent puriri in the canopy, with rewarewa, mamaku tree fern and kauri being occasional.

Type (xviii) manuka-kanuka shrublands are found throughout Puketi-Omahuta, and species associated with this type include kauri, *Hakea*, *Dracophyllum,* towai and toru, which are frequent in the canopy.

Type (xix) manuka-gorse scrub is predominant at Rahiri, with bracken being common and mamaku tree fern occasional.

Type (xx) mature kauri forest in dense stands is commonly emergent over a podocarp canopy, particularly miro, rimu and tanekaha. Tawa and Hall's totara are frequent and tawa, towai and tawari may be common in the subcanopy. Rimu is a frequent or common emergent while northern rata tends to be only an occasional emergent.

Type (xxi) secondary kauri forest - miro is common with the type being characterised by dense swards of emergent kauri rickers (most under 70 cm dbh) and being mainly found below 300 m asl. Associated species include Hall's totara, tawa and toru, which are all frequent in the canopy, with rimu and miro being frequent emergents.

Type (xxii) matai-kahikatea forest occurs on the river flat at Camp Creek with large rimu and totara.

Type (xxiii) rimu-Hall's totara - large rimu with Hall's totara are found along the Mangahorehore ridge.

Type (xxiv) miro and Hall's totara occur in dense stands with occasional rimu and monoao.

Type (xxv) pukatea and miro occur on the damp south-facing slopes of Onekura, are frequently emergent with northern rata, rimu, Hall's totara and kahikatea.

Type (xxvi) kauri-hard beech association appears on the ridges above the junction of Pukekohe and Driving Stream at Omahuta. Tanekaha, Hall's totara and northern rata are frequent emergents, with rewarewa, hinau, taraire and rimu being occasional in the canopy.

Type (xxvii) Hall's totara-towai-tawa-rewarewa forest occurs in the Pukekohe Stream Ecological Area.

Significant flora

This forest contains a number of threatened species including *Davallia* "Puketi" (Rare), *Hebe acutiflora* (Vulnerable), *Grammitis rawlingsii* (Rare), *Dactylanthus taylorii* (Endangered) and *Marattia salicina* (Vulnerable). Species with Local distribution include *Colensoa physaloides, Ileostylis micranthus* and *Pittosporum virgatum.*

Taxa endemic to the ecological district include *Davallia* and *Dracophyllum* "Puketi".

Fauna

Birds: North Island brown kiwi (Category A threatened species), kokako (Category B threatened species), NZ pigeon (Category B threatened species), pied tit, banded rail, fernbird (all regionally significant species).

Mammals: short-tailed bat (Category A threatened species), long-tailed bat (Category B threatened species).

Lizards: Pacific gecko, Northland green gecko (endemic)

Invertebrates: Northland tusked weta (Category B threatened species), Kauri snail (Category C threatened species), and several snail species of local distribution or endemic to Northland.

Fish: banded kokopu, koaro (both Category C threatened species).

Significance

At more than 21,000 ha, this forest tract is the second largest but most intact forested habitat in the Eastern Northland Ecological Region. The Department of Conservation administers 16,210.7 ha, with 250.2 ha under Conservation Covenant and 427.6 ha under covenant with the Queen Elizabeth II National Trust.

With over 360 indigenous species of plants, this forest is one of the most diverse in New Zealand. It supports five species of threatened plants, three species of local distribution, one endemic and two plant species at their northern limits as well as nine threatened fauna species and several others which are endemic, or regionally significant.

The mature kauri forest remnants are especially important in that less than 1% of the original cover of this forest type is left (Northland CMS). The kauri-hard

beech association in the Pukekohe Stream area is a rare forest type in Northland.

The lowland mixed kauri forest is one of the best remaining examples of this type.

Omahuta is a regionally important soils site:

- being a large area containing a wide range of little disturbed soil-vegetation associations on a wide range of parent materials (greywacke, argillite and limestone and derived colluvium);
- unmodified rendzina soil-vegetation associations are nationally uncommon;
- it is the reference site for Wharekohe silt and is the only record for this type in the national inventory;
- good examples of Motatau, Taumata and Hukerenui soils are uncommon;
- most Motatau soils have been developed for agriculture.

Manginangina is a nationally important soils site:

- containing a wide range of little-disturbed soils;
- the only example of Otaha, Otangaroa, Mount Rex and Pungaere soils in the national inventory;
- good examples of Okaihau and Waiotu soils are uncommon (Arand et al. 1993).

OMAHUTA WETLAND

Survey no.	O05/141
Survey date	27 February 1995
Grid reference	O05 661 663
Area	8.2 ha
Altitude	120 m asl

Ecological unit

(a) Manuka shrubland on flats.

Landform/geology

Freshwater wetland in valley of Te Kuiti Group calcareous mudstone.

Vegetation

Manuka is dominant. In the wetter areas *Coprosma robusta, Hebe stricta, Juncus* and raupo are common. *Blechnum,* putaputaweta, *Carex, Gleichenia* and flax are occasional.

Fauna

Not surveyed

Significance

Representative of a wetland type not recorded elsewhere in the Ecological District.

FIGURE 4. OMAHUTA WETLAND, O05/141

EACH GRID IS 1000 M × 1000 M AND EQUALS 100 HA. w = WETLAND.

WAIARE ROAD QUARRY

Survey no.	P05/100
Survey date	1 March 1995
Grid reference	P05 827 632, 825 620
Area	59 ha
Altitude	340 m asl

Ecological unit

(a) Secondary towai forest on hillslope.

(b) Towai-manuka forest on hillslope.

(c) Manuka shrubland on hillslope.

(d) Mixed shrubland association on stream margins.

Landform/geology

Gullies in hill country of Waipapa Group chert and overlying Te Kuiti Group glauconitic sandstone.

Vegetation

Associated species include:

Type (a) Secondary towai forest - kauri, rewarewa, mamaku, wheki and gorse are occasional. This type occurs in the northern block.

Type (b) Towai-manuka forest occurs in the southern area and contains scattered gorse.

Type (c) Manuka shrubland - gumland vegetation with bracken, kiokio, and the sedges *Baumea juncea, Baumea rubiginosa* and *Lepidosperma australe.*

Type (d) Streamside shrubland - ponga, five finger and tutu are occasionally emergent over flax, with occasional mahoe and manuka. The ferns kiokio and *Hypolepis ambigua* occur in the ground layer (Kingett- Mitchell).

Fauna

North Island brown kiwi (Category A threatened species).

Significance

Forms a partial linkage between Puketi-Omahuta Forest and habitats in the upper Kerikeri River catchment (Kerikeri Ecological District) as well as being habitat for kiwi, a threatened species.

Gumland vegetation is an under-represented vegetation type in the Ecological District and Region.

FIGURE 5. WAIARE ROAD QUARRY, P05/100.

EACH GRID IS 1000 M × 1000 M AND EQUALS 100 HA.

s = SHRUBLAND; f = FOREST.

TANGITU-LANDCORP

Survey no.	P04/025
Survey date	14 December 1994
Grid reference	P04 729 707
Area	5 ha
Altitude	200 m asl

Ecological unit
(a) Kahikatea on river flats

Landform/geology
Hill country of Waipapa Group greywacke, and Te Kuiti Group glauconitic sandstone and calcareous mudstone.

Vegetation
A small area of abundant kahikatea containing totara and towai.

Fauna
Not surveyed

Significance
An uncommon vegetation type in the Ecological District and Region.

FIGURE 6. TANGITU-LANDCORP, P04/025.

EACH GRID IS 1000 M × 1000 M AND EQUALS 100 HA. f = FOREST.

WAIARE SHRUBLAND

Survey no.	P04/041
Survey date	13 February 1995
Grid reference	P04 836 723
Area	41.5 ha
Altitude	100-160 m asl

Ecological unit

(a) Towai-manuka shrubland on hillslope.

(b) Manuka shrubland on hillslope.

(c) Secondary totara forest on hillslope.

Landform/geology

Hill country of Waipapa Group greywacke.

Vegetation

More than half of the area is shrubland between 2 and 4 metres tall.

Type (a) towai-manuka shrubland contains open areas of bracken and scattered mamaku, totara, tanekaha and pine.

Type (b) manuka shrubland contains occasional mamaku.

FIGURE 7. WAIARE SHRUBLAND, P04/041.

EACH GRID IS 1000 M × 1000 M AND EQUALS 100 HA. s = SHRUBLAND.

Type (c) secondary totara - both manuka and mamaku occur frequently in the canopy with puriri occurring occasionally.

Fauna

Kiwi (Category A threatened species) in low numbers.

Significance

Forms part of linkage between Puketi-Omahuta forest to forested areas in the southern part of Whangaroa Ecological District and is habitat for kiwi (a threatened species).

WAIARE VALLEY

Survey no.	P04/042
Survey date	13 February 1995
Grid reference	P04/P05 840 700
Area	417.5 ha
Altitude	200 m asl

Ecological unit

(a) Totara forest on hillslope.

(b) Manuka shrubland on hillslope.

(c) Towai shrubland on hillslope.

(d) Manuka-towai shrubland on hillslope.

(e) Taraire forest on hillslope.

(f) Bracken-gorse scrub on hillslope.

(g) Towai forest on hillslope.

Landform/geology

Hill country in Ihumia Stream Valley in which a variety of rock types are present, including Waipapa Group greywacke, Te Kuiti Group glauconitic sandstone, Mangakahia Complex mudstone and Whangaroa Group andesitic breccia.

Vegetation

Type (a) totara forest. A small area of secondary growth occurs at the northern tip of the site with occasional kahikatea, tanekaha and gorse in the canopy. It adjoins types (b) and (c), which form extensive areas of low vegetation. Type (a) also occurs on the western side of the Ihumia Stream and contains frequent manuka and kahikatea.

Type (b) manuka shrubland contains occasional towai and mamaku.

Type (c) towai shrubland contains frequent mamaku and occasional bracken, gorse, pine and totara.

Type (d) manuka-towai shrubland occurs extensively on the western side of the upper valley, with rewarewa, mamaku, rimu, tanekaha, and five finger occurring occasionally in the canopy. Pockets of this area have recently been cleared and planted in pine trees.

Type (d) also occurs in the Te Mata uplands, where it is lower in height and lacks rimu and tanekaha.

Type (e) occurs on the eastern side of the upper valley. Rimu, puriri, kahikatea, totara, kanuka, pukatea, towai, rewarewa and northern rata all appear occasionally in the canopy.

Type (f) bracken and gorse east of Ketetawa Stream has frequent towai and kanuka. Much of this has been cleared since surveying.

Type (g) towai forest also occurs in the upper part of the valley. Taraire and kahikatea are frequent with occasional rewarewa, puriri, totara, miro, tanekaha, pukatea, rimu and kauri.

Fauna

Kauri snail (Category C threatened species); North Island brown kiwi (Category A threatened species).

Significance

A large habitat forming the vegetated upper catchment of the Kaeo River. Progressive clearing of this site has been occurring for several years. It has a high diversity of rock types, and forms part of a forested linkage which extends from Puketi Forest northwards into the southern forests of the Whangaroa Ecological District, which is particularly important for maintaining corridors for kiwi.

FIGURE 8. WAIARE VALLEY, P04/042.

EACH GRID IS 1000 M × 1000 M AND EQUALS 100 HA.

s = SHRUBLAND; f = FOREST.

5. Summary and conclusions

The Protected Natural Area network in the Puketi Ecological District is summarised in Table 1. A list of ecological units recorded in the Puketi Ecological District and their current protection status is set out in Table 2, and a summary of the site evaluations is given in Table 3.

TABLE 1 PROTECTED NATURAL AREA NETWORK IN THE PUKETI ECOLOGICAL DISTRICT (AREA GIVEN IN HA)

	QEII	CP	SL	SR	FS	EA	CC	Total
Puketi-Omahuta	427.6	13,164	82.6	209.1	6	2749	205.2	16,837.5

Note that this site is larger than the area currently protected.

Key: CC = Conservation Covenant under Reserves Act; CP = Conservation Park; EA = Ecological Area; FS = Forest Sanctuary; QEII = Queen Elizabeth II National Trust Covenant; SL = Stewardship Land; SR = Scenic Reserve

TABLE 2 ECOLOGICAL UNITS RECORDED IN THE PUKETI ECOLOGICAL DISTRICT AND PROTECTED STATUS.

VEGETATION TYPE	SITE	PROTECTION STATUS	REPRESENTATIVE SITE
Shrubland			
Manuka	Puketi-Omahuta	Pt - CP	Yes
	Waiare Rd Quarry	UP	
	Waiare Shrubland	UP	
	Waiare Valley	UP	
Manuka (gumland)	Puketi-Omahuta	CP	Yes
	Waiare Rd Quarry	UP	Yes
Manuka (swamp shrubland)	Omahuta Wetland	UP	Yes
Manuka-kanuka	Puketi-Omahuta	Pt - CP	Yes
Manuka-gorse	Puketi-Omahuta	UP	
Bracken-gorse	Waiare Valley	UP	
Mamaku	Puketi-Omahuta	UP	
Towai	Puketi-Omahuta	Pt - CP	Yes
	Waiare Valley	UP	
Towai-manuka	Puketi-Omahuta	Pt - QEII, CP	Yes
	Waiare Shrubland	UP	
	Waiare Valley	UP	
Streamside association	Waiare Rd Quarry	UP	Yes

VEGETATION TYPE	SITE	PROTECTION STATUS	REPRESENTATIVE SITE
Forest			
Broadleaf			
Manuka	Puketi-Omahuta	EA	Yes
Towai-manuka	Puketi-Omahuta	Pt - QEII, CP, EA	Yes
	Waiare Rd Quarry	UP	
Towai (secondary)	Puketi-Omahuta	Pt - CP	Yes
	Waiare Rd Quarry	UP	
Towai (mature)	Puketi-Omahuta	CP, EA	Yes
	Waiare Valley	UP	
Towai-taraire	Puketi-Omahuta	Pt - CC, CP, EA, QEII	Yes
Taraire	Puketi-Omahuta	Pt - CP	Yes
	Waiare Valley	UP	
Nikau-taraire	Puketi-Omahuta	CP	Yes
Heketara	Puketi-Omahuta	EA	Yes
Broadleaf-podocarp			
Towai-totara (secondary)	Puketi-Omahuta	UP	
Pukatea-miro	Puketi-Omahuta	EA	Yes
Hall's totara-towai-tawa-rewarewa	Puketi-Omahuta	EA	Yes
Kauri-hard beech	Puketi-Omahuta	EA	Yes
Podocarp			
Totara (secondary)	Waiare Shrubland	UP	
	Waiare Valley	UP	
Tanekaha	Puketi-Omahuta	UP	Yes
Rimu	Puketi-Omahuta	UP	Yes
Kahikatea	Puketi-Omahuta	Pt - CP	Yes
	Tangitu-Landcorp	UP	Yes
Matai-kahikatea	Puketi-Omahuta	EA	Yes
Rimu-Hall's totara	Puketi-Omahuta	EA	Yes
Miro-Hall's totara	Puketi-Omahuta	EA	Yes
Kauri (secondary)	Puketi-Omahuta	EA, CP	Yes
Kauri (mature)	Puketi-Omahuta	EA, FS, CP	Yes

Key: CC = Conservation Covenant under Reserves Act; CP = Conservation Park; EA = Ecological Area; FS = Forest Sanctuary; QEII = Queen Elizabeth II National Trust Covenant; SL = Stewardship Land; SR = Scenic Reserve; Pt = Partly protected; UP = Unprotected

TABLE 3 SUMMARY OF SITE EVALUATIONS.

	REPRESENTATIVENESS	RARITY/SPECIAL FEATURES	
Puketi-Omahuta	Rep. site for many vege types & only site in ER for several; mature kauri forest	Flora:5 threatened species, 3 Local, 2 endemics; Fauna: 9 threatened species & several endemics	
Omahuta Wetland	uncommon habitat type		
Waiare Rd Quarry	gumland vegetation uncommon nationally	kiwi	
Tangitu-Landcorp	uncommon vegetation type		
Waiare Shrubland		kiwi	
Waiare Valley		kiwi, kauri snail	

5.1 PRIORITY NATURAL AREAS FOR PROTECTION IN THIS ECOLOGICAL DISTRICT

1. Habitat types which are nationally uncommon, including gumland vegetation, freshwater wetlands, podocarp forest and kauri forest.
2. Areas containing ecological units uncommon in the Ecological District, e.g. towai-totara and taraire-totara forms of broadleaf-podocarp forest.
3. Sites which contribute to the retention of the range of North Island brown kiwi, in the north and east of the Ecological District.
4. Sites which contribute to the maintenance and retention of linkages to large contiguous habitats in other Ecological Districts, especially Maungataniwha (via northern Omahuta) and Whangaroa (via Puketi-Mokau and Waiare Valley).

	DIVERSITY & PATTERN	NATURALNESS	BUFFER/LINKAGE/CORRIDOR	SIZE & SHAPE
	27 ecological units; large altitudinal range	Mostly very high; dense, vigorous regeneration of logged areas; some weedy margins	Linkages to habitats in other EDs	2nd largest habitat in ER; > 18,000 ha
		within pine plantation	Links Puketi-Omahuta to O05/132 (Maungataniwha ED)	c. 8 ha
	4 ecological units	Varied; some previous modification; gorse present	partial linkage between Puketi and Kerikeri River catchment	c. 60 ha
		Remnant		small (5 ha)
	3 ecological units	regenerating; uneven canopy; grazed	Partial linkage from Puketi to habitats in Whangaroa ED	c. 40 ha
	7 ecological units	regenerating; being cleared; exotic weeds present	Partial linkage between Puketi & habitats in Whangaroa ED	> 400 ha

6. Acknowledgements

We thank the landowners who cooperated with this survey and DoC Field Centre staff from Kaikohe and Kerikeri, especially Adrian Walker, Steve McManus, and Karen Riddell, who provided assistance from time to time.

Geomorphological data was compiled and written by Fred Brook, who was also scientific adviser to the survey and provided invaluable advice and guidance. Peter Anderson was a constantly positive and encouraging team leader and had considerable input into the Introduction. Fraser Moors contributed to the writing of the site reports and to the compilation of the glossary.

Richard Parrish provided advice and assistance with regard to fauna distribution and status and Lisa Forester and Ewen Cameron were frequently called upon for plant identification and botanical advice. Herbarium records from Landcare Research, Lincoln (CHR) and Auckland Museum and Institute (AK) were consulted. Some information collected in the field by Kingett-Mitchell Associates Ltd, Auckland, has been incorporated into site reports.

Editorial comment was also provided by Peter Anderson, Peter de Lange, Lisa Forester, and Ray Pierce and scientific advice was given by Neil Mitchell.

Word processor operator Barbara Lyford made a major contribution and Terry Conaghan and Loraine Wells have prepared the maps. Andrea Booth organised the publication of the report.

Mapping services were carried out by Eric Dutton with financial assistance of the Far North District Council.

7. Bibliography

Allan, H. H. 1961. *Flora of New Zealand Vol 1*. Government Printer, Wellington.

Anderson, P. 1993. A Habitat Protection Strategy for the Northland Conservancy. (Draft) Unpublished.

Arand, J., Basher, L., Wardle, R. and Wardle, K. 1993 Inventory of New Zealand Soil Sites of international, national and regional importance. Part Two - North Island and northern offshore islands (1st edn). *New Zealand Society of Soil Science occasional publication 2* Lincoln University.

Atkinson, I. A. E. 1962. Semi-quantitative measurements of canopy composition as a basis for mapping in *Proceedings NZ Ecological Society 9*: 1–8.

Atkinson, I. A. E. 1985. Derivation of vegetation mapping units for an ecological survey of Tongariro National Park, North Island, New Zealand in *New Zealand journal of botany 23*: 361–178.

Bell, B. 1986. *The Conservation Status of New Zealand Wildlife*. NZ Wildlife Service.

Brook, F. 1996. Classification of the Ecological Districts of Northland. Unpublished report, Department of Conservation.

Brownsey, P. and Smith-Dodsworth, J. C. 1989. *New Zealand Ferns and Allied Plants*. David Bateman, Auckland

Cameron, E. K., de Lange, P. J., Given, D. R., Johnson, P. N. and Ogle, C. C. 1995. (Revision) Threatened and Local Plants Lists. *NZ Botanical Society newsletter 39*: 15–28

Department of Conservation. Internal reports, files and databases. Northland Conservancy Office, Whangarei.

Department of Conservation. 1991. An Internal Review of the Protected Natural Areas Programme. Internal unpublished report, Wellington.

Department of Conservation. 1994. Protected Natural Areas Programme Draft Discussion Document. Internal unpublished report, Wellington.

Department of Conservation. 1995. Draft Conservation Management Strategy for Taitokerau Northland. Northland Conservancy management planning series no. 1, Whangarei.

Druce, A. P. 1992. Indigenous Higher Plants of New Zealand. Unpublished checklist, Landcare Research, Lincoln, New Zealand.

Evans, R. B. 1993a. *Geological map of Northland, Sheets P04/Q04: Whangaroa*. Published by the author, PO Box 383, Kerikeri.

Evans, R. B. 1993b. *Geological map of Northland, Sheet P05: Kaikohe*. Published by the author, PO Box 383, Kerikeri.

Froude, V. A. 1995. Significant natural features gain protection. *New Zealand planning quarterly 119*: 20–23.

Harrison, M. 1995. National "ecosystem" mapping for conservation. *In* Firns, P. G. and Sutherland, N. C. *Proceedings of the 1995 NZ Conference on Geographical Information Systems and Spatial Information Research*. University of Otago.

Healy, A .J. and Edgar, E. 1980. *Flora of New Zealand Vol III*. Government Printer, Wellington.

Johns, J. and Molloy, B. 1983. *Native orchids of New Zealand*. AH & AW Reed, Wellington.

Jones, Cathy. 1995. *Dactylanthus taylorii*, survey, monitoring and management. Unpublished report, Department of Conservation, Tongariro/Taupo Conservancy.

Kershaw, K. A. and Looney, J.H.H. 1985. *Quantitative and Dynamic Ecology* (3rd edn) Edward Arnold, London.

Kelly, G. C. and Park, G. N. 1986. *A Scientific Focus*. New Zealand Department of Scientific and Industrial Research, Wellington.

King, M. 1990. *A Handbook of New Zealand Mammals*. Oxford University Press, Auckland.

Leathwick , J. R. and Rogers, G.M. 1996. Modelling relationship between environment and canopy composition in secondary vegetation in central North Island, New Zealand. *New Zealand journal of ecology 20*: 147-162.

McEwen, W. M. 1987. Ecological Regions and Districts of New Zealand. *New Zealand Biological Resources Centre publication no. 5*, Wellington.

Moir, R.W., Collen, B. and Thompson, C.S. 1986. The Climate and Weather of Northland, New Zealand. *Meteorological Service miscellaneous publication 115 (2)* (2nd edn) Ministry of Transport, Wellington.

Molloy, J. and Davis, A.D. 1994. *Setting Priorities for the Conservation of New Zealand's Threatened Plants and Animals*. (2nd edn) Department of Conservation, Wellington.

Molloy, L. 1988. *The Living Mantle*. Mallinson Rendel & NZ Society of Soil Science, Wellington.

Moore, L.B. and Edgar, E. 1970. *Flora of New Zealand Vol II*. Government Printer, Wellington.

Mueller-Dombois, D. and Ellenberg, H. 1974. *Aims and Methods of Vegetation Ecology*. John Wiley & Sons, New York.

Myers, S., Park, G. and Overmars, F.A. 1987. Guidebook for the Rapid Ecological Survey of Natural Areas. *New Zealand Biological Resources Centre publication no. 6*, Wellington.

Ogle, C. 1982. Wildlife and Wildlife Habitat Values of Northland. *Fauna Survey Unit report no. 30*. New Zealand Wildlife Service, Wellington.

Park, G.N. and Walls, G.Y. 1978. *Inventory of Tall Forest Stands on Lowland Plains and Terraces in Nelson and Marlborough Land Districts, New Zealand.* Botany Division, Department of Scientific and Industrial Research, Lower Hutt.

Pierce, R.J., Atkinson, R. and Smith, E. 1993. Changes in bird numbers in six Northland forests 1979–93. *Notornis 40*: 285–293.

Poole, L. and Adams, N. 1990. (Revised edn) *Trees and Shrubs of New Zealand*. DSIR Publishing, Wellington.

Shaw, W. B. 1994. Botanical Ranking for Nature Conservation. *Science and research series no. 72* Department of Conservation, Wellington.

Turbott, E.G.(Convener, Ornithological Society of New Zealand Checklist Committee) 1990. *Checklist of the Birds of New Zealand*. Random Century, Auckland.

Wardle, P. 1991. *Vegetation of New Zealand*. Cambridge University Press.

Webb, C.J., Sykes, W.R. and Garnock-Jones, P.J. 1988. *Flora of New Zealand Vol IV*. Botany Division, Department of Scientific and Industrial Research, Christchurch.

Whitten, D.G.A. and Brooks, J.R.V. 1972. *Dictionary of Geology*. Penguin, London.

Willetts, D. 1985. *Onekura Ecological Area*. New Zealand Forest Service, Auckland.

Willetts, D. and Forester, L. 1985. *Omahuta Forest Sanctuary and Pukekohe Stream Ecological Area*. New Zealand Forest Service, Auckland.

Williams, G.R. and Given, D.R. 1981. *The Red Data Book of New Zealand: Rare and Endangered Species of Endemic Terrestrial Vertebrates and Vascular Plants*. Nature Conservation Council, Wellington.

Wilson, C.M. and Given, D.R. 1989. *Threatened Plants of New Zealand*. New Zealand Department of Scientific and Industrial Research, Wellington.

8. Appendices

8.1 FIELD SURVEY FORM

8.2 LETTER TO RATEPAYERS/NEWS MEDIA ITEM

8.3 CATEGORIES OF THREAT

New Zealand Threatened Plant List

In this report categories of threatened plants are taken from the New Zealand Threatened Plants Committee (Cameron et al. 1995), which are based on those used by the Conservation Monitoring Centre of the International Union for Conservation of Nature and Natural Resources (IUCN) in their worldwide survey of threatened species. The categories are as follows:

Presumed extinct
Taxa which are no longer known to exist in the wild or in cultivation after *repeated* searches of the type localities and *other known or likely places*.

Critical
Taxa which face *an extremely high probability of extinction* in the wild within the immediate future.

Endangered
Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Vulnerable
Taxa believed likely to move into the Endangered category in the near future if the causal factors continue operating. Included are taxa of which most or all of the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; and taxa with populations that are still abundant, but are under threat from serious adverse factors throughout their range.

Rare
Taxa with small populations which are not Endangered or Vulnerable but *are at risk*. These taxa are usually localised within restricted geographical areas or habitats, or are thinly scattered over a more extensive range. Rare species are often endemics with a narrow distribution whereas Vulnerable and Endangered species have often been formerly more widespread.

Insufficiently known
Taxa that are *suspected* but *not definitely known* to belong to any of the above categories because of lack of information. An "Insufficiently Known" taxon does not have to be *proved* to be in any of the four categories - Critical, Endangered, Vulnerable or Rare. It is hoped that listing a taxon as "Insufficiently known" will stimulate studies to find out its true category of threat.

Taxonomically indeterminate

This includes: (1) Taxa about which there is doubt regarding a taxonomic status and which require further investigation; and (2) genetic variants which are distinct at a level which may not warrant formal taxonomic recognition. Species within this category are then defined by probable category of threat.

Local

This is not an IUCN Threat Category. It has been compiled by the New Zealand Threatened Plants Committee (Cameron et al. 1995) and is regularly updated. It is designed to act as a "watchlist" for taxa which are sufficiently restricted to warrant noting and some monitoring. It may include taxa which occupy habitats potentially threatened in the future, and those found in sensitive habitats which are prone to damage.

Molloy & Davis (1994) categories of threat

The Molloy & Davis categories were developed to identify species which should be assessed for conservation action. It includes taxonomic groups not ranked under IUCN categories such as bryophytes and invertebrates.

The Categories are as follows:

Category A	Highest priority threatened species (score >47 out of a possible 83).
Category B	Second priority threatened species (score 39–47 inclusive).
Category C	Third priority threatened species (score 30–38 inclusive).
Category X	Species which have not been sighted for a number of years but which may still exist.
Category I	Species about which little information exists, but based on existing evidence, are considered to be threatened.
Category O	Species which are threatened in New Zealand, but which are known to be secure in other parts of their range outside New Zealand.
Category M	Species that are rare or localised, and of cultural importance to Maori.

Checklist of birds in Puketi Ecological District

NI brown kiwi	*Apteryx australis mantelli*	X
NZ dabchick	*Poliocephalus rufopectus*	
Australasian little grebe	*Tachybaptus novaehollandiae*	
blue penguin	*Eudyptula minor*	
Australasian gannet	*Morus serrator*	
black shag	*Phalacrocorax carbo*	
pied shag	*Phalacrocorax varius*	
little black shag	*Phalacrocorax sulcirostris*	
little shag	*Phalacrocorax melanoleucos*	
white heron	*Egretta alba*	
white-faced heron	*Ardea novaehollandiae*	X
reef heron	*Egretta sacra*	
Australasian bittern	*Botaurus poiciloptilus*	
royal spoonbill	*Platalea regia*	
*black swan	*Cygnus atratus*	
*feral goose	*Anser anser*	
paradise shelduck	*Tadorna variegata*	X
*mallard	*Anas platyrhynchos*	X
grey duck	*Anas superciliosa*	X
Australasian shoveler	*Anas rhynchotis*	
grey teal	*Anas gracilis*	
brown teal	*Anas aucklandica*	
NZ scaup	*Aythya novaeseelandiae*	
Australasian harrier	*Circus approximans*	X
*pheasant	*Phasianus colchicus*	X
*peafowl	*Pavo cristatus*	
*wild turkey	*Meleagris gallopavo*	
*tufted guineafowl	*Numida meleagris*	
*Californian quail	*Callipela californica*	X
*brown quail	*Synoicus ypsilophorus*	X
weka	*Gallirallus australis*	
banded rail	*Rallus philippensis*	X
spotless crake	*Porzana tabuensis*	
marsh crake	*Porzana pusilla*	
pukeko	*Porphyrio porphyrio*	X
Australian coot	*Fulica atra*	
pied oystercatcher	*Haematopus ostralegus*	
variable oystercatcher	*Haemotopus unicolor*	
spur-winged plover	*Vanellus miles*	
pied stilt	*Himantopus himantopus*	
banded dotterel	*Charadrius bicinctus*	
NZ dotterel	*Charadrius obscurus*	
Pacific golden plover	*Pluvialis fulva*	
grey plover	*Pluvialis squatarola*	
lesser knot	*Calidris canutus*	
Curlew sandpiper	*Calidris ferruginea*	
wrybill	*Anarhynchus frontalis*	
turnstone	*Arenaria interpres*	
Terek sandpiper	*Tringa terek*	
sanderling	*Calidris alba*	
sharp-tailed sandpiper	*Calidris acuminata*	
pectoral sandpiper	*Calidris melanotos*	
red-necked stint	*Calidris ruficollis*	
eastern curlew	*Numenius madagascariensis*	
whimbrel	*Numenius phaeopus*	
bar-tailed godwit	*Limosa lapponica*	
black-tailed godwit	*Limosa limosa*	
Hudsonian godwit	*Limosa haemastica*	
marsh sandpiper	*Tringa stagnatilis*	
greenshank	*Tringa nebularia*	
wandering tattler	*Tringa incana*	
Siberian tattler	*Tringa brevipes*	
Arctic skua	*Stercorarius parasiticus*	
pomarine skua	*Stercorarius pomarinus*	
black-backed gull	*Larus dominicanus*	X
red-billed gull	*Larus novaehollandiae*	
Caspian tern	*Sterna caspia*	
white-fronted tern	*Sterna striata*	
fairy tern	*Sterna nereis*	
little tern	*Sterna albifrons*	
grey ternlet	*Procelsterna cerulea*	
NZ pigeon	*Hemiphaega novaeseelandiae*	X
*rock pigeon	*Columba livia*	
*Barbary dove	*Streptopelia roseogrisea*	
kaka	*Nestor meridionalis*	X
*eastern rosella	*Platycercus eximius*	X
red-crowned parakeet	*Cyanoramphus novaezelandiae*	X
shining cuckoo	*Chrysococcyx lucidus*	X
long-tailed cuckoo	*Eudynamis taitensis*	X
morepork	*Ninox novaeseelandiae*	X
*kookaburra	*Dacelo novaeguineae*	
kingfisher	*Halcyon sancta*	X
welcome swallow	*Hirundo tahitica*	X
rifleman	*Acanthisitta chloris*	
silvereye	*Zosterops lateralis*	X
grey warbler	*Gerygone igata*	X
*blackbird	*Turdus merula*	X
*song thrush	*Turdus philomelos*	X
*dunnock	*Prunella modularis*	X
*skylark	*Alauda arvensis*	X
NZ pipit	*Anthus novaeseelandiae*	X
fernbird	*Bowdleria punctata*	X
fantail	*Rhipidura fuliginosa*	X
tomtit	*Petroica macrocephala*	X
NZ robin	*Petroica australis*	X
kokako	*Callaeas cinerea*	X
tui	*Prosthemadera novaeseelandiae*	X
bellbird	*Anthornis melanura*	X

* Introduced

*house sparrow	*Passer domesticus*	X	*yellowhammer	*Emberiza cintrinella*	X
*chaffinch	*Fringilla coelebs*	X	*starling	*Sturnus vulgaris*	X
*redpoll	*Carduelis flammea*	X	*myna	*Acridotheres tristis*	X
*goldfinch	*Carduelis carduelis*	X	*Australian magpie	*Gymnorhina tibicen*	X
*greenfinch	*Carduelis chloris*	X			

B. Other fauna in the Ecological District

Indigenous freshwater fish

shortfinned eel	*Anguilla australis*	common smelt	*Retropinna retropinna*
longfinned eel	*Anguilla dieffenbachii*	red finned bully	*Gobiomorphus huttoni*
torrentfish	*Cheimarrichthys fosteri*	common bully	*G. cotidianus*
koaro	*Galaxias brevipennis*	grey mullet	*Mugil cephalus*
banded kokopu	*G .fasciatus*	lamprey	*Geotria australis*
inanga	*G. maculatus*	yellow eyed mullet	*Aldrichetta forsteri* is reported locally.

Reptiles

Copper skink	*Cyclodina aenea*
Pacific gecko	*Hoplodactylus pacificus*
Forest gecko	*Hoplodactylus granulatus* is widespread in Northland and thought to be present but there are no confirmed records.

Introduced mammals

mouse	*Mus musculus*	dog	*Canis familiaris*
ship rat	*Rattus rattus rattus*	cattle	*Bos taurus*
Norway rat	*Rattus norvegicus*	goat	*Capra hircus*
weasel	*Mustela nivalis*	possum	*Trichosurus vulpecula*
stoat	*Mustela erminea*	pig	*Sus scrofa*
ferret	*Mustela furo*	hedgehog	*Erinaceus europeus occidentalis*
feral cat	*Felis catus*		

Introduced amphibians

golden bell frog	*Litoria aurea*
green tree frog	*Litoria raniformis*

Introduced fish

rainbow trout	*Oncorhynchus mykiss*
Chinook salmon	*Oncorhynchus tshawytscha* (1985 record near Omahuta HQ)

8.5 COMMON AND SCIENTIFIC PLANT NAMES USED IN THE TEXT

This is not a definitive list of common names used for plants from the ecological district. Rather it is a guide to the reader as to exactly which species is referred to when the common name is used in the text.

Indigenous

bracken	*Pteridium esculentum*
bush cabbage tree	*Cordyline banksii*
bush lawyer	*Rubus australis*
bush rice grass	*Microlaena avenacea*
cabbage tree	*Cordyline australis*
club moss	*Lycopodium* sp.
cutty grass	*Gahnia setifolia*
five finger	*Pseudopanax arboreus*
flax	*Phormium tenax*
hairy shield fern	*Lastreopsis hispida*
Hall's totara	*Podocarpus hallii*
hangehange	*Geniostoma rupestre* var. *ligustrifolium*
hard beech	*Nothofagus truncata*
heketara	*Olearia rani* var. *rani*
hinau	*Elaeocarpus dentatus*
hook sedge	*Uncinia uncinata*
kahikatea	*Dacrycarpus dacrydioides*
kanono	*Coprosma grandifolia*
kanuka	*Kunzea ericoides s.l.*
karamu	*Coprosma robusta*
kauri	*Agathis australis*
kauri grass	*Astelia trinervia*
kawaka	*Libocedrus plumosa*
kidney fern	*Trichomanes reniforme*
kiekie	*Freycinettia banksii*
kiokio	*Blechnum* "blackspot"
Kirk's tree daisy[1]	*Brachyglottis kirkii* var. *kirkii* or *B. kirkii* var. *angustior*
kohekohe	*Dysoxylum spectabile*
kohuhu	*Pittosporum tenuifolium* subsp. *tenuifolium*
lancewood	*Pseudopanax crassifolius*
large-leaf mahoe	*Melicytus macrophylla*
mahoe	*M. ramiflorus*
mairehau	*Phebalium nudum*
makamaka	*Ackama rosifolia*
mamaku	*Cyathea medullaris*
mamangi	*Coprosma arborea*
manuka	*Leptospermum scoparium*
mapou	*Myrsine australis*
matai	*Prumnopitys taxifolia*
mingimingi	*Leucopogon fasciculatus*
miro	*Prumnopitys ferruginea*
monoao	*Halocarpus kirkii*
neinei	*Dracophyllum latifolium*
nikau	*Rhopalostylis sapida*
northern rata	*Metrosideros robusta*
parataniwha	*Elatostema rugosum*
pate	*Schefflera digitata*
ponga	*Cyathea dealbata*
pukatea	*Laurelia novae-zelandiae*
puriri	*Vitex lucens*
putaputaweta	*Carpodetus serratus*
raupo	*Typha orientalis*
rewarewa	*Knightia excelsa*
rimu	*Dacrydium cupressinum*
shining karamu	*Coprosma lucida*
silver pine	*Manoao colensoi*
sundew	*Drosera* sp.
swamp maire	*Syzygium maire*
tanekaha	*Phyllocladus trichomanoides*
tangle fern	*Gleichenia* sp.
taraire	*Beilschmiedia tarairi*
tawa	*Beilschmiedia tawa*
tawari	*Ixerba brexioides*
toatoa	*Phyllocladus toatoa* (in press)
toro	*Myrsine salicina*
toru	*Toronia toru*
totara	*Podocarpus totara*
towai	*Weinmannia silvicola*
umbrella fern	*Sticherus* sp.
narrow-leaf maire	*Nestegis montana*

Adventive

African club moss	*Selaginella kraussiana*
hakea	*Hakea sericea* and *H. salicifolia*
Mexican devil	*Ageratina adenophora*
mistweed	*Ageratina riparia*

[1] Data considered in this report do not distinguish whether the species referred is *Brachyglottis kirkii* var. *kirkii* or *B. kirkii* var. *angustior*. The vernacular "Kirk's tree daisy" may refer to one or both of these species.

8.6 GLOSSARY

Biodiversity

The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (IUCN 1993).

Bog

Infertile/acid wetland. Usually characterised by a peat substrate, sedges, manuka and *Gleichenia* fern. Water arrives via rainfall rather than by streams and other run-off.

Buffer

A zone surrounding a natural area which reduces the effects of external influences on the natural area. For example, shrubland, scrub and exotic trees around native forested areas provide a gradation of habitats from fully modified to a natural state. This effect also applies to waterways - riparian vegetation and wetlands protect both water quality and habitat from influences arising from the surrounding land.

Chert

Very fine-grained sedimentary rock formed of silica of organic or inorganic origin.

Community

An association of populations of plants and animals which occur naturally together in a common environment.

Diversity and pattern

Diversity is the variety and range of species of biological communities, ecosystems and landforms. Pattern refers to changes in species composition, communities and ecosystems along environmental gradients.

Ecological District

A local part of New Zealand where geological, topographical, climatic and biological features and processes, including the broad cultural pattern, interrelate to produce a characteristic landscape and range of biological communities.

Ecological Region

A group of adjacent Ecological Districts which have diverse but closely related characteristics, or in some cases a single very distinctive Ecological District.

Ecological unit

Vegetation type occurring on a particular landform or soil or rock type.

Ecosystem

Any inter-related and functioning assemblage of plants, animals and substrates (including air, water and soil) on any scale including the processes of energy flow and productivity (Myers et al. 1987).

Endemic

Occurring naturally in, and restricted to, a particular country, region or locality.

Exotic

Introduced from outside New Zealand.

Fernland

Dominated by ferns such as *Gleichenia*, bracken, tree ferns, with occasional woody plants.

Forest

A tall, predominantly closed canopy consisting mainly of tree species (a tree being a woody plant which attains a 10 cm diameter at breast height (dbh) - Atkinson 1985).

Much of Northland's forest consists of or includes secondary growth which has developed following disturbance or destruction of the original forest. This may include secondary manuka/kanuka forest where those species have reached tree size and may contain other canopy species.

Glauconitic

Containing glauconite, a green-coloured hydrous potassium-iron-alumino-silicate clay mineral.

Greywacke

Hard sandstone containing a high proportion of clay minerals.

Habitat

The part of the environment where a plant or animal lives. It includes both the living and non-living features of the area.

Horst

Upthrown rock mass bounded by high angle faults.

Indigenous

Native to and occurring naturally within the New Zealand Biogeographic Region.

Landform

A part of the land's surface with distinctive naturally formed physical characteristics, e.g. a hill, valley, etc.

Linkages/Corridors

Vegetated or aquatic areas (can be forest, shrubland, wetland, streams, beach or exotic vegetation such as pine) that link up two or more habitats. With a link between habitats the gene pool for a species is greater, which enhances the viability of that population. The corridor does not have to be continuous for many species to utilise it. Small remnants can act as stepping stones between two larger habitats so that birds such as kiwi can move from remnant to remnant up to 500 m apart.

Natural Area

A tract of land which supports natural landforms and predominantly native vegetation or provides habitat for indigenous species; identified as a unit for evaluation of ecological quality and representativeness and has potential to be ecologically significant.

Naturalness

The degree to which a habitat is modified and disturbed by human activity or introduced plants and animals and what natural values are retained despite these factors, i.e. to what extent native species are functioning according to natural processes.

Podzol

A soil type formed under some types of forest and characterised by very strong leaching and the development of whitish-grey clay sub-soils.

Rarity

A measure of commonness and may apply to entire ecosystems through to single species. It may refer to the threatened status of a species (see Appendix 3) or habitat type in any one of the following ways: formerly common but now rare; rare elsewhere but common in the district; rare in the district but common elsewhere; confined to a limited geographic area; at the limit of its range; or with a contracting or fragmented range. For example, old growth alluvial swamp forests are an extremely rare ecosystem type in Northland, and indeed nationally, even though they contain no species which are regarded as rare in themselves.

Refuge

Native bush enclaves in production forest become a refuge for some native species during the logging phase. For example, they allow bird species, such as kiwi, a retreat from logged areas.

Representativeness

The extent to which an area represents or exemplifies the components of the natural diversity of the ecological district. This implies consideration of the full range of natural ecosystems and landscapes that were originally found in the ecological district, how well they are represented in today's environment, and the extent to which they are included in the protected areas network.

Riparian functions

Riparian vegetation performs important functions such as providing corridors linking habitats and providing shading to streams. This is important in Northland, as many streams have small catchments and the water temperature can rise depleting the available oxygen, leading to the death of aquatic life. Litter debris enters the nutrient cycle and supports invertebrates such as mayfly, caddisfly and stonefly feeding on it. Riparian vegetation also acts as a buffer for non-point water discharges.

Riparian zone

An area of land immediately adjacent to a watercourse.

Scrub

Refers to seral communities, often dominated by or with a large component of exotic species such as gorse, *Hakea,* tobacco weed etc and/or commonly lacking a closed canopy and in which an understorey is either absent or composed primarily of exotic species.

Secondary vegetation

Native vegetation established after destruction or disturbance of the previous vegetation and which is essentially different from the original vegetation (see Succession, below).

Seral

Describes a plant community in the process of succession.

Shrubland

Vegetation in which the canopy is dominated by woody plants less than 10 cm diameter at breast height.

There are 2 main types:

(i) Successional vegetation dominated by seral species such as manuka, kanuka, mahoe etc or shrubs such as hangehange, bracken, kumerahou.

As used in this report it implies a closed canopy and in more advanced stages contains an understorey of indigenous species.

(ii)Seral vegetation where the rate of further succession is extremely slow, being limited by abiotic factors such as soil structure and fertility, wind shear, etc., e.g. gumland manuka shrubland, *Muehlenbeckia* shrubland on dunes.

Site

An area of habitat identified during the rapid field inventory phase of the PNAP. Its boundaries may be defined by the edge of the habitat (where discrete), catchment or other geographical feature, e.g. river, vegetation type or legal title.

Succession

The process of change in the appearance, composition and structure of a community over a period of time. Change may be due to natural or human-induced factors, or both. For example the colonisation of bare rock or soil by algae and lichens ending with a stable climax community in equilibrium with the environment. Secondary succession occurs where the original vegetation has been destroyed, e.g. by fire.

Survey No.

The identifier number given to each site. The first three figures refer to the NZMS 260 topographical map sheet that the habitat is on.

Sustainability

The long-term ecological viability of a natural area. This is related to the size and shape of the area as well as to threats from introduced pests.

Vegetation type

Defined by the dominant canopy species and the structure of the vegetation, e.g taraire forest, manuka shrubland.

Viability

The ability of an area's natural communities to maintain themselves in the long-term in the absence of particular management efforts to achieve this. Regeneration and vigour of species within these communities and stability of communities and processes contribute to viability.

Wetland

An area of land that is permanently or intermittently waterlogged and supports flora and fauna adapted to wet conditions. Wetland is used as a broad definition for several types of aquatic systems, e.g. swamps, bogs and ephemerals.

9. Index of sites