

(such as dotterels and oystercatchers), rails, herons, gulls, terns, shags, fernbirds, katipo, and the moth *Notoreas* sp. “northern”.

- Two substantial remnants of old-growth forest, Tapu Bush and Pretty Bush, on sand dunes at Pouto.
- The large gumland-wetland complex at Maitahi.

Kaipara ED adjoins four other Ecological Districts: Tutamoe to the north, Tangihua to the northeast, Tokatoka to the east, and Otamatea to the southeast.

Of the natural areas identified, comprising some 23 652 ha, < 1% (324 ha) of the total area is forest, 17% (4037 ha) forest/shrubland, 4% (901 ha) shrubland, 3% (687 ha) flaxland, 4% (857 ha) freshwater wetland (including small areas of open water), 2% (532 ha) open water, 4% (1027 ha) estuarine wetland, 47% (11145 ha) estuarine waters (Kaipara Harbour), and 16% (3818 ha) sand communities.

2. Methods

2.1 GENERAL APPROACH

Between 1994 and 1996, reconnaissance surveys using rapid semi-quantitative methods were carried out in 12 Ecological Districts in the northern sector of Northland, to obtain information on the composition, extent, and ecological values of remaining indigenous natural areas. A rapid survey method was selected by DOC because of time constraints for the field survey, the extensive areas to be covered, and because it could be easily applied to all natural areas. These methods were also specified by DOC for the present study, in order to achieve consistency in information between surveys over several decades.

For the present survey, natural areas (henceforth called ‘sites’) were identified regardless of tenure using recent aerial photography (orthophotography flown in 2002 for Northland Regional Council and Kaipara District Council) and the Sites of Special Biological Interest (SSBI) information system held by DOC. Consequently, sites administered by DOC as well as other protected areas were surveyed using the same methods, providing a consistent approach to determine the representativeness of all sites.

Each site was mapped, allocated a specific number, and described. After evaluation, each site was allocated to one of two levels of ecological significance.

Scientific names of species for which common names have been used are given in Appendix 6 (flora) and Appendix 8 (fauna).

Extensive use was made of information from biological databases and information systems such as the SSBI, the Bioweb Threatened Plants and

Herpetofauna Databases, the NIWA Freshwater Fish Database (NIWA 2007), published information and DOC internal reports. Herbarium records from Auckland Institute and Museum (prefixed 'AK '), Te Papa, Wellington (prefixed 'WELT '), and the Allan Herbarium (prefixed 'CHR ') were also consulted. Geographical and geological information was gained from existing published and unpublished maps.

2.2 CONSULTATION WITH LANDOWNERS

Initially, all ratepayers were advised by the Northland Conservator of DOC by letter (Appendix 2) of the survey programme and the reasons for it, and a press release on the survey methods featured in the local newspapers (see Appendix 2). In most instances, permission for access was sought from landowners in person, including Te Uri o Hau; with one exception this was obtained.

2.3 DATA ACQUISITION AND ANALYSIS

Methods followed those prescribed by DOC (see Lux & Beadel 2006) but additionally, an effort was made to visit all sites and assess ecological units (vegetation composition and structure, and landform) on site following Myers et al. (1987). The location of each site was recorded by Global Positioning Systems (GPS). In each ecological unit, the composition and relative abundance of canopy plant species was recorded on the field survey form (Appendix 1) in four categories: greater than 50% cover 'abundant'; 20-50% cover 'common'; 5-20% cover 'frequent'; and less than 5% cover 'occasional'. Dominant species in understorey and ground cover layers were also recorded, and at several of the better sites, comprehensive vascular plant species lists were compiled. Fauna observations during the survey were incidental only.

All field data from each site were entered into a Microsoft Excel spreadsheet. The canopy vegetation composition of ecological units was then classified by multivariate cluster analysis within PATN (Belbin 1995) to delineate the major vegetation types of Kaipara ED (Northland). Specifically, the cluster analysis was agglomerative and hierarchical using the Bray and Curtis similarity index. Vegetation types are named based on 'abundant' (species which form > 50% of the canopy) or 'common' (20-50% of the canopy) species, and structure. If there are no abundant or common canopy species, vegetation types are named based on 'frequent' species (which form 10-20% of the canopy). Structural names follow Myers et al. (1987), except scrub and shrubland are both referred to as shrubland. Each site was mapped by GIS, including where possible, the ecological units identified in the field. In some cases where two or more ecological units occurred in a fine mosaic and/or could not be distinguished clearly on aerial photographs, they were mapped as a single unit.

In contrast to previous Northland PNAP surveys, the LENZ classification

(Leathwick et al. 2002) was used to provide the underlying environmental framework within which sites were assessed. Levels II and IV were used to provide a broad environmental framework (at which 7 and 13 environments respectively were mapped) and a national biodiversity priorities framework, respectively. The representativeness of each ecological unit was assessed based on distribution, extent, existing degree of statutory protection, and threat classification (MfE 2007) of each land environment.

Other relevant information such as condition, threats, and site history and management (from landowners) was also recorded for each site. After completion of the field survey, sites were numbered and information from other databases and information systems incorporated into the site descriptions. Copies of completed field survey forms are held by the Northland Conservancy of the Department of Conservation.

After the field survey, 5 wetlands, Omamari GPWMR (P07/127), Maitahi Wetland SR (P07/133), Lake Rotopouua (P09/014), and Lakes Oteone and Matthews (P09/001), representative of the range present in Kaipara ED (Northland), were selected for research on the biotic composition of New Zealand wetlands within the FRST-funded Maintaining and Restoring Wetlands programme. Vegetation, invertebrate, and nutrient data were collected and entered into the National Wetlands Database at Landcare Research, Hamilton. Maitahi Wetland SR (P07/133) was selected as a representative 'gumland' (northern heathland) site for a comprehensive ecological survey of the Northland gumlands in the summer of 2007/2008 in the FRST-funded Maintaining Threatened Rare Ecosystems programme.

2.4 CRITERIA FOR ASSESSMENT OF THE SIGNIFICANCE OF ECOLOGICAL UNITS

Following on from the use of the LENZ framework, sites were also assessed using the criteria of Conning et al. (2004).

All sites meet at least one of the following criteria:

- They are predominantly indigenous in character, by virtue of physiognomic dominance in or species composition of the canopy.
- 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 or regionally uncommon or much reduced from its former extent.

The conservation values of these sites were 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, and characteristics such as buffering, linkages or corridors, size and shape, and long-term viability that are important for the maintenance of ecosystems (Table 1).

2.4.1 Level 1 sites

A level 1 site contains significant vegetation and/or significant habitats of indigenous fauna and is defined by the presence of one or more of the following ecological characteristics (cf. Lux & Beadel 2006), except where the level of modification meets Level 2 criteria.

- Contains or is regularly used by critical, endangered, vulnerable or declining or naturally uncommon taxa (i.e. species and subspecies), or taxa of indeterminate threatened status nationally.
- Contains or is regularly used by indigenous or endemic taxa that are threatened, rare, or of local occurrence in Northland or in the Ecological District.
- Contains the best representative examples in the Ecological District of a particular ecological unit or combination of ecological units.
- Has high diversity of taxa or habitat types for the Ecological District.
- Forms ecological buffers, linkages or corridors to other areas of significant vegetation or significant habitats of indigenous fauna.
- Contains habitat types that are rare or threatened in the Ecological District or regionally or nationally.
- Supports good populations of taxa which are endemic to Northland.
- Is important for endemic and indigenous migratory taxa.
- Covers a large geographic area relative to other similar habitat types within the Ecological District.

2.4.2 Level 2 sites

A Level 2 site (Lux & Beadel 2006) supports populations of indigenous flora and fauna, and meets one or more of the following criteria:

- contains common indigenous species but which is not one of the best representative examples of its type;
- may be small and isolated from other habitats;
- may contain a high proportion of adventive species;
- may be structurally modified, e.g., has a grazed forest understorey;
- has not been surveyed sufficiently to determine whether it meets the criteria for Level 1 sites.

TABLE 1: LINKS BETWEEN THE PNAP CRITERIA AND LEVELS 1 AND 2

PNAP CRITERIA	LEVEL 1	LEVEL 2
Representativeness	Contains one or more of the best examples of ecological units representative of the diversity in the Ecological District. Includes ecological units with high representative value, e.g., severe depletion from original extent, and/or high representative quality, e.g., highest level of naturalness, diversity, in the best condition. Supports good populations of taxa which are endemic to Northland-Auckland.	Not one of the best examples of its type in the Ecological District.
Rarity and Special Features	Contains or is regularly used by critical, endangered, vulnerable or declining or naturally uncommon taxa (i.e. species and subspecies), or taxa of indeterminate threatened status nationally. Contains or is regularly used by indigenous or endemic taxa that are threatened, rare, or of local occurrence in Northland or in the Ecological District. Contains habitat types that are rare or threatened in the Ecological District or regionally or nationally. Is important for endemic and indigenous migratory taxa.	Does not regularly contain, or there is no currently known threatened, rare, or species of local occurrence. Contains common habitat types. No currently known special features.
Diversity and Pattern	Has a high diversity of taxa or habitat types for the Ecological District.	May contain only one habitat type and/or have a low diversity of taxa relative to other areas of a similar type.
Naturalness	Exhibits a higher level of naturalness than other examples of its type.	Exhibits a lower level of naturalness than other examples of its type.
Buffering/Corridors and Linkages	Forms ecological buffers, linkages or corridors to other areas of significant vegetation or significant habitats of indigenous fauna.	May be heavily impacted by external influences or may be fragmented and isolated from other natural areas.
Size and Shape	Covers a large geographic area relative to other similar habitat types within the Ecological District.	Is likely to be small relative to other similar examples of its type, or if large, is not the best example of its type and meets no other criteria for a Level 1 site.
Long-term Ecological Viability	If the long-term viability of the site is high or medium, it is likely to meet one or more of the other criteria above, or if low, may nevertheless be the best or only example of its type in the Ecological District.	May require a high degree of management to achieve viability or may never be viable under present circumstances or if viable, may not meet any other criteria for a Level 1 site.