WAIKATO PROTECTION STRATEGY

A REPORT TO THE FOREST HERITAGE FUND COMMITTEE

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1.0 INTRODUCTION

This report has arisen from the need to identify clearer priorities for indigenous forest protection in the Waikato Conservancy. Applications to the Forest Heritage Fund seeking financial assistance for forest protection far exceed the Fund's present resources. The wide range of forest types proposed for protection, and the serious depletion of indigenous ecosystems in parts of the Conservancy, mean that funding decisions are difficult. Furthermore, the consideration of funding applications is hampered by limited information about the extent of indigenous ecosystems and the extent to which they are protected.

The Forest Heritage Fund was established by Government in 1990 to help achieve the objectives of Government's Indigenous Forest Policy. The vision (kaupapa) of the Fund is "the protection of remaining indigenous forests and associated vegetation, particularly those areas containing old growth forest and forest of high ecological value" (Harding, 1994a). The Fund receives an annual allocation of funds from Government to "enable, facilitate, and support activities directed at the protection and restoration of indigenous forest" (*ibid*).

The Waikato Conservancy covers an area in the North Island stretching from the lower Waikato River in the northwest, the Coromandel Peninsula in the northeast, the Hauhangaroa Range (Pureora Conservation Park) in the southeast, and the lower Mokau River in the southwest. It includes all of the western King Country, Waikato and Hauraki Plains, Coromandel Peninsula, and the northern part of the volcanic plateau. It supports a wide range of indigenous ecosystems, including: kauri forest; podocarp-hardwood forest; podocarp-hardwood-beech forest; dense podocarp forest; coastal (pohutukawa) forest; montane conifer-broadleaved forest; wetland vegetation, duneland vegetation, estuarine vegetation, and many important regenerating forest and shrubland communities.

The Waikato Conservation Management Strategy describes the cultural context as follows: "The Conservancy falls mainly within the rohe of the Tainui waka, however the tribal diversity within Waikato, Raukawa, Maniapoto and Hauraki is also recognised. The Conservancy also includes part of the territory of Tuwharetoa" (Department of Conservation, 1995).

This report assesses the original extent of the forest ecosystems in the Waikato Conservancy, the current extent of those ecosystems, and the extent to which they are protected. It identifies opportunities for further protection of indigenous ecosystems, and lists general priorities for forest protection. The report also sets out a strategy for forest protection in the Waikato Conservancy, based on the Forest Heritage Fund's national strategy, to assist in the assessment of individual funding applications. The ultimate objective of the strategy is to help establish a representative and sustainable protected natural areas system in the Waikato Conservancy.

2.0 METHODOLOGY

2.1 INTRODUCTION

The methodology adopted for this report aims to achieve the following:

- determine the extent of the original (pre-human) forest ecosystems in the Waikato Conservancy;
- determine the present (remaining) extent of these ecosystems;
- determine the proportion of these ecosystems protected;
- determine the opportunities for further protection of these ecosystems;
- devise a strategy for determining priorities for ecosystem protection;
- summarise the general priorities for protection; and,
- review existing proposals for protection.

The best data presently available for determining the existing and original extent of ecosystems are the vegetation maps and statistical analyses presented in the recent contract report prepared by Landcare Research, Hamilton for Environment Waikato and titled *Vegetation of the Waikato Region: Current and Historical Perspectives* (Leathwick *et al*, 1995). The use of satellite imagery was investigated but, in this case, would have been more expensive and more time-consuming than the use of the existing Landcare Research report.

The definition of ecosystem types, based on the above report, is discussed in section 2.2 below. The methodology for determining the extent of vegetation cover is discussed in section 2.3, and for calculating the extent of protected ecosystems in section 2.4. The actual assessment of vegetation cover, the extent of protected natural areas (PNAs[1]), and the identification of opportunities for protection are undertaken in section 3.0 of this report.

The development of a strategy for ecosystem protection for the Waikato Conservancy is undertaken in section 4.0. The information presented in sections 3.0 and 4.0 is then combined, in section 5.0, to determine general priorities for ecosystem protection in the Conservancy. Finally, existing proposals for protection are presented and discussed in section 6.0.

The information presented in this report is derived from published and unpublished data where indicated, with full references listed in section 7.0, and from consultation with the individuals listed in the Acknowledgements section at the beginning of this document.

[1] Abbreviations used in the text are listed in Appendix 3

2.2 DEFINING ECOSYSTEM TYPES

The ecosystem types used for analyses in this report are adapted from those used in the Landcare Research document, *Vegetation of the Waikato Region: Current and Historical Perspectives* (Leathwick *et al*, 1995), as that document provided much of the base data used for this report. The above Landcare Research document utilised published and unpublished forest-type maps (including those of Nicholls prepared during the 1970s), aerial photographs (mostly flown in 1993), and field checks. The limitations of the forest types used are recognised, but these forest types are considered adequate for the analysis undertaken in this report.

The vegetation types of the above document have been retained for primary forest ecosystems, but secondary vegetation types have been grouped together for analysis. This simplification has not reduced the accuracy of the assessment, as it does not affect the vegetation types that are most important for forest protection. Furthermore, the relative importance of other vegetation types, such as logged or secondary forest, is recognised in the priority-setting process (section 4.5), and in the discussion of opportunities for protection (section 3.0). Methods for determining the extent of vegetation cover are discussed in section 2.3.

ECOSYSTEM TYPES USED IN THIS REPORT

Primary Vegetation:

"*Vegetation which is essentially original in composition and structure*" (ibid).

(D) Rimu-tawa[2] forest: This forest comprises a canopy dominated by tawa, with emergent rimu. Other canopy species are hinau, rewarewa, and pukatea, with kohekohe and puriri near the coast. Other emergent species are northern rata and occasionally miro, kahikatea, and totara.

(E) Rimu-taraire-tawa forest: This forest comprises a canopy dominated by tawa and taraire, with emergent rimu. Previously present along the lower Waikato River, and localised on northern Coromandel Peninsula, it is now largely absent from the Conservancy.

(F) Rimu-broadleaved forest: This forest comprised a canopy dominated by kamahi, hinau, maire, broadleaf, and quintinia, with emergent rimu, miro, and mountain totara. This forest is largely limited to the Hauhungaroa Range (Pureora ED).

(G) Lowland steepland and montane conifer/broadleaved forest: This forest comprises montane associations of miro, mountain totara, toatoa and kaikawaka, with towai, taraire, kamahi, and quintinia. At lower altitudes rimu, miro, mountain totara, and tanekaha are emergent over a canopy of tawa and kamahi.

(H) Rimu-tawa-beech forest: This forest is similar to D (above) but includes pockets of hard beech, and is present only in the southwest of the Conservancy.

(I) Rimu-broadleaved-beech forest: This forest comprises rimu, miro, matai, and/or mountain totara emergent over red and/or silver beech and kamahi. It is generally confined to the Hauhangaroa Range (Pureora ED).

[2] Species names used in the text are listed in Appendix 1.

(L) Dense podocarp forest: This forest comprises either dense kahikatea on poorly drained alluvial sites in lowland Waikato, or mixed podocarps (totara, rimu, miro, matai, mountain totara) and tanekaha on deep free-draining volcanic soils in the southern Waikato (Western Volcanic Plateau ED).

(M) Rimu-matai-broadleaved forest: This forest is similar to L (above), but with conifers less abundant. It comprised occasional rimu, miro, matai, and kahikatea emergent over hinau, rewarewa, maire, tawa, kamahi, pokaka, and broadleaf.

(P2) Coastal forest: This forest comprises hardwood species that typically occupy coastal slopes and offshore islands, notably in the Coromandel Ecological Region. Dominant species are pohutukawa, kohekohe, and puriri, with occasional tawa, rewarewa, mangeao, and karaka. It is likely that, in places, the understorey or canopy of this forest has been modified. However, it best fits the definition of 'primary forest', as the remnants have generally not been subjected to intensive logging. Forest remnants on coastal slopes in the west of the Conservancy are, in most cases, included in Vegetation Type D (below).

(sc) Mixed scrub and **(ts) Tussock shrubland:** These vegetation types are confined to areas above the treeline, are of limited extent, and are almost entirely protected in the Conservancy.

(id) Spinifex dunelands: This primary community comprises spinifex, pingao, and a range of low-growing small-leaved shrubs, with a range of adventive herbs, growing on dunelands at scattered sites on the Coromandel Peninsula and west coast.

Saline wetlands, including:

(mg) mangroves
(ma) saltmarsh
(zo) Zostera (eelgrass)
(jl) Juncus-Leptocarpus
(md) saltmeadow.

Freshwater wetlands, including:

(fl) raupo-flaxlands
(sg) sedgelands
(sh) shrub/sedgelands
(rs) restiad wetlands.

Logged Forest:

(A), (B), and (C) Kauri Forest: These forest types comprise kauri and associated species. No significant areas of unlogged and unprotected kauri forest were recorded during the preparation of this report, except those protected within the Manaia Kauri Sanctuary, even though these forests were once relatively widespread in the Coromandel and northern Waikato. For this reason, these forest types have been grouped together for analysis.

(N) Tawa forest: This comprises tawa-dominant forests - (D), (M), and some (G) (above) - from which the emergent podocarps have been removed. Tawa is dominant with kamahi, northern rata, hinau, rewarewa, and maire.

(O) Tawa-beech forest: This comprises rimu-tawa-beech forest (H) from which the podocarps have been removed.

(P) Broadleaved forest: Comprises logged forest in which tawa was absent, mostly logged (F), (L), and (M).

(S) Taraire-tawa forest: Comprises logged rimu-taraire-tawa forest (E).

Secondary Forest:

"*Vegetation which has established after the destruction or disturbance of the previous cover, and which is essentially different from the original vegetation*" (ibid).

Conifer (podocarp) regeneration, including:

- **(CO)** secondary conifer forest
- **(CS)** secondary conifer-small-leaved forest
- **(CB)** secondary conifer/broad-leaved forest.

Hardwood regeneration, including:

- **(BL)** secondary broadleaved forest
- **(SL)** secondary small-leaved forest
- **(BS)** secondary broadleaved/small-leaved forest.

Induced Scrub and Shrubland:

All seven indigenous vegetation types have been grouped together for analysis.

Scrub and Shrubland: This group comprises:

- **(bl)** broadleaved scrub
- **(sl)** small-leaved scrub
- **(co)** conifer scrub
- **(tf)** treefern 'scrub'
- **(mn)** monoao scrub
- **(bs)** broadleaved/small-leaved scrub
- **(cs)** conifer/small-leaved scrub.

2.3 DETERMINING THE EXTENT OF INDIGENOUS VEGETATION

The analysis in this section utilises the maps and the forest-type data in the Landcare Research document *Vegetation of the Waikato Region: Current and Historical Perspectives* (Leathwick *et al*, 1995). However, for the analysis in this report, the original extent of indigenous ecosystems is regarded as the extent to which they were present in pre-human times. This pre-human extent is estimated from the above data, topographical and geological maps, and ecological district descriptions (McEwen, 1987). The current extent of indigenous ecosystems is determined from the maps and data in the Landcare Research document, topographical maps, ecological district descriptions (McEwen, 1987), PNAP reports, and discussions with DoC staff and other specialists.

The main limitations of this data are that: areas of indigenous forest are more reliably mapped than areas of other indigenous vegetation; that lightly logged forest may have occasionally be mapped as intact forest (and, conversely, intact forest with low conifer content mapped as logged forest); and, that areas with complex mosaics of logged and intact forest (such as the Coromandel Peninsula), or limited aerial photography coverage, are less reliably mapped (Leathwick *et al*, 1995). Also, mapping was less reliable for forest remnants of less than 25 hectares, and secondary vegetation remnants of less than 50 hectares, except where remnants with high conservation value (such as stands of kahikatea in modified landscapes) were already known (*ibid*).

For these reasons the extent of estuarine (eg. salt meadow-md, or mangrove-mg), duneland (eg, spinifex-id), and dense podocarp (esp. lowland kahikatea-L) ecosystems was frequently difficult to determine in the analyses undertaken in sections 3.0 and 6.0 of this report. Conversely, widespread and extensive ecosystems, such as rimu-tawa forest (D), and kauri forests (A,B, or C), were not differentiated to local forest types. In these cases, it is considered that this grouping of forest type variations does not compromise the results because a degree of differentiation is achieved by undertaking the analysis separately for each of the 23 ecological districts within the Conservancy.

2.4 CALCULATING THE EXTENT OF PROTECTED ECOSYSTEMS

The extent to which each ecosystem type is protected was determined by overlaying the Conservation Management Strategy maps prepared by the DoC Conservancy Office (Department of Conservation, 1995), which delineate PNAs, with the vegetation maps in the Landcare Research report *Vegetation of the Waikato Region: Current and Historical Perspectives* (Leathwick *et al*, 1995). The percentage of each ecosystem type within each DoC-administered PNA was estimated and then these estimates were totalled for each ecological district. Similarly, registered Open Space (QEII) covenants were located on the maps and the percentage of each ecosystem protected was estimated and totalled.

These estimates are presented in the Tables and Figures in section 3.0, where comparisons are made between the original extent of the ecosystem, the present extent, and the percentage of both the original and present extent of the ecosystem that is currently protected.

The primary limitation of this analysis is that it is based on map estimates, rather than field inspections or electronic (computer-based) analysis. However, it is considered these estimates provide a sufficiently accurate assessment of the extent to which an ecosystem is depleted, and protected, relative to other ecosystems. It is this relativity that is most important for the determination of overall priorities for protection.

The ecological districts that are fully or partly covered by the Waikato Conservancy are listed below, and illustrated in Figure 1.

Coromandel Ecological Region	Colville ED
	Mercury Islands ED
	Thames ED
	Tairua ED
	Waihi ED*
Waikato Ecological Region	Meremere ED
	Hapuakohe ED
	Hauraki ED
	Hamilton ED
	Hinuera ED*
	Maungatautari ED
	Waipa ED
Tainui Ecological Region	Raglan ED
	Kawhia ED
	Herangi ED
Taranaki Ecological Region	North Taranaki ED*
King Country Ecological Region	Waitomo ED
	Taumarunui ED*
Western Volcanic Plateau ER	Ranginui ED
	Pureora ED
	Tokoroa ED*
Central Volcanic Plateau ER	Atiamuri ED*
	Taupo ED*

(* ED only partly within the Waikato Conservancy)
Figure 1 - Waikato Conservancy and Ecological District Boundaries

3.0 REVIEW OF EXISTING PROTECTED NATURAL AREAS

3.1 INTRODUCTION

In this section the existing protected natural areas (PNA) system in the Waikato Conservancy is assessed to determine how well it represents the indigenous ecosystems that were originally present. This assessment also includes the identification of opportunities for further protection of indigenous ecosystems in each ecological district. Priorities for protection are not discussed in this section. Those priorities are set out in section 5.0 of this report.

The analysis in this section is based on the methodology outlined in section 2.0. Ecological regions (and districts) are assessed in the order they are listed in section 2.4, beginning with the Coromandel ER and ending with the Central Volcanic Plateau ER. Seven ecological districts (Waihi, Hinuera, North Taranaki, Taumarunui, Tokoroa, Atiamuri, and Taupo) lie only partly within the Waikato Conservancy. For these districts the extent of ecosystems has been estimated from the Landcare data and topographical maps. Also, three ecological districts (North Taranaki, Taumarunui, and Pureora) are not fully covered by the Landcare maps, as the Waikato Conservancy and Environment Waikato boundaries differ in this area. For these districts the extent of ecosystems has, again, been estimated.

For each ecological district, the original extent of each ecosystem, the present extent of each ecosystem, and the proportion of the ecosystem protected, are presented in Tables and are discussed in the text. An analysis of the extent of secondary vegetation, especially regenerating broadleaved or conifer forest is also undertaken, and presented in the Tables, but not the Figures, because of the importance of these plant communities for the restoration of forest cover and for linking and buffering existing PNAs.

The proportion of the original ecosystem that remains is presented in Column Charts (Figures) and split into the proportions that are protected and unprotected. Finally, significant unprotected remnants are identified in the text and listed in a ‘Summary of Opportunities for Protection’.

3.2 COLVILLE ECOLOGICAL DISTRICT

The Colville ED covers the northern part of the Coromandel Peninsula, north of Tapu (on the Firth of Thames) in the west and north of Whitianga in the east. It largely comprises steep broken hill country rising to a maximum height of 892 m at Mt Moehau. Large harbours, and extensive estuaries, are present at Whangapoua, Coromandel, and Manaia. It is bordered by the Thames and Tairua EDs in the south.

Formerly, various associations of kauri forest, especially kauri-taraire-conifer-broadleaved forest (B), dominated the ED. There were some dense stands of kauri forest (A) and localised areas of rimu-tawa forest (D) and rimu-taraire-tawa forest (E) present. Areas of montane conifer-broadleaved forest (G) were present at higher altitudes. Coastal forest (P2), dominated by pohutukawa, occupied a significant proportion of coastal slopes. The extent of dense podocarp forest (L) is less clear, though there were localised stands at lower altitudes. Smaller areas of duneland vegetation (id) and saline wetland (estuary vegetation) were present, but data on the extent of these vegetation types is limited.

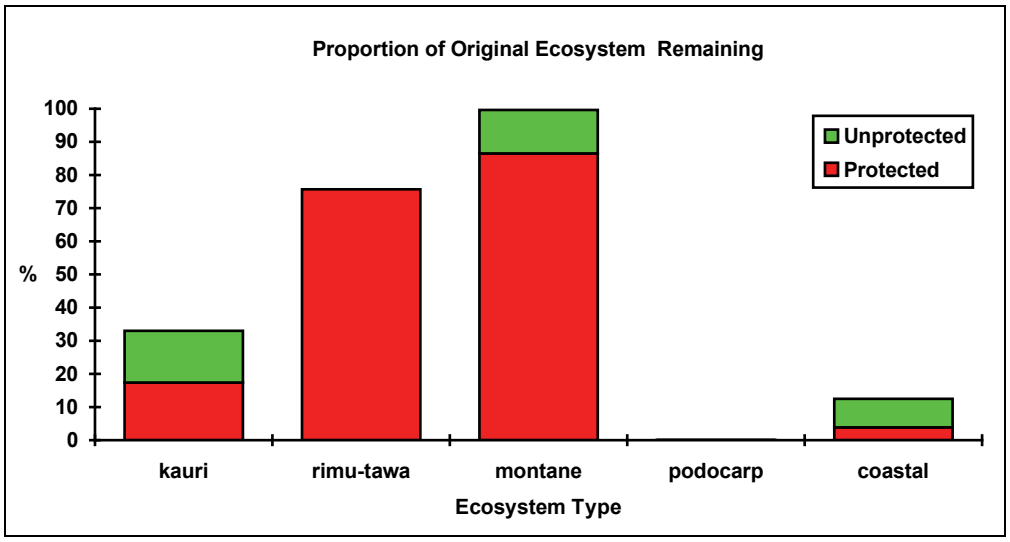
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 1 and Figure 2.

Table 1 - Colville ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
A,B,C,E	51,000	16,821	33.0	8,746	125	8,871	17.4	52.7
D	3,500	2,650	75.7	2,650	0	2,650	75.7	100.0
G	1,200	1,195	99.6	1,038	0	1,038	86.5	86.9
L	6,000	?	c.0.1	?	0	?	?	?
P2	15,000	1,876	12.5	584	6	590	3.9	31.4
id	250	58	23.2	?	0	?	2.0	8.6
wetland	250	c.90	c.36.0	0	0	0	0	0
BL,SL,BS	n/a	12,909	n/a	3,420	181	3,601	n/a	27.9
sl,bs	n/a	9,658	n/a	1,145	23	1,168	n/a	12.1
TOTALS	77,200	45,257		17,583	335	17,918		

The most severely depleted ecosystems in the Colville ED are the dense podocarp (L), coastal (P2), and kauri (A,B,C,E) forests. Almost all of the remaining kauri forests have been logged, but frequently contain vigorous regeneration of kauri rickers. The remaining rimu-tawa forests (D) are entirely protected, and a significant proportion of the montane conifer-broadleaved forest (G) is protected. The Coromandel ER PNAP report (Humphreys and Tyler, 1995) identified lowland and coastal ecosystems, including dunelands and saline wetlands, as the most severely depleted ecosystems in the region.

Figure 2 - Colville ED Ecosystems:



Opportunities for the protection of areas of dense podocarp forest (L), and data on the extent of this ecosystem type, are very limited, though one area has been identified for protection (RAP Col 13) in the Whangapoua Harbour. There are opportunities for the protection of coastal forest (P2), though remnants are mostly scattered and frequently modified, notably by introduced plants and animals. Unprotected kauri forests (A,B,C,E) are also scattered, though there are significant opportunities for protection inland from Manaia and Coromandel Harbours, and at Potiki Bay (RAP Col 6). Opportunities for the protection of montane conifer-broadleaved forest (G) are limited to small areas inland from Manaia and on the summit of the Moehau Range.

Other important opportunities for protection include: linkages between existing PNAs along the Moehau and Coromandel Ranges; linkages between montane PNAs and the coast; terrestrial buffers to estuaries; and, offshore islands, especially those with coastal forest, such as those in the Motukawao Group, or those with restoration potential.

Summary of Opportunities for Protection

- regenerating kauri forest, inland from Manaia and Coromandel Harbours, and at Potiki Bay;
- coastal forest, especially linking montane PNAs with the coast;
- lowland podocarp remnants at Whangapoua Harbour;
- estuarine vegetation in Manaia and Cormandel Harbours;
- islands with coastal forest or restoration potential, such as those in the Motukawao Group; and,
- areas of intact or regenerating forest linking existing PNAs, or providing important wildlife habitat.

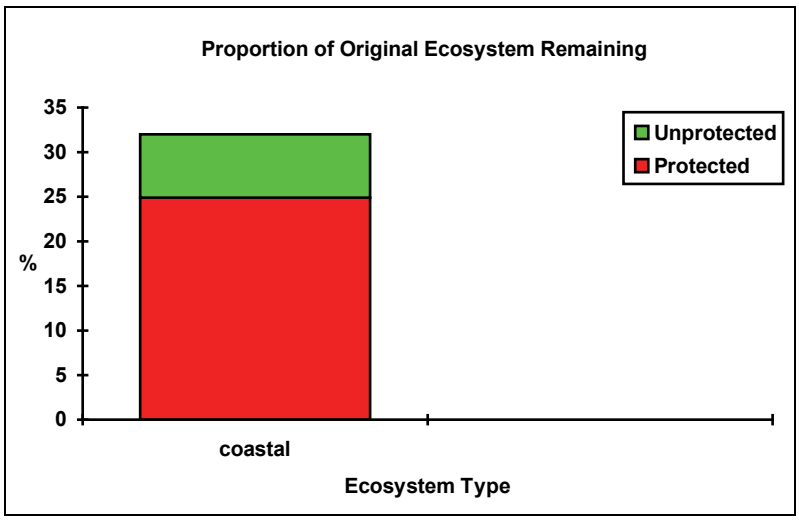
3.3 MERCURY ISLANDS ECOLOGICAL DISTRICT

The Mercury Islands ED covers three groups of small islands off the east coast of Coromandel Peninsula: the Cuvier, Mercury, and Aldermen Islands. All islands were formerly dominated by coastal forest (P2) and most are now modified to some extent, either by forest removal or introduced species.

Originally, the coastal forest covered about 2,650 hectares, of which about 850 hectares remain. Of this, 661 hectares (77.8%) are protected as DoC-administered land. The most significant opportunity for further forest protection is on Great Mercury Island. Also, the more severely modified parts of Great Mercury Island offer the potential for habitat restoration, and are regarded as having significant long term value for conservation (Rob Chappell, *pers.comm*).

The proportion of the original ecosystem remaining, either protected or unprotected, is illustrated below in Figure 3.

Figure 3 - Mercury Islands ED Ecosystems:



Summary of Opportunities for Protection

- unprotected coastal forest on Great Mercury Island; and,
- modified areas on Great Mercury Island for habitat restoration.

3.4 THAMES ECOLOGICAL DISTRICT

The Thames ED covers the steep hill country on the western side of the Coromandel Peninsula from the Colville ED in the north to the Kauaeranga Catchment near Thames in the south. It includes the coastline of the Firth of Thames south of about Tapu, but no significant areas of estuary. The highest elevation in the ED is Table Mountain (846 m) on the Coromandel Range. It is bordered by Colville ED in the north, Tairua ED in the east, and Hauraki ED in the south.

Formerly, associations of kauri forest, especially kauri-conifer-broadleaved forest (B), dominated the ED. Within this there were some stands of dense kauri forest (A). At higher altitudes rimu-tawa forest (D) and montane conifer-broadleaved forest (G) were dominant. Coastal forest (P2) was present along the Thames coast. The distribution and extent of dense podocarp forest (L) is unclear, but probably confined to valley floors, such as in the Kauaeranga Valley.

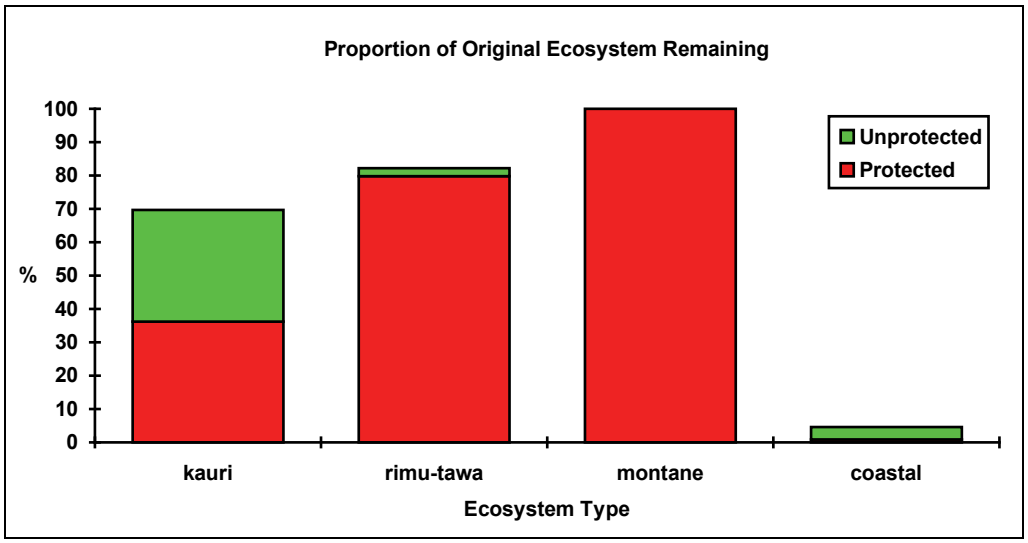
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 2 and Figure 4.

Table 2 - Thames ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
A,B,C,E	27,900	16,493	69.7	10,095	0	10,095	36.2	61.2
D	6,200	5,100	82.2	4,950	0	4,950	79.8	97.1
G	2,500	2,500	100.0	2,500	0	2,500	100.0	100.0
L	2,000	?	?	?	0	?	?	?
P2	2,000	93	4.6	19	0	19	0.9	20.4
wetland	100	?	?	0	0	0	?	0
N	n/a	358	n/a	232	0	232	n/a	64.8
BL,BS,SL	n/a	6,225	n/a	4,350	22	4,372	n/a	70.2
bl,sl,bs	n/a	4,663	n/a	3,378	4	3,382	n/a	72.6
TOTALS	40,700	35,432		25,524	26	25,550		

The most severely depleted ecosystems in the Thames ED are the coastal forest (P2) and the various associations of kauri forest (A,B,C,E). The original coastal forest has all but disappeared from along the Thames coastline, and what remains is substantially modified. Kauri forest has been almost entirely removed at lower altitudes and almost all that remains at higher altitudes has been logged. However, kauri regeneration on montane hill country is widespread. The status of lowland (dense) podocarp forest (L) is unclear.

Figure 4 - Thames ED ecosystems:



Opportunities for further protection of coastal forest (P2) are limited to one small remnant near Te Puru or areas of strongly regenerating broadleaved forest. Introduced plants pose a substantial threat to intact and regenerating forest along this coastline. Opportunities for the protection of regenerating kauri forest include areas in the lower Kauaeranga Valley, inland from Whakatete Bay on the Thames coast, and in the lower Tapu River catchment. No areas of unprotected dense podocarp forest were identified. Minor areas of estuary, including mangrove forest, are present around Thames township, and remain largely unprotected.

Other important opportunities for protection are enclaves within Coromandel CP along the Coromandel Range and linkages from the montane forests to the Thames coast.

Summary of Opportunities for Protection

- forest remnants and regenerating broadleaved forests along the Thames coast;
- kauri forest remnants in the Kauaeranga Valley, Whakatete Bay, and the Tapu River;
- estuarine vegetation around Thames township;
- enclaves along the Coromandel Range; and,
- linkages from the Coromandel Range to the Thames coast.

3.5 TAIRUA ECOLOGICAL DISTRICT

The Tairua ED covers the eastern and southern flanks of the Coromandel Range, and the rolling hill country on the eastern coast of the Coromandel Peninsula, from Whitianga in the north to Whangamata in the south. It rises to about 850 m in the west and includes the extensive harbours and estuaries of Whitianga, Tairua, Wharekawa, and Whangamata in the east. It is bordered by Colville ED in the north, Thames and Hauraki EDs in the east, and Waihi ED in the south.

Formerly, associations of kauri forest, especially kauri-conifer-broadleaved forest (B) dominated the ED. There were also significant areas of kauri-conifer-broadleaved-beech forest (C) in the area. At higher altitudes rimu-tawa forest (D) and montane conifer-broadleaved forest (G) were dominant. Substantial areas of coastal forest (P2) and large areas of saline wetland, including extensive mangrove forests, were also present. The extent of dense podocarp forest is, again, unclear, though it is likely to have been prominent on the gentler low altitude country in the east of the ED.

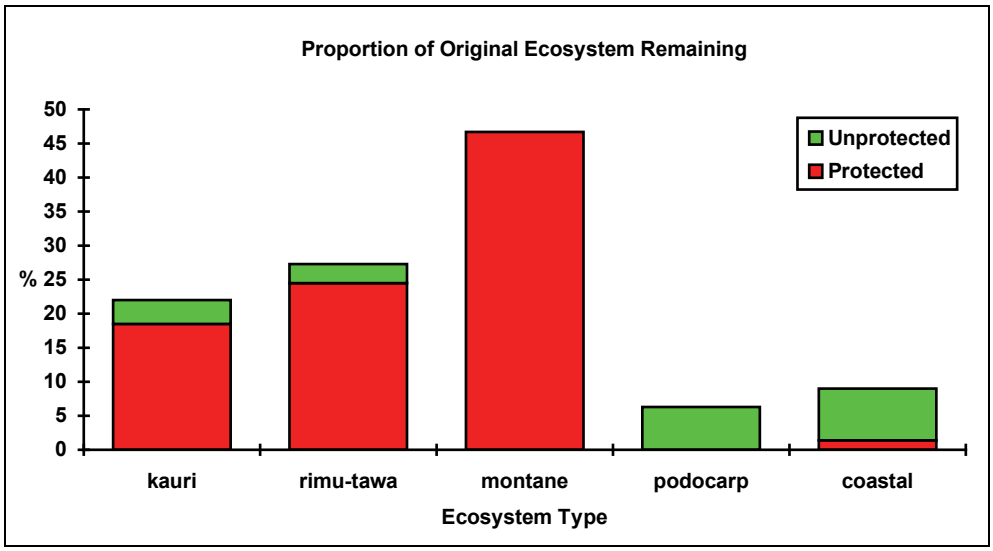
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 3 and Figure 5.

Table 3 - Tairua ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
A,B,C,E	68,950	15,185	22.0	12,788	0	12,788	18.5	84.2
D	6,500	1,774	27.3	1,590	0	1,590	24.5	89.6
G	2,500	1,168	46.7	1,168	0	1,168	46.7	100.0
L	2,500	157	6.3	0	0	0	0	0
P2	9,000	808	9.0	112	15	127	1.4	15.7
id	250	31	12.4	?	0	?	?	?
wetland	1,000	252	25.2	?	0	?	?	?
N	n/a	714	n/a	322	0	322	n/a	45.1
BL,BS,SL	n/a	6,059	n/a	1,430	0	1,430	n/a	23.6
bl,bs,sl	n/a	19,290	n/a	11,711	0	11,711	n/a	60.7
TOTALS	90,700	45,438		29,121	15	29,136		

The most severely depleted ecosystems in the Tairua ED are the lowland (dense) podocarp forests (L), coastal forests (P2), and duneland vegetation (id). The extent of kauri forest (A,B,C,E), rimu-tawa forest (D), and montane conifer-broadleaved forest (G) has also been significantly reduced. Of the indigenous vegetation remaining, the kauri, rimu-tawa, and montane forests are substantially protected, though nearly all kauri forest has been logged. Very little coastal forest or duneland vegetation is protected, and there are no significant areas of dense podocarp forest protected, though the present extent of this forest type is unclear.

Figure 5 - Tairua ED Ecosystems:



Opportunities for the further protection of areas of forest are very limited, partly due to the widespread establishment of plantation forests in the area. Scattered remnants of coastal forest remain unprotected, notably in northern Mercury Bay, south of Hot Water Beach (RAP Tai 3) and north of Whangamata (RAP Tai 13). Scattered podocarp remnants remain unprotected along the lower Whenuakite River (RAP Tai 6) and Rangihau River. The only significant kauri remnants unprotected are east of Whenuakite (RAP Tai 3) and around Neavesville (including RAP Tai 16). There are good opportunities for the protection of estuarine vegetation, and adjoining shrublands, notably in Whitianga Harbour (RAP Tai 1) and Wharekawa Harbour (RAP Tai 12). Unprotected duneland vegetation is present at Hot Water Beach (RAP Tai 4).

The main opportunity for linking and buffering existing PNAs is on the Coromandel Range near Neavesville, south of the Kopu-Hikuai Highway. Significant areas of logged kauri forest and shrubland in this area are unprotected, and have the potential to provide an important linkage along the southern Coromandel Range. Other opportunities for protection are limited to regenerating shrubland and hardwood forest on coastal slopes, especially those that link or buffer existing PNAs.

Summary of Opportunities for Protection

- coastal and regenerating kauri forest south of Hot Water Beach;
- coastal forest north of Whangamata;
- kauri forest and shrubland linkage south of the Kopu-Hikuai Highway;
- podocarp remnants in the lower Whenuakite and Rangihau Rivers;
- dunelands at Hot Water Beach; and,
- estuarine vegetation in Whitianga and Wharekawa Harbours.

3.6 WAIHI ECOLOGICAL DISTRICT

The part of the Waihi ED that lies within the Waikato Conservancy covers the southern end of the Coromandel Range and the northern tip of the Kaimai Range, and the Ohinemuri River Catchment (and Karangahake Gorge) between. It includes the east coast between Whangamata and Waihi Beach, north of Tauranga Harbour. The ED comprises mostly hilly country rising to about 750 m on the Coromandel Range. It is bordered by Tairua ED in the north, Tauranga and Te Aroha EDs in the south, and Hauraki ED in the west.

Formerly, associations of kauri forest, especially kauri-conifer-broadleaved forest (B) and kauri-conifer-broadleaved-beech forest (C) dominated the ED. There were significant areas of rimu-tawa forest (D) and, at higher altitudes, montane conifer-broadleaved forest (G). Areas of coastal forest (P2) dominated in the east, and lowland (dense) podocarp forest (L) was present in the major valleys. Small areas of dune vegetation and wetland were also present.

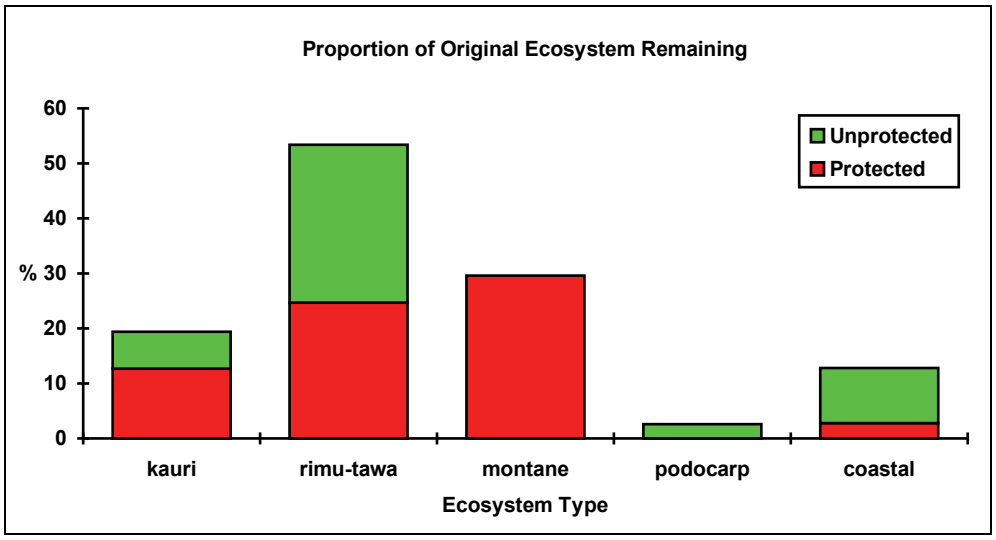
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 4 and Figure 6.

Table 4 - Waihi ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
A,B,C	25,540	4,950	19.4	2,798	434	3,232	12.7	65.3
D	11,500	6,137	53.4	2,843	0	2,843	24.7	46.3
G	250	74	29.6	74	0	74	29.6	100.0
L	1,000	26	2.6	?	?	?	?	?
P2	4,500	578	12.8	127	0	127	2.8	22.0
wetland	400	46	11.5	0	0	0	0	0
N	n/a	2,179	n/a	1,309	0	1,309	n/a	60.1
BL,BS,SL	n/a	3,682	n/a	1,265	0	1,265	n/a	34.4
bl,bs,sl	n/a	2,675	n/a	474	47	521	n/a	19.5
TOTALS	43,190	20,347		8,890	481	9,371		

The most severely depleted ecosystems in the Waihi ED are the lowland (dense) podocarp forests (L) and coastal forests (P2). Kauri forests (A,B,C) are also seriously depleted, though the logged remnants are largely protected. Rimu-tawa forest (D) is also depleted and only half of the remnants are protected. Montane conifer-broadleaved forest (G) remnants, though much reduced, are fully protected. There has been widespread and almost complete loss of forest cover from the lower altitude southeastern parts of the ED around Waihi.

Figure 6 - Waihi ED Ecosystems:



Opportunities for the protection of podocarp forest are limited to small remnants in the Waitekauri Valley (RAP Wai 7). The best opportunities for coastal forest protection are in the southeast, on the coast north of Waihi Beach, south of Mataora Bay, and around Whiritoa Beach (RAPs Wai 2 and Wai 3). Small areas of unprotected (logged) kauri forest are present west of Whiritoa, east of Hikutaia, and east of Komata. Opportunities for protection of rimu-tawa forest are limited to areas east of Komata and smaller areas north of Waihi.

Opportunities for the protection of linkages and corridors are limited to regenerating forest and shrubland, including significant areas of exotic shrubland, around the Karangahake Gorge, to link the Coromandel and Kaimai Ranges, and areas of shrubland south of Whiritoa, to link the montane PNAs on the Coromandel Range with the lowland coastal forests.

Summary of Opportunities for Protection

- regenerating forest and shrubland linkages around the Karangahake Gorge;
- regenerating shrubland linkages south of Whiritoa;
- coastal forest remnants in the southeast of the ED;
- kauri and rimu-tawa forest east of Komata;
- podocarp remnants in the Waitekauri Valley.

3.7 MEREMERE ECOLOGICAL DISTRICT

The Meremere ED covers the lowland basin surrounding the lower Waikato River, from Huntly to Port Waikato, in the northwest of the Conservancy. It comprises extensive alluvial flats, and large lakes and wetlands, including Whangamarino, Waikare, and Whangape. It is bordered by Awhitu, Manukau, and Hunua EDs in the north, Hapuakohe ED in the east, and Hamilton and Raglan EDs in the south and west.

Formerly, associations of kauri forest (A,B,C), dense podocarp forest (L), and wetland vegetation dominated the ED. The exact original extent of these vegetation types is unclear, as they had suffered considerable depletion prior to 1840. However, the dramatic reduction in the extent of both kauri and lowland forest makes the exact figures academic. Smaller areas of rimu-tawa forest (D) were present on hill country, and a significant area of duneland vegetation was present at the Waikato River mouth.

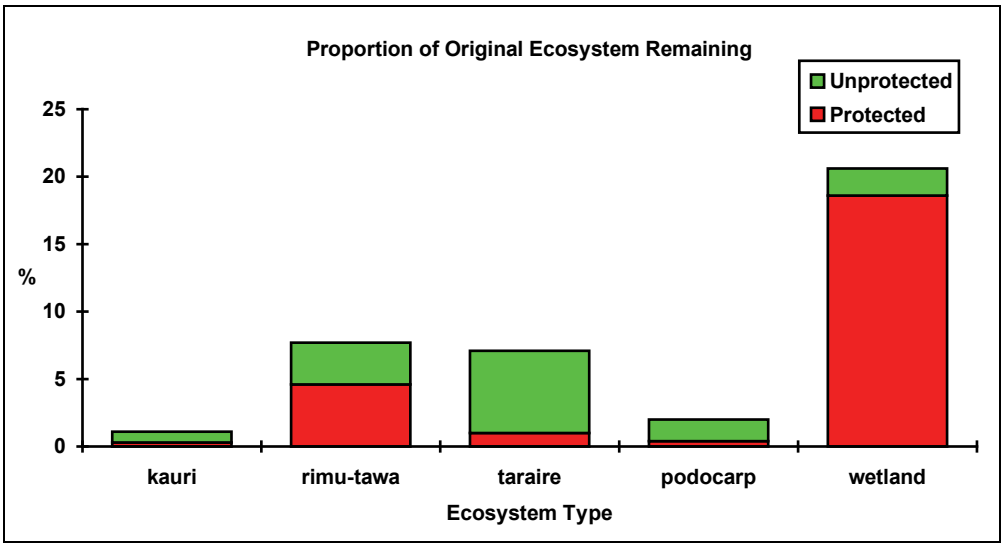
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 5 and Figure 7.

Table 5 - Meremere ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
A,B,C	51,000	637	1.2	149	7	156	0.3	24.5
D	775	44	5.7	36	0	36	4.6	81.8
E	5,000	356	7.1	43	7	50	1.0	14.0
L	24,500	499	2.0	92	6	98	0.4	19.6
wetland	24,100	4,979	20.6	4,485	0	4,485	18.6	90.1
duneland	510	? 0	? 0	60	0	60	? 0	? 0
N	n/a	536	n/a	145	5	150	n/a	28.0
BL,SL,BS	n/a	1,917	n/a	80	13	93	n/a	4.8
sl,bs,cs	n/a	692	n/a	80	0	80	n/a	11.6
TOTALS	105,885	9,304		5,127	31	5,158		

All ecosystems in the Meremere ED are severely depleted. Less than 10% of the district retains any indigenous vegetation, and much of this is wetland or regenerating vegetation. Most of the wetland vegetation is associated with the Whangamarino Wetland, Lake Whangape, and Lake Waikare. Both kauri forest (A,B,C) and dense podocarp forest (L) are reduced to less than 2% of their original extent, even though together they originally covered an estimated 75% of the district. Rimu-tawa forest (D) and rimu-taraire-tawa forest (E) have fared better, but were originally a relatively minor component of the forest cover. Duneland vegetation is also severely depleted and, although 60 hectares of duneland is protected in the Port Waikato Dunes RR, remaining vegetation is often dominated by exotic species, usually pines.

Figure 7 - Meremere ED Ecosystems:



Opportunities for further protection of indigenous vegetation are very limited, as the ED is dominated by intensive landuses, notably dairying. There is some unprotected (logged) kauri forest on the northern Taupiri Range, east of Huntly. Opportunities for the protection of rimu-tawa forest are limited to one small remnant near Opuatia, and to logged remnants on the southern Taupiri Range. Unprotected remnants of logged rimu-taraire-tawa forest exist near Tauranganui on the lower Waikato River. There are no large areas of unprotected dense podocarp forest, but small scattered remnants are present along Matahuru Stream near Lake Waikare, along the Ruaotehuia Stream in the northeast of the ED, along the Waikato River south of Meremere, and on islands in the lower Waikato River.

Long-term protection of lowland dense podocarp (L) and kauri (A,B,C) will only be achieved by restoration, as the protected remnants are too small and isolated to be truly viable. The best opportunity for restoration of podocarp forest is probably on islands in the lower Waikato River, which are presently dominated by exotic vegetation. Wetland restoration, including effective willow control, may also permit sustainable podocarp restoration.

Opportunities for linking and buffering existing PNAs in the ED are realistically limited to wetland restoration, as all other areas are intensively farmed.

Summary of Opportunities for Protection:

- podocarp remnants on Matahuru Stream, Ruaotehuia Stream, and along the Waikato River;
- tawa forest on the southern Taupiri Range;
- tawa-taraire forest at Tauranganui;
- logged kauri forest on the northern Taupiri Range;
- restoration of depleted wetlands, especially by restoring the hydrological regime; and,
- restoration of podocarp forest on islands in the lower Waikato River.

3.8 HAPUAKOHE ECOLOGICAL DISTRICT

The Hapuakohe ED covers the Hapuakohe Range and the Hangawera Hills in the central Waikato, between the Waikato River catchment and the Hauraki Plain. It comprises rolling hill country rising to a high point of 535 m on Maungakawa. It is bordered by Hunua ED in the north, Hauraki ED in the east, Hinuera and Hamilton EDs in the south, and Meremere ED in the west.

Formerly, associations of kauri forest, especially kauri-conifer-broadleaved forest (B), were dominant, with lesser areas of rimu-tawa forest (D) at higher altitudes, and dense podocarp forest (L) on lower altitude alluvial flats. Small areas of wetland vegetation were also present.

The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 6 and Figure 8.

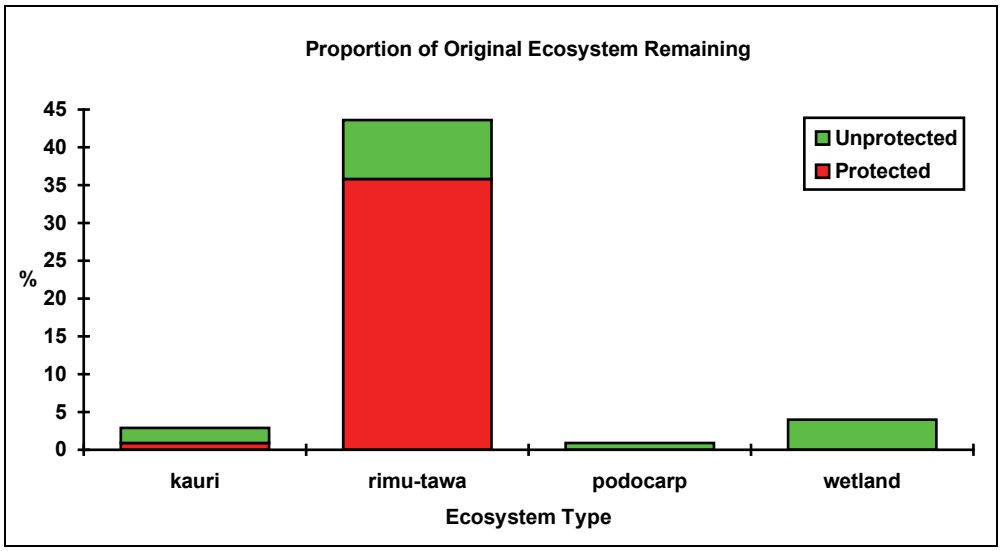
Table 6 - Hapuakohe ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
B,C	57,500	1,687	2.9	529	0	529	0.9	31.4
D	6,500	2,834	43.6	2,326	0	2,326	35.8	82.1
L	9,100	78	0.9	0	0	0	0	0
wetland	520	21	4.0	0	0	0	0	0
N	n/a	2,072	n/a	431	0	431	n/a	20.8
SL,BS,CO	n/a	2,898	n/a	228	60	288	n/a	9.9
TOTALS	73,620	9,590		3,514	60	3,574		

The most severely depleted ecosystems in the Hapuakohe ED are the kauri forests (B,C), the dense podocarp forests (L), and wetland vegetation. The former were widespread along the Hapuakohe Range, and only remain as logged remnants of kauri-conifer-broadleaved-beech forest (C) around Maungakawa and Te Hoe. Dense podocarp forest has all but disappeared from the ED, and wetlands, though never extensive, are now almost non-existent. Rimu-tawa forest (D), and its logged counterpart (N), occupies about 40% of its former range.

Opportunities for further protection of kauri forest are limited to a remnant northwest of Mt Te Hoe in the Mangatea Stream catchment, and on hill country east of Mt Te Hoe. Unprotected areas of rimu-tawa forest are present as scattered remnants north of Mt Rataroa, and as a segment on the southwest flank of Mt Te Hoe. Unprotected remnants of logged tawa forest (N) are present in the Taniwha Stream catchment and on the southeastern Hapuakohe Range. Opportunities for protection of dense podocarp forest are limited to scattered remnants along the Whangamarino River and Matahura Stream.

Figure 8 - Hapuakohe ED Ecosystems:



Opportunities for establishing linkages or corridors of protected vegetation are constrained by extensive areas of plantation forest on the northern and western parts of the Hapuakohe Range, and by farming on the lower altitude hill country. Linking of the Hapuakohe Range with Mt Rataroa in the north and Mt Hangawera in the south are possible long term objectives but would still leave the central Waikato hill country as an island among intensively-farmed low altitude country. A worthy short term objective would be the linking of Matahuru SR, Mangapiko Valley SR, Hapuakohe EA, and Mt Te Hoe at the southern end of the Hapuakohe Range. Buffering of the long and narrow Matahuru SR by encouraging forest regeneration along the length of the Hapuakohe Range would also be worthwhile.

Summary of Opportunities for Protection

- logged kauri and logged tawa remnants on the southern Hapuakohe Range and north of Mt Te Hoe;
- rimu-tawa forest on Mt Te Hoe;
- logged tawa forest in Taniwha Stream;
- podocarp remnants along the Whangamarino River and Matahuru Stream;
- linkages between PNAs at the southern end of the Hapuakohe Range; and,
- forest restoration along the Hapuakohe Range to buffer Matahuru SR.

3.9 HAURAKI ECOLOGICAL DISTRICT

The Hauraki ED covers the alluvial lowlands of the Hauraki Plains, including the extensive peatlands of the Kopuatai Dome. It is drained - and was formerly flooded - by the Waihou and Piako Rivers, which enter the Firth of Thames near Thames township. It is bordered by Thames, Tairua, and Waihi EDs in the east, Hinuera ED in the south, and Hapuakohe ED in the west.

Formerly, dense podocarp forest (L) and wetland vegetation dominated the ED. The extent and density of these impressive lowland podocarp forests, and the beginning of their demise, is discussed in a recent account of the lower Waihou River (Park 1995). Lesser areas of mixed kauri forest (A,B) and rimu-tawa forest (D) were present on more elevated country around the margins of the ED. Considerable areas of saline vegetation, especially mangrove forest, was present along the shores of the Firth of Thames.

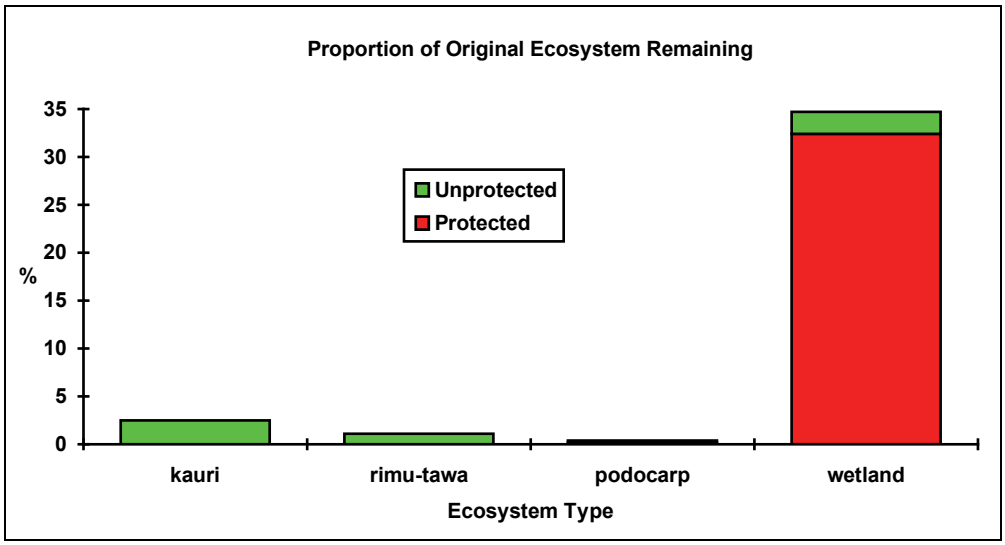
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 7 and Figure 9.

Table 7 - Hauraki ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
A,B	5,800	143	2.5	0	0	0	0	0
D	1,800	20	1.1	0	0	0	0	0
L	43,000	173	0.4	c90	5	c95	0.2	54.9
wetland	28,000	9,714	34.7	9,087	0	9,087	32.4	93.5
N	n/a	57	n/a	0	0	0	n/a	0
SL,BS	n/a	266	n/a	0	0	0	n/a	0
TOTALS	78,600	10,373		9,177	5	9,182		

The former forest cover of the Hauraki ED has been almost completely removed. Indigenous forest only remains as isolated remnants surrounded by intensive farming, especially dairying, and the indigenous forest ecosystem is no longer present in the ED. Wetland vegetation has also suffered extensive losses, notably through the drainage of low-lying flats and the stop-banking of the large rivers, which previously spread floodwaters across the plain inundating both wetlands and podocarp forests. The only substantial PNA in the ED is the Kopuatai Wetland Management Reserve, covering the Kopuatai Peat Dome, the associated Flax Block WMR, and the Torehape Wetland Management Reserve and Patetonga Lake WMR. Many remaining wetlands are threatened by infestations of willow and by the continued drainage of surrounding lands.

Figure 9 - Hauraki ED Ecosystems:



Opportunities for further protection of wetland vegetation include an area adjoining the Kopuatai Reserve to the east and two areas north of the Torehape Reserve. Opportunities for protection of podocarp forest are limited to scattered remnants along the Waitakaruru River in the northwest of the ED, on islands in the Waihou River near Wharepoa and Netherton, and on the central Hauraki Plains near Horahia. The only other opportunity for forest protection is an area of logged kauri forest and hardwood forest regeneration adjoining the Maratoto West Block, in the east of the ED. There is considerable potential for further protection of saline wetlands, especially mangrove and saltmeadow communities along the Firth of Thames.

Opportunities for protecting linkages or corridors in the ED are severely constrained by the intensive land uses that dominate the Hauraki Plains. The further buffering of some wetland areas is possible through wetland restoration and the re-establishment of hydrological regimes. Restoration offers the only long term prospect for further protection of forested ecosystems, and even that is presently constrained by the high value of dairying land and the presence of aggressive introduced wetland weeds.

Summary of Opportunities for Protection:

- wetland areas adjoining Kopuatai and north of Torehape;
- podocarp remnants at Waitakaruru Stream, Waihou River near Wharepoa and Netherton, and near Horahia;
- potential restoration of podocarp forest in major wetlands;
- logged kauri forest adjoining the West Maratoto Block; and;
- mangrove communities and saltmeadow along the Firth of Thames.

3.10 HAMILTON ECOLOGICAL DISTRICT

The Hamilton ED covers the alluvial plains of the Waikato River basin, centred around Hamilton City. It comprises extensive alluvial deposits, peatlands, lakes and wetlands and is bisected by the Waikato River. It is bordered by Meremere and Hapuakohe EDs in the north, Hinuera and Maungatautari EDs in the east, Waipa ED in the south, and Raglan ED in the west.

Formerly, wetland vegetation and dense podocarp forest (L) were dominant, covering almost 90% of the ED, though the relative extent of each is unclear. Minor areas of kauri forest (B,C) were present in the north, and rimu-tawa forest (D) occupied the hill country surrounding the basin.

The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 8 and Figure 10.

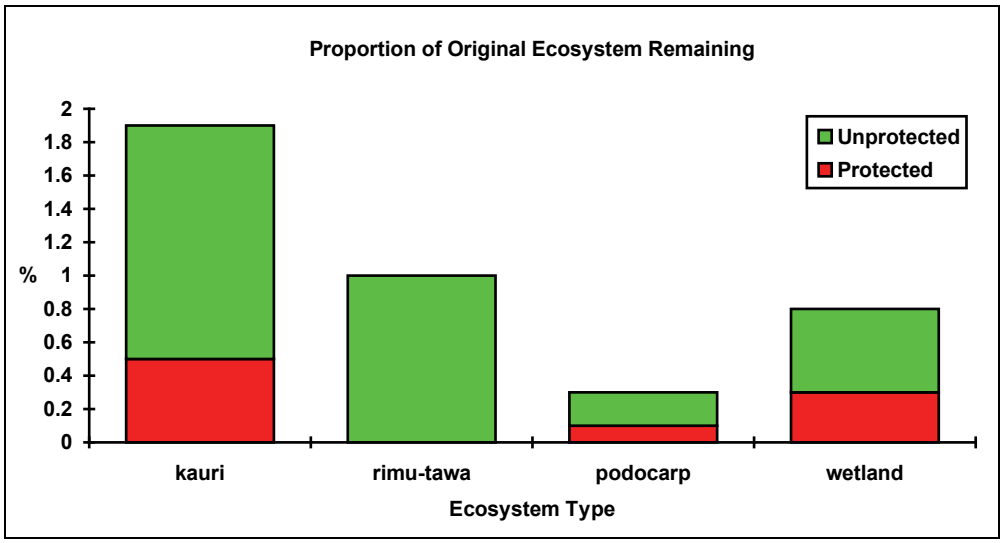
Table 8 - Hamilton ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
B,C	5,000	93	1.9	27	0	27	0.5	29.0
D	12,000	115	1.0	0	0	0	0	0
L	82,000	253	0.3	14	29	43	0.1	17.0
wetland	60,000	462	0.8	114	69	183	0.3	39.6
N	n/a	479	n/a	114	0	114	n/a	23.8
SL,BL	n/a	960	n/a	116	61	177	n/a	18.4
sl,bs	n/a	84	n/a	0	0	0	n/a	0
TOTALS	159,000	2,446		385	159	544		

All ecosystems in the Hamilton ED are severely depleted; all are reduced to less than 2% of their former extent. Furthermore, protected remnants are small and scattered, with the exception of the areas of logged kauri, logged tawa, and rimu-tawa forest which are contiguous with larger PNAs in the adjoining Raglan and Meremere EDs. The largest protected podocarp remnant in the ED is the 14.5 hectare Yarndleys Bush just north of Te Awamutu.

Opportunities for further protection are very limited. Unprotected areas of hill country forest include an area of logged kauri on the flanks of the Taupiri Range, an area of rimu-tawa forest and logged tawa forest west of Karakariki, logged tawa forest on the lower slopes of Mt Pirongia, logged tawa forest bordering Maungakawa SR, and a small area of logged tawa north of Whitikau. Opportunities to protect podocarp forest are limited to scattered remnants along Tauhei Stream north of Whitikau, along Komakorau Stream east of Taupiri, a small remnant north of Whewells Bush Scientific Reserve on the outskirts of Hamilton, and isolated remnants in the upper Mangahia Stream south of Hamilton.

Figure 10 - Hamilton ED Ecosystems:



An important wetland area with potential for podocarp forest restoration at Maratoto near Hamilton airport is protected by covenant. Opportunities for the further protection of wetlands are limited to two isolated areas along the Eastern Outlet Drain northeast of Hamilton, and an area south of Mangawara in the north of the ED.

There are no practical opportunities for the protection of linkages or corridors in the ED, with the possible exception of riparian forest restoration along some of the larger streams. The extent of land modification in the area is such that the Waikato Plain has been transformed, and is now occupied by intensive land uses such as dairy farming and, to a lesser extent, urban growth around Hamilton and Cambridge. There are limited opportunities for buffering of remnant forest ecosystems on the hill country that surrounds the ED, notably along the Taupiri and Hakarimata Ranges in the northwest, around Karakariki SR in the west, and on the lower slopes of Mt Pirongia in the southwest of the ED.

Summary of Opportunities for Protection

- logged kauri on the flanks of the Taupiri Range;
- rimu-tawa forest and logged tawa forest west of Karakariki;
- logged tawa forest on the lower slopes of Mt Pirongia, bordering Maungakawa SR, and north of Whitikau;
- podocarp forest remnants along Tauhei Stream, along Komakorau Stream, north of Whewells Bush Scientific Reserve, and in the upper Mangahia Stream; and
- wetlands along the Eastern Outlet Drain, and south of Mangawara.

3.11 HINUERA ECOLOGICAL DISTRICT

The part of the Hinuera ED that lies within the Waikato Conservancy covers the extensive alluvial flats of the Thames Basin, between the Kaimai Range to the east and the mid Waikato hill country to the west. It stretches from Te Aroha in the north to Putaruru in the south, and is traversed by the Waihou, Waitoa, and Piako Rivers. It is bordered by Hauraki ED in the north, Te Aroha and Otanewainuku EDs in the east, Tokoroa ED in the south, and Maungatautari, Hamilton, and Hapuakohe EDs in the west.

Formerly, wetland vegetation and lowland (dense) podocarp forest (L) covered over 95% of the ED. Rimu-tawa forest was present on the eastern edge of the ED, along the lower slopes of the Kaimai Range.

The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 9.

Table 9 - Hinuera ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
D	4,600	39	0.8	0	0	0	0	0
L+wetland	102,000	417	0.4	7	4	11	< 0.1	2.6
N	n/a	267	n/a	0	6	6	n/a	2.2
BL,SL,BS	n/a	373	n/a	0	0	0	n/a	0
TOTALS	106,000	1,096		7	10	17		

Less than 0.5% of the original vegetation of the Hinuera ED remains. Of this, only 17 hectares are protected in reserves, including 6 hectares of logged tawa forest protected by covenant. Further minor areas are within marginal strips. The ED has been transformed by intensive farming, especially dairying. A further 0.6% of the ED supports regenerating indigenous vegetation.

Opportunities for protection of indigenous ecosystems are very limited. Minor areas of logged tawa forest (N) remain unprotected along the lower slopes of the Kaimai Range, within the Bay of Plenty Conservancy. Important remnants of podocarp forest (L) with associated wetland vegetation are present along the Waitoa River between Waitoa and Ngarua, and minor remnants are present along the Waihou River east and south of Matamata, along the Piako River west of Springdale, and at Totara Springs near Matamata. There are no practical opportunities for the protection of linkages or corridors, except for restoration along parts of the major rivers.

Summary of Opportunities for Protection

- podocarp remnants along parts of the Piako, Waitoa, and Waihou Rivers.

3.12 MAUNGATAUTARI ECOLOGICAL DISTRICT

The Maungatautari ED covers the low hill country surrounding three old volcanic cones in the central Waikato. It lies between the Thames Basin to the east and the Waikato River Basin to the west stretching from Morrinsville in the north to Arapuni in the south, and including the mountains of Maungakawa, Te Tapui, and Maungatautari. It is bordered by Hinuera ED in the north and east, Tokoroa and Ranginui EDs in the south, and Hamilton ED in the west.

Formerly, rimu-tawa forest (D) was dominant in the ED, covering all the higher hill country, with a minor area of montane conifer-broadleaved forest (G) on the summit of Maungatautari. Dense podocarp forest (L) was dominant on the lower altitude country, covering about 10% of the ED, mostly along the Waikato River valley.

The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 10 and Figure 11.

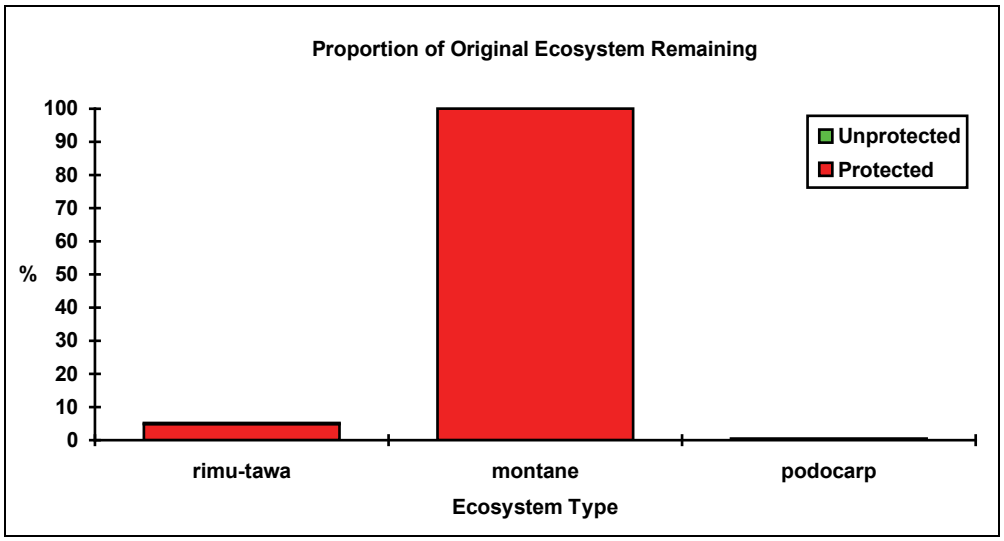
Table 10 - Maungatautari ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
D	76,500	3,951	5.2	3,744	0	3,744	4.9	94.8
G	332	332	100.0	332	0	332	100.0	100.0
L	10,000	47	0.5	0	0	0	0	0
N	n/a	3,191	n/a	712	57	769	n/a	24.1
BL,SL,BS	n/a	665	n/a	0	0	0	n/a	0
TOTALS	86,832	8,186		4,788	57	4,845		

Two of the three major ecosystems of the Maungatautari ED are substantially depleted. Only 0.5% of dense podocarp forest (L) remains, and no significant remnants are protected. The major ecosystem type, rimu-tawa forest (D) is also depleted, with only about 5% remaining, but most of this remaining area is protected. Logged tawa forest (N) covers a similar area to the remaining rimu-tawa forest, but is less adequately protected.

Opportunities for further protection of rimu-tawa forest are limited to an area east of Te Miro SR in the Torehape Stream catchment, and an enclave within Maungatautari Mountain SR. Unprotected areas of logged tawa forest include scattered remnants in the hill country between Te Tapui SR and Maungakawa SR, including a larger remnant east of Cambridge, an area south of Karapiro, scattered remnants east of Maungatautari around Paepaerahi, and areas surrounding Maungatautari Mountain SR. Opportunities to protect dense podocarp forest are limited to a small remnant north of Horahora, small remnants around Piarere, and small remnants southeast of Te Miro SR.

Figure 11 - Maungatautari ED Ecosystems:



Opportunities to protect linkages or corridors of indigenous vegetation are principally limited to the linking of small remnants of logged tawa forest that are scattered through the hill country in the west and south of the ED. Linking Te Miro and Te Tapui SR, by restoring forest cover to the intervening hill country is possible, but unlikely to be achievable. Linkages between Maungatautari Mountain SR and scattered remnants to the west and northwest may also be possible. A more important priority is the protection of the enclave of rimu-tawa forest in Maungatautari Mountain SR, and the protection of logged tawa forest remnants that buffer this reserve. There may also be potential to restore podocarp forest along sections of the Waikato River, especially around the Pairere Stream confluence.

Summary of Opportunities for Protection

- rimu-tawa forest east of Te Miro SR and within Maungatautari Mountain SR;
- logged tawa forest remnants between Te Tapui SR and Maungakawa SR, south of Karapiro, east of Maungatautari, and areas surrounding Maungatautari Mountain SR;
- dense podocarp forest north of Horahora, around Piarere, and southeast of Te Miro SR; and
- linkages between scattered tawa remnants throughout the hill country.

3.13 WAIPA ECOLOGICAL DISTRICT

The Waipa ED covers the inland basin of the Waipa River, between karst hill country to the west and higher altitude volcanic plateau country to the southeast. It stretches from Te Awamutu in the north to Te Kuiti in the south and comprises alluvial flats with peat bogs and some old eroded volcanic cones. It is bordered by Hamilton ED in the north, Ranginui ED in the east, Waitomo ED in the south and west, and Kawhia ED in the northwest.

Formerly, dense podocarp forest (L) with areas of fernland was the dominant vegetation, probably covering over half the ED. Smaller areas of wetland vegetation were also present. Elevated areas supported rimu-tawa forest (D), which occupied about 35% of the ED.

The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 11.

Table 11 - Waipa ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
D	25,000	17	< 0.1	0	0	0	0	0
L	41,000	158	0.3	0	8	8	< 0.1	5.1
wetland	3,500	11	0.3	0	0	0	0	0
N	n/a	302	n/a	112	0	112	n/a	37.1
BL,SL,BS	n/a	224	n/a	20	3	23	n/a	10.3
TOTALS	69,500	712		132	11	143		

The Waipa ED has been almost completely altered, with less than 1% of its original vegetation remaining. Both podocarp forest (L) and rimu-tawa forest (D) have been reduced to tiny remnants, and wetland vegetation has largely disappeared. Slightly larger areas of logged tawa forest (N) are present, and about one-third of this ecosystem type is protected, notably in Kakepuku Mountain HR.

Opportunities for protection are also very limited. The only apparent remnant of rimu-tawa forest is in hill country northeast of Te Kuiti, and the only areas of logged tawa are two remnants slightly further north in the Mangarapa Stream catchment. Opportunities for the protection of podocarp forest are limited to small remnants along the Mangapiko Stream west of Te Awamutu, along the Puniu River near Tokanui, along the Waipa River south of Tihiroa, and scattered remnants along the Mangaokewa River north of Te Kuiti

Summary of Opportunities for Protection

- rimu-tawa and logged tawa remnants north of Te Kuiti;
- podocarp remnants along the Mangapiko Stream, Puniu River, Waipa River, and the Mangaokewa River.

3.14 RAGLAN ECOLOGICAL DISTRICT

The Raglan ED covers the broken hill country and low ranges in the northwest of the Conservancy and includes the drowned valley system that forms Raglan Harbour. It stretches from Port Waikato in the north to the southern side of Raglan Harbour in the south, and from the coast in the west to the Waikato River Basin in the east. It is bordered by Meremere ED in the north and east, Hamilton ED in the southeast, and Kawhia ED in the south.

Formerly, associations of kauri forest dominated the vegetation in the north of the ED, with kauri-taraire-conifer-broadleaved forest (A,C,E) dominant in the northwest, and kauri-conifer-broadleaved forest (A,B,C) dominant in the northeast. Rimu-tawa forest (D) was dominant in the south and minor areas of rimu-taraire-tawa forest (E) were present at low altitudes in the north. Dense podocarp forest (L) was relatively common on low altitude alluvial sites. Wetland and duneland vegetation was almost absent from the ED and only small areas of estuary vegetation existed in Raglan Harbour.

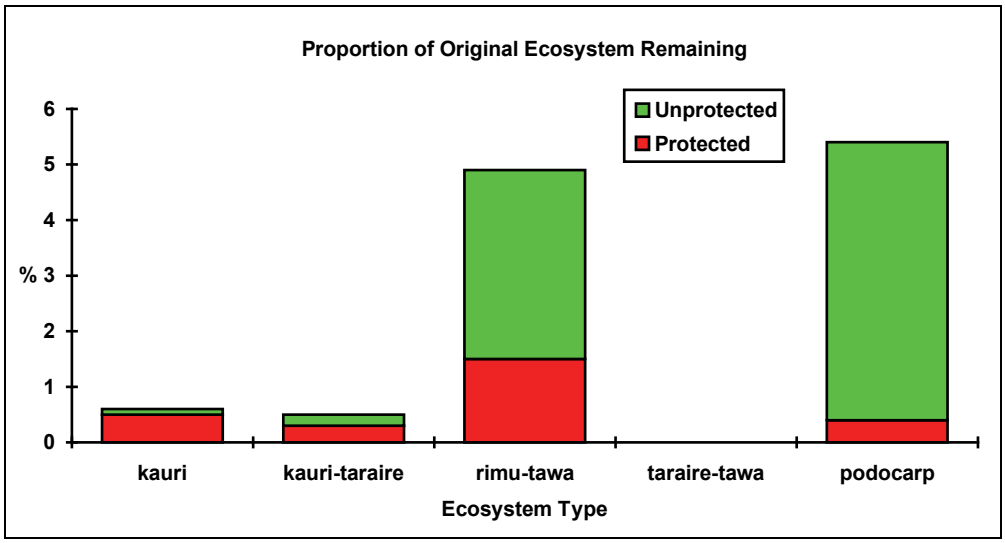
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 12 and Figure 12.

Table 12 - Raglan ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
A,B,C	22,000	139	0.6	125	0	125	0.5	90.0
A,C,E	23,300	c110	0.5	26	35	61	0.3	55.5
D	79,000	3,868	4.9	1,152	12	1,164	1.5	30.1
E	1,350	0	0	0	0	0	0	0
L	6,700	363	5.4	0	26	26	0.4	7.2
N	n/a	7,307	n/a	1,132	327	1,459	n/a	20.0
S	n/a	920	n/a	64	52	116	n/a	12.6
BL,SL,BS	n/a	4,644	n/a	105	23	128	n/a	2.7
CO,CS,CB	n/a	264	n/a	0	0	0	n/a	0
bl,sl,bs,tf	n/a	2,174	n/a	0	0	0	n/a	0
TOTALS	132,350	19,789		2,604	475	3,079		

The kauri forest ecosystems are the most severely depleted in the Raglan ED, with less than 1% of each of the main kauri forest associations remaining. This is largely because the lower altitude hill country in the north of the ED has been converted to farmland. Forest with a taraire component, although originally covering only about 1% of the ED, no longer exists in its original state, with rimu-taraire-tawa forest (E) now only represented by a small area of logged forest (S). Rimu-tawa forest (D) has fared slightly better, with comparatively large areas still present in the southeast of the ED, and even greater areas of logged tawa forest (N). Dense podocarp forest, though never widespread, is still present as scattered remnants making up about 5% of its former extent.

Figure 12 - Raglan ED Ecosystems:



Opportunities for further protection of kauri forest remnants are limited to areas adjoining and east of Te Karaka Memorial SR in the northeast, an area south of Wairamarama, and a small remnant in the Mangatia Stream north of Glen Murray. There are greater opportunities for the protection of rimu-tawa forest (and logged tawa forest), with relatively large areas unprotected around Kakariki SR in the hill country east of Raglan, and smaller areas around Te Puroa SR north of Kakariki SR, and in the Mangaokahu Stream catchment south of Kakariki SR. Logged tawa forest is also present as scattered remnants further north, notably east of Kaawa and north of Limestone Downs.

Unprotected logged tawa-taraire forest is present in the northeast, near Limestone Downs and south of the Waikato River near Colebaker SR. Lowland (dense) podocarp remnants are scattered across the northeast of the ED, but are nowhere large. The best opportunities for protection appear to be along Naike Stream and Taringapeka Stream in the Maire Stream catchment southwest of Glen Murray, along Waikaretu Stream near Waikaretu, and along the Opuatia Stream north of Glen Murray.

Opportunities for the protection of linkages or corridors are limited to hill country in the southeast of the ED. The protection of large areas of forest around Kakariki SR would provide a relatively intact forest corridor from the Hakarimata Range to Raglan Harbour, and even further south to Mt Pirongia if forest could be restored to the low hills around Waitetuna. There is also an unprotected gap between the two portions of Hakarimata SR on the Hakarimata Range. Potential linkages exist between smaller remnants in the northeast of the ED and, to a lesser extent, through the central hill country. Relatively large areas of regenerating forest south of Port Waikato and around Raglan Harbour also provide potential for forest restoration and for buffering coastal systems.

Summary of Opportunities for Protection

- rimu-tawa and logged tawa forest around, and north and south of, Kakariki SR;
- scattered kauri and podocarp remnants in the north of the ED;
- logged taraire forest remnants in the northeast;
- regenerating forest south of Port Waikato and around Raglan Harbour; and,
- linkages along and south of the Hakarimata Range and around Kakariki SR.

3.15 KAWHIA ECOLOGICAL DISTRICT

The Kawhia ED covers the hill country and ranges along the western coast of the Conservancy between Raglan Harbour in the north and south of Kawhia Harbour in the south. It includes the Aotea and Kawhia Harbours and the old volcanic cones of Karioi and Pirongia. It is bordered by the Raglan ED in the north, the Hamilton and Waipa EDs in the east, and by the Waitomo and Herangi EDs in the south.

Formerly, rimu-tawa forest (D) dominated the ED forming an extensive forest cover over the broken hill country. At coastal sites broadleaved species were more common, but are included with rimu-tawa forest in this analysis. Also, rare occurences of kauri at its southern limit in the Te Kauri Stream catchment are not separated for analysis. At higher altitudes montane conifer-broadleaved forest (G) dominated, and minor areas of dense podocarp forest (L) were present at low altitude alluvial sites. Extensive duneland vegetation was present, notably around the entrances to Aotea and Kawhia Harbours, and minor areas of freshwater wetland were also present.

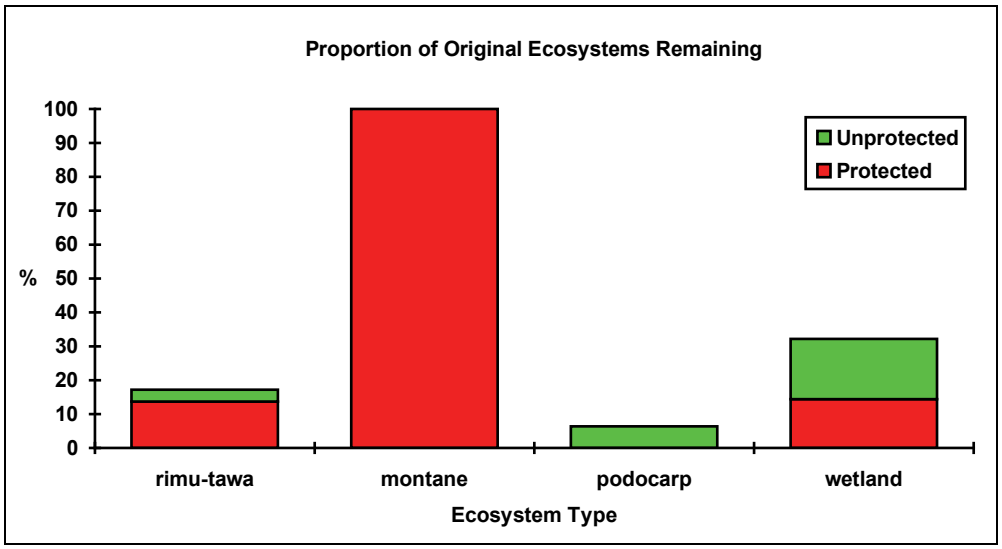
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 13 and Figure 13.

Table 13 - Kawhia ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
D	121,500	20,930	17.2	16,588	106	16,694	13.7	79.8
G	2,557	2,557	100.0	2,557	0	2,557	100.0	100.0
L	450	29	6.4	0	0	0	0	0
duneland	4,425	?	?	500	0	500	11.3	?
wetland	360	119	32.2	52	0	52	14.4	44.8
N	n/a	14,451	n/a	3,842	198	4,040	n/a	28.0
BL,SL,BS	n/a	6,668	n/a	1,288	100	1,388	n/a	20.8
bl,sl,bs,tf	n/a	1,581	n/a	248	0	248	n/a	15.7
TOTALS	129,292	46,335		25,075	404	25,479		

The most depleted ecosystem in the Kawhia ED is dense podocarp forest (L), though this was always a minor component of the original vegetation. The most extensive ecosystem, rimu-tawa forest (D), occupies only about 18% of its former extent, but almost 80% of this is protected. Its logged counterpart (N) is almost as extensive. Montane conifer-broadleaved forest remains at its former extent on the summits of Karioi and Pirongia and is entirely protected. Wetland and duneland vegetation are depleted, but the present extent of duneland vegetation is unclear, though 500 hectares of dunes are protected within the Aotea Heads Scientific Reserve.

Figure 13 - Kawhia ED Ecosystems:



Opportunities for further protection of podocarp forest (L) are limited to two very small remnants north of Aotea Harbour and another very small remnant east of Kawhia Harbour. Unprotected areas of rimu-tawa forest (D) are present north of Karioi, minor areas on the lower slopes of Pirongia, in the Ngutunui Stream catchment south of Pirongia, relatively large areas east and south of Owhiro adjoining Taumatatotara Forest, and significant areas around Lake Taharoa in the southwest of the ED. There are also large areas of unprotected logged tawa forest (N), notably on the lower northern slopes of Pirongia, on hill country east of Aotea Harbour, extensive areas around Tamatatotara Forest, around Lake Taharoa, and an important remnant in the Owhiro Inlet of Kawhia Harbour. Dune vegetation appears to have been replaced by plantation forest, or modified by introduced species, such as marram, and opportunities for protection are not evident.

Opportunities for protecting linkages or corridors of indigenous vegetation are most apparent in the country south and east of Kawhia Harbour, linking the isolated parts of Taumatatotara Forest, and extending that linkage through to Te Kauri Park SR to the north, Hauturu Forest and Pirongia South Forest in the east, and even through to Pirongia in the northeast. Other obvious unprotected linkages include a large area around Lake Taharoa south of Kawhia Harbour, areas of regenerating forest around the relatively-unmodified Aotea Harbour, and linkages from Karioi to the coast.

Summary of Opportunities for Protection

- podocarp forest remnants north of Aotea Harbour and east of Kawhia Harbour;
- rimu-tawa forest north of Karioi, on the lower slopes of Pirongia, in the Ngutunui Stream catchment, east and south of Owhiro, and around Lake Taharoa;
- logged tawa forest on the lower northern slopes of Pirongia, on hill country east of Aotea Harbour, around Tamatatotara Forest, and around Lake Taharoa; and,
- extensive forest corridors in the south and west of the ED.

3.16 HERANGI ECOLOGICAL DISTRICT

The Herangi ED covers the mostly steep-sided hills of the Herangi Range in the southwest of the Conservancy. It stretches from Lake Harihari in the north to the Awakino River in the south, though does not include the coastal hill country south of Huikomako SR (south of Waikawau). It is bordered by Kawhia ED in the north, Waitomo ED in the east, and North Taranaki ED in the south and west.

Formerly, rimu-tawa forest (D) was dominant, with broadleaved species such as puriri and kohekohe along coastal slopes in the north. The southern part of the ED supported rimu-tawa-beech forest (H), usually mixed with rimu-tawa forest depending on the site. At higher altitudes montane conifer-broadleaved forest (G) was dominant, and relatively minor areas of dense podocarp forest (L) were present at low altitude alluvial sites. Small areas of wetland vegetation were also present.

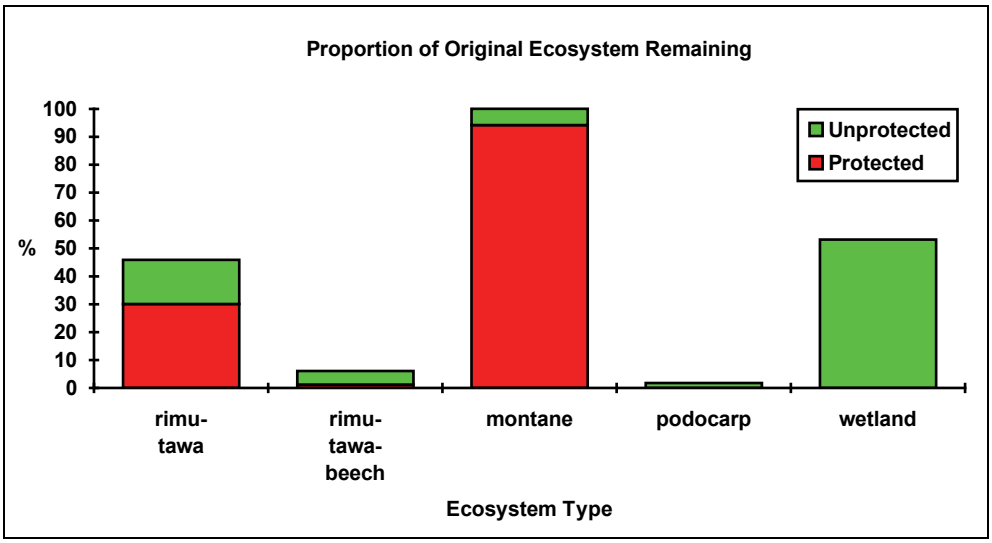
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 14 and Figure 14.

Table 14 - Herangi ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
D	43,500	19,963	45.9	13,091	0	13,091	30.1	65.6
D-H	7,430	451	6.1	90	0	90	1.2	20.0
G	1,433	1,433	100.0	1,350	0	1,350	94.2	94.2
L	2,250	41	1.8	0	0	0	0	0
wetland	250	133	53.2	0	0	0	0	0
N	n/a	8,385	n/a	1,291	52	1,343	n/a	16.0
O	n/a	161	n/a	0	0	0	n/a	0
BL,SL,BS	n/a	1,362	n/a	944	0	944	n/a	69.3
bl,sl,bs,tf	n/a	3,187	n/a	1,029	0	1,029	n/a	32.2
TOTALS	54,863	35,116		17,795	52	17,847		

Dense podocarp forest (L) is the most seriously depleted ecosystem in the Herangi ED, though it was a relatively minor component of the original vegetation cover. Rimu-tawa-beech forest (H), which was common in the south of the ED, now covers only 6% of its former extent, and only one-fifth of that is protected. The dominant ecosystem, rimu-tawa forest (D), has been reduced by half, with substantial areas still present on the upper parts of the Herangi Range. However, the coastal form of that ecosystem, with more broadleaved species, is more seriously depleted. High altitude conifer-broadleaved forest (G) is still present over its original extent, though some areas remain unprotected. Wetland vegetation though never widespread, has been reduced by half and remains unprotected.

Figure 14 - Herangi ED Ecosystems:



Opportunities for further protection of dense podocarp forest are limited to two moderate-size remnants on the lower Waikawau River, one small remnant on the lower Marokopa River, remnants along the Manganui River and the Awakino River west of Mahoenui. Unprotected rimu-tawa-beech remnants are present on the southern end of the Herangi Range northwest of Mahoenui, north of the lower Awakino River in the south of the ED, and north of Huikomako SR. The only area of unprotected montane conifer-broadleaved forest is at the southern end of the Herangi Range northwest of Mahoenui. Opportunities for the protection of wetland vegetation are confined to an area on the lower Marokopa River, and a larger area in a small catchment near the coast north of the Marokopa River.

Opportunities for the protection of the formerly widespread rimu-tawa forest, and its logged equivalent (N) are more extensive. Large unprotected remnants are present in the north of the ED on hill country north of Marokopa, on the northern end of the Herangi Range around Kiritehere and Moeatoa, east of the Herangi Range around Waikawau, on the eastern side of the upper Awakino River at the southeastern end of the Herangi Range, and large areas of logged forest in the Manganui River and Turipoto Stream catchments at the southwestern end of the Herangi Range.

There are several good opportunities to protect corridors of indigenous vegetation, notably links between the Herangi Range and Moeatoa SR, Te Marama SR, Huikomako SR, and Mahoenui SR. Other important opportunities are the protection of intact and regenerating forest with coastal links and wetland vegetation north of Marokopa, and a potential link to the coast beside Te Marama SR.

Summary of Opportunities for Protection:

- podocarp remnants on the Waikawau River and lower Marokopa River;
- rimu-tawa-beech on the southern Herangi Range and lower Awakino River;
- montane conifer-broadleaved forest on the southern Herangi Range;
- wetland vegetation on the lower Marokopa River and north of the Marokopa River;
- rimu-tawa forest north of Marokopa, and along the Herangi Range;
- rimu-tawa and logged rimu forest linking the Herangi Range with adjoining SRs; and,
- coastal links north of Marokopa and near Te Marama SR.

3.17 NORTH TARANAKI ECOLOGICAL DISTRICT

The part of the North Taranaki ED that lies within the Waikato Conservancy covers the coastal hill country from Huikomako SR in the north to the Mokau River in the south, broken hill country between the middle reaches of the Awakino and Mokau Rivers, and hill country to the east in the Panirau Stream tributary of the Mokau River. It comprises steep dissected sandstone and mudstone hill country with coastal cliffs and estuaries around the major river mouths. It is bordered by Herangi ED in the north, Waitomo ED in the northeast, and Taumarunui ED in the east.

Formerly, rimu-tawa forest (D) and rimu-tawa-beech forest (H) was dominant throughout the ED, with montane conifer-broadleaved forest (G) at higher altitudes. A variation of rimu-tawa-beech forest, with broadleaved species, was present on coastal slopes in the west of the ED. Dense podocarp forest (L) was localised on major valley floors, especially along the lower Awakino and Mokau Rivers. Areas of duneland vegetation were present in the southwest of the ED.

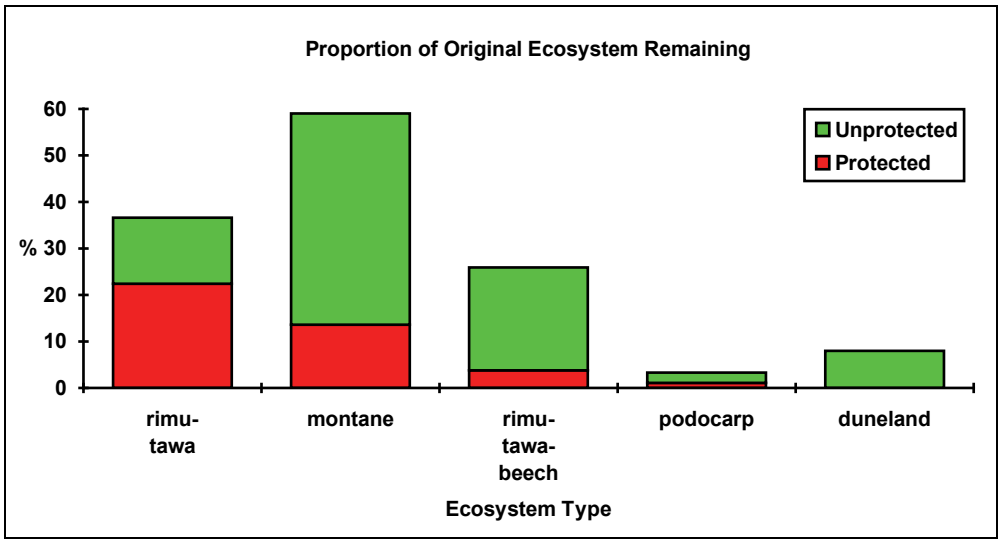
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 15 and Figure 15.

Table 15 - North Taranaki ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
D	16,000	5,848	36.6	3,592	0	3,592	22.4	61.1
G	1,000	590	59.0	136	0	136	13.6	23.0
H	10,600	2,741	25.9	114	290	404	3.8	14.7
L	900	30	3.3	10	0	10	1.1	33.3
duneland	500	40	8.0	0	0	0	0	0
N	n/a	1,517	n/a	0	0	0	n/a	0
O	n/a	1,883	n/a	313	354	667	n/a	35.4
BL,SL,BS	n/a	2,695	n/a	54	0	54	n/a	2.0
bl,sl,bs,tf	n/a	3,051	n/a	42	0	42	n/a	1.4
TOTALS	29,000	18,395		4,261	644	4,905		

Dense podocarp forest (L) and duneland vegetation are the most depleted ecosystems in the North Taranaki ED, due to the modification of low altitude areas. The major ecosystem types, rimu-tawa forest (D) and rimu-tawa-beech forest (H), have fared better with 36% and 26% remaining respectively. However, coastal and lower altitude areas of these forest types have suffered proportionally greater depletion. About half of the montane conifer-broadleaved forest (G) ecosystem remains, but less than one-quarter is protected. A PNAP survey of the North Taranaki ED was undertaken in the late 1980s (Bayfield *et al* 1991).

Figure 15 - North Taranaki ED Ecosystems:



Opportunities for further protection of dense podocarp forest are limited to very small areas of regenerating forest on the lower Awakino River, though a larger unprotected remnant exists on the lower Mokau River (RAP 8) just outside the Conservancy. The only opportunity for the protection of duneland vegetation is at the Awakino River mouth (RAP 4). Unprotected areas of montane conifer-broadleaved forest are present in the upper Mangaawakino Stream catchment south of Mahoenui Forest, and there are extensive unprotected areas of both rimu-tawa and rimu-tawa-beech forest in this area (RAP 7). Unprotected areas of logged rimu-tawa-beech forest (O) are present on the coastal hills north of Awakino SR (RAP 2), and between the lower Awakino and Mokau Rivers (RAP 6). A large unprotected area of logged tawa forest (N) is present just east of Arorangi SR.

The most important opportunity to protect forest corridors is the potential linkage, comprising an extensive area of mixed intact and regenerating forests, between Mahoenui Forest, Mangaawakino Block Forest, and Panirau Forest, across the mid-catchment of the Mokau River in the southeast of the ED. Other important linkages are the area of intact and logged tawa forest between Arorangi SR and Mahoenui Forest, and potential linkages along the coastal hills between Huikomako SR in the north, the large Native Forest Restoration Trust covenant at Ounutae, and Awakino SR in the south.

Summary of Opportunities for Protection

- duneland vegetation at the Awakino River mouth (RAP 4);
- montane conifer-broadleaved forest in upper Mangaawakino Stream (RAP 7);
- rimu-tawa and rimu-tawa-beech forest in upper Mangaawakino Stream;
- logged rimu-tawa-beech forest north of Awakino SR (RAP 2) and between the Awakino and Mokau Rivers (RAP 6);
- logged tawa forest east of Arorangi SR;
- linkages between Mahoenui Forest, Mangaawakino Block Forest, and Panirau Forest;
- linkages between Arorangi SR and Mahoenui Forest; and,
- potential linkages between Huikomako SR, the large Native Forest Restoration Trust covenant at Ounutae, and Awakino SR.

3.18 WAITOMO ECOLOGICAL DISTRICT

The Waitomo ED covers the mostly-gentle hill country east and south of Te Kuiti, including the upper catchment of the Mokau River. It is comprises volcanic sediments in the east and extensive areas of limestone with distinctive karst topography in the west. It stretches from just east of Otorohanga in the north to the North Taranaki hill country in the south. It is bordered by the Kawhia and Waipa EDs in the north, Taumarunui and Ranginui EDs in the east, North Taranaki ED in the south, and Herangi ED in the west.

Formerly, rimu-tawa forest (D) dominated the district, especially on hill country in the north and west. To the south this merged with rimu-tawa-beech forest (H), and at lower altitudes dense podocarp forest (L). Minor areas of wetland were present throughout the lower altitude areas of the ED.

The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 16 and Figure 16.

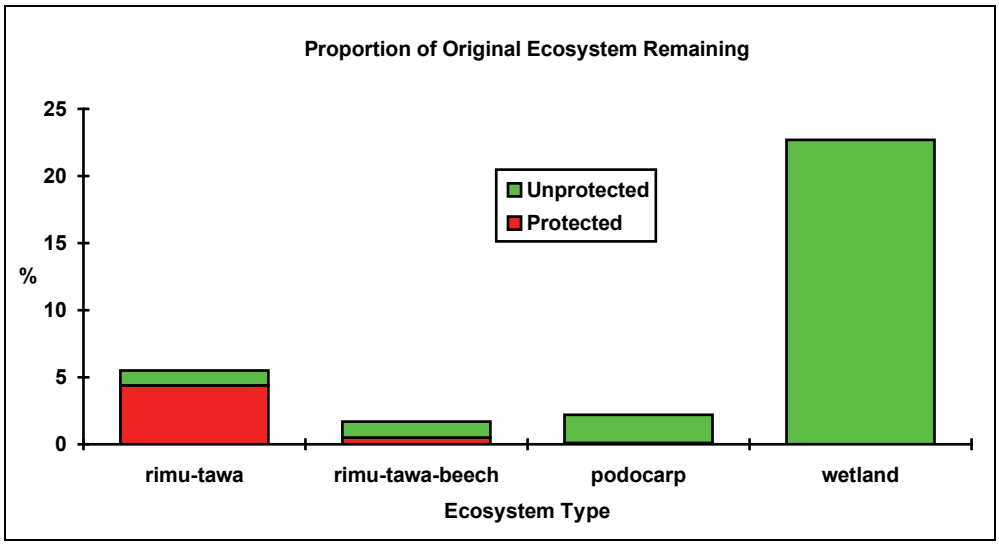
Table 16 - Waitomo ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
D	137,670	7,562	5.5	6,100	0	6,100	4.4	80.7
H	10,630	180	1.7	48	0	48	0.5	26.7
L	13,780	305	2.2	8	6	14	0.1	4.6
wetland	400	91	22.7	0	0	0	0	0
N	n/a	15,466	n/a	4,406	336	4,742	n/a	30.7
O	n/a	102	n/a	36	0	36	n/a	35.3
BL,SL,BS	n/a	3,307	n/a	893	40	933	n/a	28.2
bl,sl,bs,tf	n/a	3,236	n/a	716	0	716	n/a	22.1
TOTALS	162,480	30,249		12,207	382	12,589		

The most severely depleted ecosystems in the Waitomo ED are the dense podocarp forests (L) and the rimu-tawa-beech forests (H), with about 2% of the original cover of each remaining. Forest cover is almost entirely absent from low altitude areas and from the southern hill country in the ED, due to conversion to farmland. Wetland vegetation has also suffered, though it was only a minor component of the original vegetation. About 5% of the original cover of the most extensive ecosystem, rimu-tawa forest (D), remains and that is concentrated in the western hill country. A large proportion of this is protected. There are also relatively extensive areas of logged tawa forest in the northwest and southeast of the ED, of which about one-quarter is protected.

A Landcare group has been working, with the assistance of Environment Waikato, for more effective resource protection in the Waitomo River catchment , including the protection of forest remnants.

Figure 16 - Waitomo ED Ecosystems:



There are several opportunities for protection of dense podocarp forest, though all remnants are relatively small. The best prospect is an area along Mangapu Stream northwest of Te Kuiti, which is probably the most extensive unprotected lowland podocarp remnant in the Conservancy. Other smaller remnants are present in the upper Mangapu Stream west and southwest of Te Kuiti, along Waitomo Stream north of Waitomo Caves, along the upper Marokopa River in the extreme west of the ED, along the upper Mokau River southwest of Mahoenui Giant Weta Scientific Reserve, and along Mapiu Stream east of Ngatamahine. Unprotected wetland vegetation is present in the upper Mokau catchment east of Piopio.

The only unprotected remnants of rimu-tawa-beech (and logged tawa-beech) are areas adjoining Mahoenui Forest and Waitewhena Forest in the south of the ED. Unprotected remnants of rimu-beech are more extensive, notably adjoining Tawarau Forest east of Piripiri and northwest of Waitanguru, west of Mangaohae Stream SR, adjoining Panirau Forest in the south of the ED, west of Karaka Forest, an area in the Mangawhata Stream catchment north of Mokauiti, and areas of logged forest adjoining Mapara WMR.

There are important opportunities to protect corridors of indigenous forest, especially linkages on the karst hill country around and north of Waitomo, linkages between the separate parts of Tawarau, Mahoe, Taumatatotara, and Whareorino Forests in the west of the ED, a linkage between Mangaohae Stream SR and Whareorino Forest, and a potential linkage from Tapuae SR and Taumatini SR near Aria to Karaka Forest to the east.

Summary of Opportunities for Protection

- podocarp remnants in the Mangapu Stream catchment;
- podocarp remnants along Waitomo Stream, Marokopa River, upper Mokau River, and Mapiu Stream;
- wetland vegetation east of Piopio;
- rimu-tawa-beech adjoining Mahoenui and Waitewhena Forests;
- rimu-beech adjoining Tawarau, Panirau and Karaka Forests, and west of Mangaohae Stream SR, and north of Mokauiti;
- corridors linking Tawarau, Mahoe, Taumatatotara, and Whareorino Forests; and,
- linkages between forest remnants around Waitomo and east of Aria.

3.19 TAUMARUNUI ECOLOGICAL DISTRICT

The part of the Taumarunui ED that lies within the Waikato Conservancy covers hill country from Mangapehi Forest in the north to the Taringamotu Valley in the south, including the southern end of the Hauhangaroa Range. It lies between Ranginui ED in the north, Pureora and Taupo EDs in the east, and Waitomo ED in the west.

Analysis of indigenous forest cover in the Taumarunui ED is constrained by the lack of Landcare map coverage for the southern part of the ED, as the Waikato Local Government Region differs from the DoC Conservancy area. Forest cover for this part of the ED has been estimated from topographical maps.

Formerly, rimu-tawa forest (D) was dominant on the hill country in the headwaters of the Wanganui River in the west of the ED, with lesser areas of rimu-tawa-beech forest (H). Dense podocarp forest (L) covered minor lower altitude areas in the north and west of the ED. Forests of the Hauhangaroa Range were montane conifer-broadleaved (G) on the upper slopes, and a mosaic of rimu-broadleaved forest (F), and rimu-matai-broadleaved forest (M) on the lower slopes. Wetland vegetation was relatively insignificant in the ED.

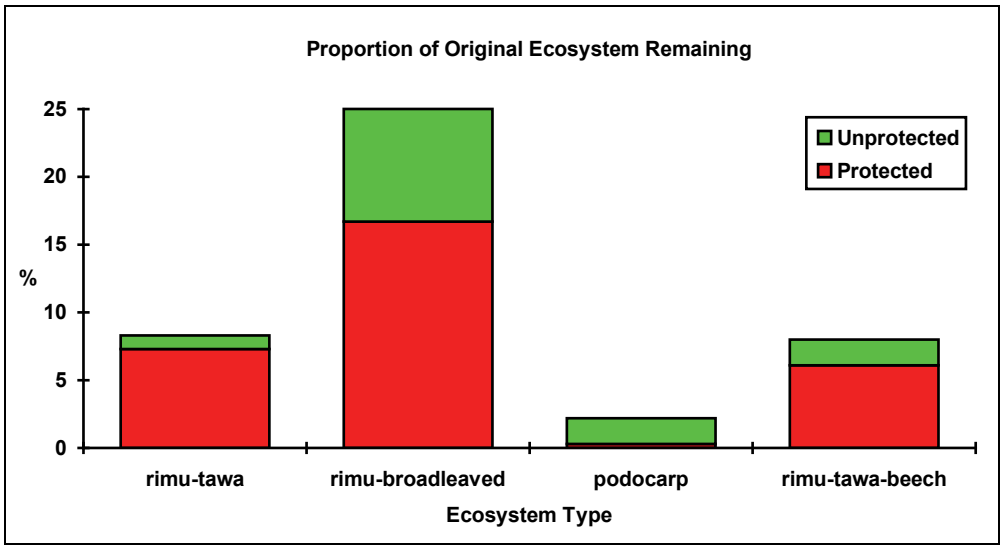
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 17 and Figure 17.

Table 17 - Taumarunui ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
D	30,000	2,500	8.3	2,190	0	2,190	7.3	87.6
F	3,000	c750	25.0	c500	0	c500	16.7	66.7
G	1,000	c1,000	100.0	c600	0	c600	60.0	60.0
H	5,000	c400	8.0	307	0	307	6.1	76.7
L	2,000	c50	2.5	6	0	6	0.3	12.0
M	2,000	c500	25.0	c500	0	c500	25.0	100.0
N	n/a	3,059	n/a	1,977	0	1,977	n/a	64.6
O	n/a	c1,000	n/a	307	0	307	n/a	30.7
P	n/a	c2,000	n/a	c1,000	0	c1,000	n/a	50.0
BL,SL,BS	n/a	762	n/a	112	0	112	n/a	14.7
bl,sl,bs,br	n/a	678	n/a	489	0	489	n/a	72.1
TOTALS	43,000	12,699		7,988	0	7,988		

The most seriously depleted ecosystems in this part of the ED appear to be rimu-tawa forest (D), rimu-tawa-beech forest (H), and rimu-broadleaved forest (F). The status of rimu-matai-broadleaved forest (M) is less clear, though it appears most of the remaining remnants in the ED are protected within Pureora CP. Low altitude dense podocarp forest (L), though a relatively minor component, has almost disappeared from the ED. Significant areas of logged forest, including tawa (N), tawa-beech (O), and broadleaved forest (P) are also present in the ED.

Figure 17 - Taumarunui ED Ecosystems:



Opportunities for protection of podocarp forest are limited to small remnants in the Mangapehi Stream west of Kopaki, and scattered remnants along Mapiu Stream north of Mapiu. Unprotected remnants of rimu-tawa forest, and logged tawa forest, are present on hill country west of Benneydale, east of Mapiu, north and west of Waimiha, north of Ongarue, and around the Uepango Stream catchment between Ongarue and Taumarunui. One intact area of montane conifer-broadleaved forest remains unprotected around the summit of Hauhangaroa Mountain.

Unprotected areas of rimu-broadleaved forest and rimu-matai-broadleaved forest are present around the southern end of the Hauhangaroa Range, notably the enclave running across the range around Hauhangaroa Mountain, and mostly-logged forest in the Pungapunga River catchment west of Waituhi Saddle.

The most important opportunity to protect a corridor of indigenous forest is the strip of intact forest traversing Hauhangaroa Mountain. Other opportunities in the ED are potential linkages between Mapara WMR and Mangapehi Forest (north of Mangapehi), and between Raepahu Forest, Herekawe SR, and Mangapehi Forest (south of Benneydale).

Summary of Opportunities for Protection

- podocarp remnants in Mangapehi Stream and Mapiu Stream;
- rimu-tawa forest around the Ongarue Stream catchment, and scattered blocks between Ongarue and Mangapehi;
- montane conifer-broadleaved forest on Hauhangaroa Mountain;
- rimu-broadleaved forest and rimu-matai-broadleaved forest around Hauhangaroa Mountain and in the Pungapunga River catchment;
- linkage across Hauhangaroa Mountain; and,
- linkages between parts of Mangapehi Forest and Raepahu Forest, Mapara WMR, and Herekawe SR.

3.20 RANGINUI ECOLOGICAL DISTRICT

The Ranginui ED covers the hill country of the upper Waipa River catchment, the Rangitoto Range, and the surrounding ignimbrite plateau country. Its stretches from Puniu River in the north to the Mangatutu EA (Pureora CP) in the south, and spans the area between the Waipa River Basin to the west and the Waikato River to the east. It is bordered by Maungatautari ED in the north, Tokoroa ED in the east, Pureora and Taumarunui EDs in the south, and Waipa and Waitomo EDs in the west.

Formerly, almost all the hill country, including that around the Rangitoto Range, supported rimu-tawa forest (D), with montane conifer-broadleaved forest (G) at higher altitudes. Rimu-matai-broadleaved forest (M) was reasonably extensive, especially in the southeast of the ED on pumice soils. Dense podocarp forest (L) was also present at lower altitude sites.

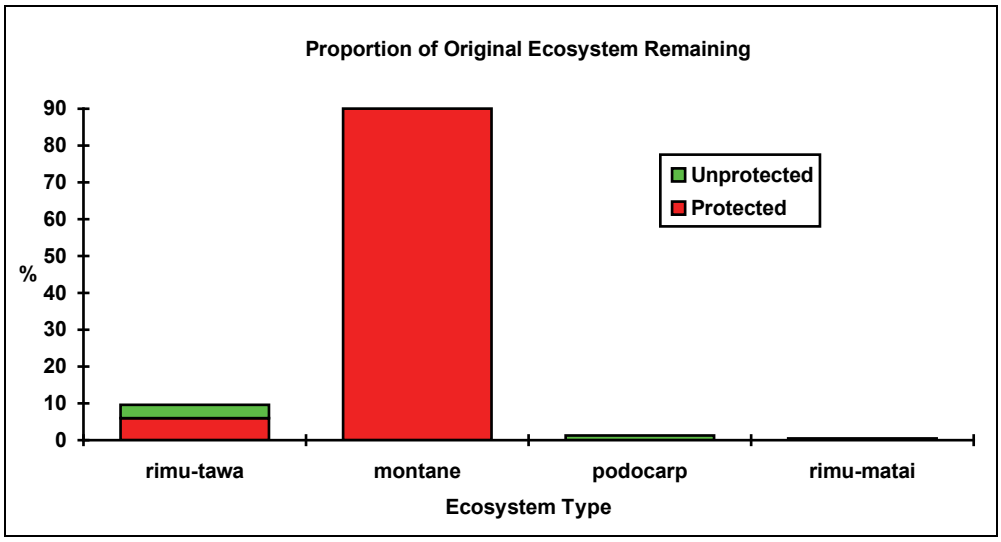
The estimated original extent of ecosystems, present extent, and proportions of ecosystems protected are presented below in Table 18 and Figure 18.

Table 18 - Ranginui ED Ecosystems:

Ecosystem Type	Extent of Ecosystem			Extent of Ecosystem Protected				
	original est. ha.	1994 (ha.)	% remain.	DoC (ha.)	Cov. (ha.)	Total (ha.)	% of original	% of 1994
D	104,430	9,998	9.6	5,982	325	6,307	6.0	63.1
G	800	720	90.0	720	0	720	90.0	100.0
L	2,350	31	1.3	0	0	0	0	0
M	5,090	23	0.5	0	0	0	0	0
N	n/a	12,194	n/a	5,973	619	6,592	n/a	54.1
BL,SL,BS	n/a	3,446	n/a	659	438	1,097	n/a	31.8
bl,sl,bs,br	n/a	1,106	n/a	288	0	288	n/a	26.0
TOTALS	112,670	27,518		13,622	1,382	15,004		

The most severely depleted ecosystems in the Ranginui ED are the rimu-matai-broadleaved forest (M), with less than 1% remaining, and the dense podocarp forest (L), with just over 1% remaining. These ecosystems have suffered from the removal of forest at lower altitudes for farming and in montane areas for timber. Rimu-tawa forest (D) is also dramatically reduced in extent, though an extensive intact area is protected within Pureora CP. Large areas of logged tawa forest are present, especially around Pureora CP and as scattered, but substantial, remnants in the northwest and east of the ED. Significant areas west of the Rangitoto Range have recently been protected through the efforts of Arthur Cowan, Stephen King, and the Native Forests Restoration Trust.

Figure 18 - Ranginui ED Ecosystems:



Opportunities for the protection of podocarp forest (L) are limited to small remnants along the Mangatutu Stream south of Korakonui, and in Mangare Stream and the upper Owairaka Stream east and north of Arohena. The only remnant of rimu-matai-broadleaved forest (M) in the ED is unprotected and lies southwest of Ngaroma and just outside Pureora CP. All remaining areas of montane conifer-broadleaved forest are protected.

Unprotected remnants of rimu-tawa forest (D) are present in the upper Puniu River adjoining the northern edge of Pureora CP, northwest of the Rangitoto Range adjoining the Mangatutu EA, west of the Rangitoto Range in the Waimahora Sream and Rakauwhakahue Stream catchments, and southeast of the Rangitoto Range along the upper Waipa River. Extensive unprotected areas of logged tawa forest (N) include areas adjoining the rimu-tawa forest remnants described above, and an area in the Otamaroa Stream catchment south of the Rangitoto Range, and areas lower down the Waipa River.

There are some very important opportunities for protecting corridors of indigenous forest in this ED, especially areas along the Waipa River to link Pureora CP with Oturu SR, areas north and west of the Rangitoto Range (described above) to link Mangatutu EA with Mangatutu Outlier to the north, potential corridors around Ngaroma to link outliers of Pureora CP, and potential riparian linkages along the Mangaokewa River.

Summary of Opportunities for Protection

- podocarp remnants along Mangatutu Stream and around Arohena;
- rimu-matai-broadleaved forest southwest of Ngaroma;
- rimu-tawa forest in the upper Puniu River, north and west of the Rangitoto Range, and along the upper Waipa River;
- linkages along the Waipa River;
- linkages between the Rangitoto Range and Mangatutu Outlier; and,
- potential linkages around Ngaroma.

3.21 PUREORA ECOLOGICAL DISTRICT

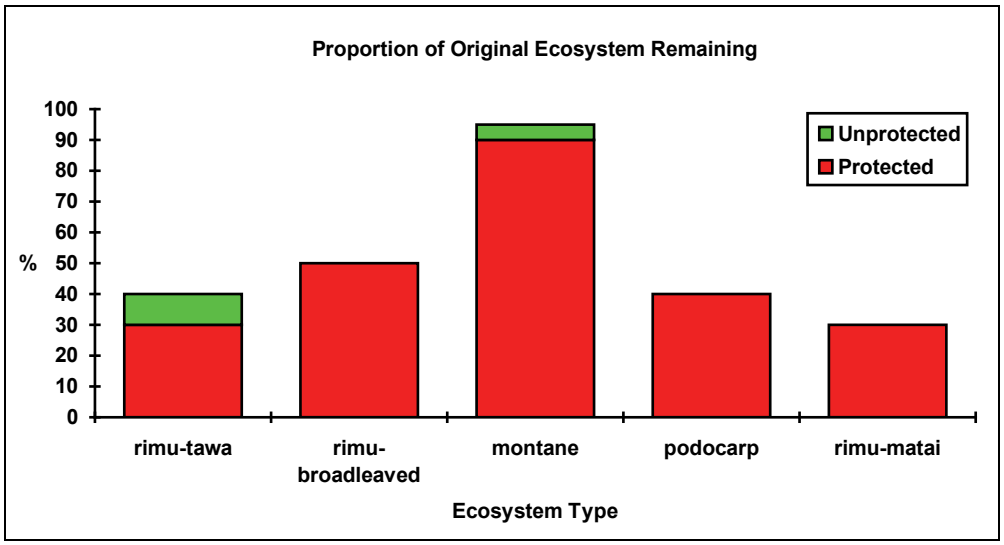
The Pureora ED covers the eastern flank of the Hauhangaroa Range west of Lake Taupo and the lower ignimbrite plateau country to the north. It includes most of Pureora CP and the Waipapa and Pikiariki EAs. It stretches from the Waikato River in the northeast to the end of the Hauhangaroa Range in the south, with the summit of the Hauhangaroa Range forming its eastern boundary and the Ongarue River its western boundary. It is bordered by Ranginui and Tokoroa EDs in the north, Atiamuri and Taupo EDs in the east, and Taumarunui ED to the south and west.

Analysis of indigenous forest cover in the Pureora ED is constrained by the lack of Landcare map coverage for the southwestern part of the ED, as the Waikato Local Government Region differs from the DoC Conservancy area. Therefore estimates of forest cover have been made from topographical maps.

Formerly, rimu-matai-broadleaved forest (M) was the dominant forest cover on the flanks of the Hauhangaroa Range and on the gentle country north of the range. Rimu-tawa forest (D) was dominant on the surrounding hill country and in the northwest of the ED. Extensive areas of dense podocarp forest (L) were also present, especially on the lower altitude country of gentle relief, such as around Pikiariki and Waipapa. The higher altitude parts of the range supported montane conifer-broadleaved forest (G), and monoao scrub (mn) and mire vegetation was present in frost-prone basins.

The estimated proportions of the original ecosystem remaining, and protected, are presented below in Figure 19.

Figure 19 - Pureora ED Ecosystems:



The estimated proportions of the original ecosystems illustrated above indicate that, although only 30% to 50% of most ecosystems remain, most of the remaining indigenous vegetation is protected. The Pureora ED is the least modified of all the ecological districts in the Waikato Conservancy. It also has the most extensive remaining areas of dense podocarp forest and podocarp-dominated forest such as rimu-matai-broadleaved forest (M) and rimu-broadleaved forest (F) in the Conservancy, and probably in the North Island. There are also substantial areas of logged broadleaved forest (P). The most depleted ecosystems are the lower altitude ecosystems, especially rimu-tawa forest (D), rimu-matai-broadleaved forest (M), and dense podocarp forest (L).

Opportunities for further protection of indigenous vegetation are limited, as most intact forests are within Pureora CP. Significant unprotected remnants include an extensive area of logged broadleaved forest (P), logged rimu-tawa forest (N), and intact montane conifer-broadleaved forest (G) on the northern flanks of Titiraupenga, an enclave of montane conifer-broadleaved forest and rimu-matai-broadleaved forest on the crest of the Hauhangaroa Range southeast of Ketemaringi (surrounded by Ratanunui EA), an area of rimu-tawa forest in the Ongarue River catchment southwest of Pureora Village, and areas of rimu-tawa forest and rimu-matai-broadleaved forest on the lower eastern slopes of the Hauhangaroa Range along the Mangakahu, Mangatukutuku, and Waione Streams and along the Maramataha River. Unprotected areas of conifer-broadleaved (mire) vegetation near Pureora Village are managed by Carter Holt Harvey.

Opportunities for linking or buffering PNAs in the ED are the protection of forested areas on the lower western slopes of the Hauhangaroa Range (described above), the protection of the large enclave on Titiraupenga, and the desirability of linking the Pikiariki EA with both the Waipapa EA and the Hauhangaroa Range. This latter proposal would be a long-term restoration project, involving the removal of substantial areas of plantation forest presently administered by DoC, and the restoration of forest cover to a large area of privately-owned farmland.

Summary of Opportunities for Protection

- mixed intact and logged forest enclave on Titiraupenga;
- forested enclave south of Ketemaringi Mountain;
- areas of rimu-tawa and rimu-matai-broadleaved forest on the lower western flanks of the Hauhangaroa Range;
- potential linkage between Pikiariki EA and the Hauhangaroa Range; and,
- potential linkage between Pikiariki EA and Waipapa EA.

3.22 TOKOROA ECOLOGICAL DISTRICT

The part of the Tokoroa ED that lies within the Waikato Conservancy covers the flat to rolling country between Tokoroa and the Waikato River. It comprises ash soils and entrenched streams with generally low relief. It is bordered by Maungatautari ED in the north, Ranginui and Pureora EDs in the west, and Atiamuri ED in the south.

Formerly, rimu-tawa forest (D) was dominant in the ED, especially on the hilly country. Rimu-matai-broadleaved forest (M) was extensive on the lower country and dense podocarp forest (L) was also common.

Now the part of the Tokoroa ED that lies within the Conservancy is almost entirely dominated by farmland or plantation forest. The only original ecosystem still represented is dense podocarp (about 18 hectares, or less than 1% of the original extent, in the Walter Barnett SR at Waotu) and even that is modified. Scattered remnants of logged tawa forest (N) are present west and south of Waotu, totalling about 70 hectares. The only other indigenous vegetation cover is about 100 hectares of broadleaved shrubland and low forest (BL) along the banks of the Waikato River in the south of the ED.

Some of these small remnants of indigenous vegetation are protected, notably small areas of podocarp forest and logged tawa forest near Waotu protected by QEII covenants. Opportunities to protect other remnants are limited to a small area of podocarp forest near the Waikato River southwest of Waotu, and small scattered tawa forest remnants west and south of Waotu.

The extent of plantation forest cover precludes the short term re-establishment of indigenous ecosystems or forest corridors, with the possible exception of a narrow corridor along the Waikato River in the south of the ED.

3.23 ATIAMURI ECOLOGICAL DISTRICT

Only a small part of the Atiamuri ED, on the northern side of the Waikato River between Mangakino and Atiamuri, lies within the Waikato Conservancy. It has very similar characteristics to the Tokoroa ED which borders it in the north, including the dominance of plantation forests.

The original vegetation has been entirely removed from this part of the ED, and the only indigenous forest remaining is a small area (about 40 hectares) of logged broadleaved forest (P) surrounded by plantation pine forest, southeast of Kinleith.

There are no PNAs in the part of the ED that lies within the Waikato Conservancy, and the only opportunity to protect indigenous vegetation is the small remnant described above.

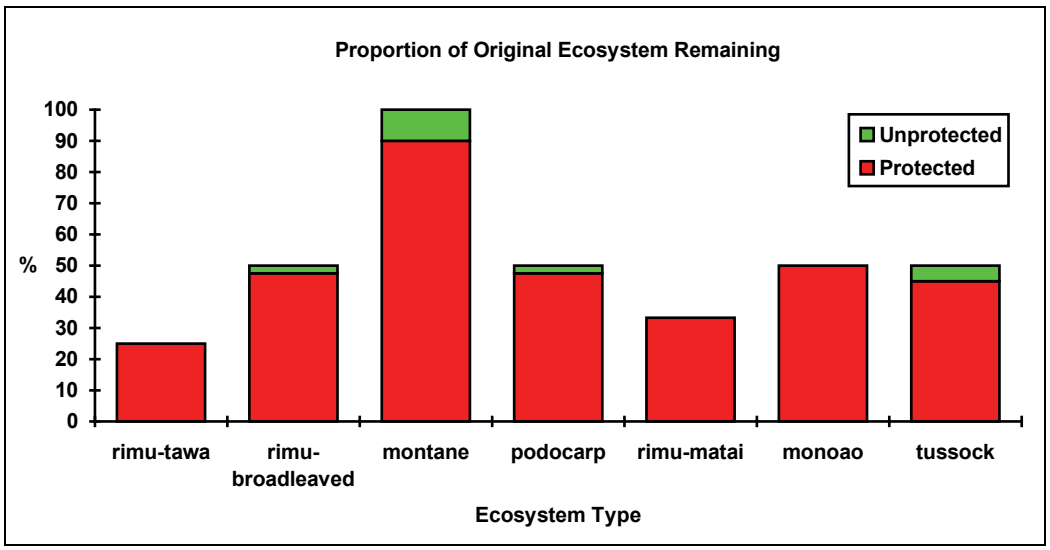
3.24 TAUPO ECOLOGICAL DISTRICT

The part of the Taupo ED that lies within the Waikato Conservancy covers the eastern flanks of the Hauhangaroa Range in the southeast of the Conservancy. It stretches from the Waimonoa EA in the north to the Taupo-Turangi Highway in the south. Its western edge is the summit of the Hauhangaroa Range, and its eastern limit (the Conservancy boundary) is the western Taupo Highway. It is bordered by Pureora ED in the north and west, Tongariro ED in the south, and Taumarunui ED in the south and west.

Formerly, this part of the ED was dominated by rimu-matai-broadleaved forest (M) which covered the slopes of the Hauhangaroa Range. Dense podocarp forest (L) was also widespread on the lower slopes. Relatively large areas of montane conifer-broadleaved forest (G) covered the summit of the Hauhangaroa Range. Smaller areas of rimu-broadleaved forest (F), rimu-tawa forest (D), monoao scrub (mn), and tussockland (ts) were also present.

The estimated proportions of the original ecosystem remaining, and protected, are presented below in Figure 20.

Figure 20 - Taupo ED Ecosystems:



Most ecosystems in this part of the Taupo ED are only moderately depleted. Forests have been removed or modified on the lower slopes of the Hauhangaroa Range but the mid slope and upper slope forests are largely intact and are mostly protected within Pureora CP.

The main opportunities for protection are large areas of broadleaved forest (P) (remaining after logging of L, M, or F forests) west of Tihoi, at the edge of the CP around Whanganui Stream, and on the eastern slopes of Hauhangaroa Mountain west of Te Raina. This latter area also has unprotected montane conifer-broadleaved forest and forms an important forest corridor between the Hauhangaroa Range and Hauhangaroa Mountain. Small areas of unprotected montane conifer-broadleaved forest and tussockland are also present along the Whanganui River.

Small areas of dense podocarp forest (L) appear unprotected on the edge of Pureora CP in the upper Waikino Stream and north of Moerangi, and a small enclave of rimu-broadleaved forest (F) high on the Hauhangaroa Range south of Tuhingamata Mountain is unprotected. The only other significant area of indigenous vegetation that remains unprotected is a large area of regenerating broadleaved forest and shrubland south of Arataki.

Opportunities to protect corridors of indigenous vegetation include the forested strip dividing the CP over Hauhangaroa Mountain (discussed above), and the significant unprotected enclaves west of Tihoi and south of Aratika. There are other longer-term opportunities to protect important enclaves north of Moerangi, which are presently planted in pines.

Summary of Opportunities for Protection

- podocarp forest in Waikino Stream and north of Moerangi;
- rimu-broadleaved forest enclave south of Tuhingamata Mtn;
- logged broadleaved forest west of Tihoi, around Whanganui Stream, and across Hauhangaroa Mtn;
- montane conifer-broadleaved forest on Hauhangaroa Mtn, and along Whanganui Stream;
- tussockland along Whanganui Stream;
- regenerating broadleaved forest south of Aratika;
- linkage across Hauhangaroa Mtn; and,
- enclaves of plantation forest north of Moerangi.

4.0 A STRATEGY FOR FOREST PROTECTION

4.1 INTRODUCTION

The fundamental purpose of a protection strategy for the Waikato Conservancy is to help determine priorities for forest protection. Forest protection proposals must be prioritised so that the limited funds available for forest protection are spent on the most important remnants. Furthermore, not all unprotected forest remnants warrant formal protection. Remnants may be under no immediate threat, may be of low conservation value, or may already be partially protected by difficult access or Resource Management Act provisions.

This section of the report proposes a forest protection strategy for the Waikato Conservancy by assessing the draft *Waikato Conservancy Acquisition/Protection Strategy for Private Land* (section 4.2), other regional forest protection strategies for Northland and the West Coast (section 4.3), and the Forest Heritage Fund's national strategy (section 4.4). The proposed strategy for the Waikato Conservancy is then presented in section 4.5.

4.2 THE EXISTING WAIKATO CONSERVANCY STRATEGY

The existing *Waikato Conservancy Acquisition/Protection Strategy for Private Land* is a draft set of guidelines prepared in 1995 to assist the FHF and DoC to prioritise proposals for protection (Jason Roxburgh, *pers.comm*). The guidelines set out:

- priorities for protection;
- management considerations;
- a process for assessment of potential land acquisitions; and,
- suggested criteria for assessing relative importance.

Priorities for Protection

Two categories are identified, the first listing threatened or under-represented ecosystems, and the second listing other sites or values. Ecosystems in the first category are listed in order of priority as:

- "dune systems;
- lowland wetlands;
- riparian zones;
- wetland forest types;
- coastal forest (by ED); and,
- lowland forest (by type)."

Other sites and values, not in order of priority, are listed as: "special flora/fauna values; archaeological values; historical; cultural; recreational; geological; landscape; and, special management values."

Critical Attributes

Critical attributes for assessing natural or historical values are listed as:

- "connectivity;
- intactness;
- representativeness;
- diversity; and,
- distinctiveness."

Management Considerations

Management considerations are listed as:

- potential fate/risk assessment;
- DoC management responsibilities if the area is acquired; and,
- expected long and short term costs of management.

Process

This sets out the process to be followed when an application or offer is received, including an assessment of the value of the area and an assessment of likely management costs, resulting in either the application being declined or referred on to an agency (such as FHF or QEII) for possible funding.

Suggested Criteria

These are criteria for assessing the significance of the area proposed for protection, including the following:

- representativeness (nationally or within ED);
- presence of unusual vegetation or habitat;
- presence of threatened or endangered species;
- abundance or diversity of species present;
- importance for habitat restoration or species recovery;
- importance for reducing the effects of natural hazards; and,
- size and sustainability.

The four-page strategy is a brief presentation of the Conservancy's priorities for land acquisition and the process by which acquisition (or protection) proposals are assessed. It is useful in that it sets out some clear priorities and therefore provides staff with some direction when responding to, or seeking out, land acquisition or protection proposals.

Its main limitations are that it does not determine the relative priorities of similar ecosystems in different ecological districts, and it does not place relative values on the different criteria listed. Therefore, while it identifies some priorities, it may be of limited help in determining the merit of one proposal against another. Also, while the strategy identifies some important sustainability criteria (such as size, linkages and buffering) it does not determine how these should be ranked in importance when considering protection proposals.

The Conservancy also has a list of important managed ecosystems which was developed as part of wild animal management. This list was used, and separated into nationally and regionally important areas, for the identification of plant pest control priorities (Harding 1996), and is reproduced in Appendix 2. While useful for determining priorities for management, the lists are of peripheral value in setting priorities for land acquisition as they focus on sites that are already administered by DoC.

Discussions with staff in the Waikato Conservancy office, Field Centre Managers in the Conservancy, and other local specialists, identified the following general priorities for ecosystem protection in the Waikato Conservancy (not listed in order of priority):

- linkages between PNAs on the Coromandel Peninsula (along the Coromandel and Kaimai Ranges);
- linkages between PNAs in the western King Country (from the Herangi Range to Pirongia);
- linkages between and buffering of PNAs on the volcanic plateau (Pureora CP);
- restoration of floodplain kahikatea forest;
- enclaves within PNAs, especially Pureora CP and on the Coromandel Range;
- forests on karst in the western King Country;
- podocarp-rich forests on pumice soils on the volcanic plateau;
- forested areas east of Raglan Harbour;
- coastal forest linkages around Karioi;
- catchment protection around Waitomo and around Aotea Harbour;
- dunelands;
- estuaries, including mangrove forest, especially on Coromandel Peninsula;
- offshore islands for forest restoration and predator-free habitats;
- secondary forest with important wildlife habitat (especially on the Coromandel Peninsula and in the western King Country);
- riparian and lake margin vegetation;
- peat-dome vegetation; and,
- coastal forest, especially pohutukawa and puriri-dominated forest.

4.3 OTHER REGIONAL STRATEGIES

Two other regional protection strategies are relevant to the preparation of this strategy for the Waikato Conservancy and are discussed below:

Northland Conservancy Strategy

This unpublished document was prepared by Peter Anderson (DoC, Whangarei) in 1995 to assist the Conservancy and the FHF to determine priorities for protection. It describes the major ecosystem types, assesses how depleted they are, and then lists them in one of six priority classes.

This strategy is useful in that it assesses the proportion that remains of the seriously depleted ecosystems and clearly lists these different ecosystems in order of priority for protection. It also breaks the ecosystems down into habitat types, so that their relative importance for species protection can be assessed.

The main apparent limitation of the strategy is that it does not differentiate between different ecological districts. This may not matter if the priority setting is limited to reacting to a limited number of proposals, but if many proposals - or two very similar proposals - are being assessed, it may be more difficult to determine relative priorities.

West Coast Conservancy Strategy

This document, *The Protected Status of West Coast Ecosystems* (Harding, 1994b), was prepared to assist the FHF and DoC to prioritise proposals for forest protection in the West Coast Conservancy. It assesses the extent of each of the original forest ecosystems remaining in each ecological district and identifies opportunities to protect further areas of these ecosystems. The document lists two sets of priorities based on sustainability (functioning ecosystems and landscapes) and representativeness.

The document is comprehensive in the sense that it systematically analyses the Conservancy on the basis of ecological districts, and sets out some clear - and ranked - priorities for protection. Its main limitation is that it is based on estimates derived from maps and aerial photographs. The document has been useful in assisting the FHF and DoC to target their forest protection efforts on the West Coast. However, the document is the result of considerably more work than the other regional strategies described above.

4.4 THE FOREST HERITAGE FUND'S NATIONAL STRATEGY

This report, *Implementing Biodiversity Conservation: An Assessment of the Strategic Direction of the Forest Heritage Fund* (Harding, 1994a), sets out the history, operation and achievements of the FHF, assesses its strategic direction, and then proposes a vision for the Fund. It is based on consultation with DoC Conservancies, key NGO representatives, and nature conservation practitioners, along with an assessment of contemporary conservation theory and legislation. The report concludes that the FHF has been an effective agency for forest protection and that it has been prioritising applications for funding according to sound conservation principles.

An important part of the report is the development and presentation of a set of criteria for the assessment of applications for forest protection funds. These criteria are split into four sets:

- representativeness
- sustainability
- landscape integrity
- amenity/utility

Representativeness

The extent to which the area proposed for protection is representative of the full range of community variation that was originally present in the natural landscape, including:

- both commonplace and rare indigenous species, habitats, and communities;
- the ecological processes that link them; and
- the extent to which the ecosystems are already protected in the proportion they were originally present in the ecological district.

Sustainability

The extent to which the area proposed for protection is likely to continue to be viable and evolve in a natural way in the long term, including the extent to which area is:

- protected by its size and shape;
- buffered from the effects of adjoining land uses or activities;
- linked to or dependent on other protected areas(either physically or by ecological processes) for its continued viability;
- expected to maintain its ecological integrity through major natural disturbance events;
- resilient to the depredations of introduced species;
- able to be managed to protect its ecological values; and
- expected to contribute to sustaining existing protected areas, through additional scale, buffering, linkages or restoration.

Landscape integrity

The extent to which the area proposed for protection contributes to and maintains the original integrity of the landscape, including the extent to which it:

- protects the original character;
- protects the original context;
- protects the range of processes that link the ecosystems present;
- maintains the natural nutrient cycles, energy flows, and hydrological regimes;
- maintains the functional coherence of the original and remaining natural landscape values;
- protects an uninterrupted ecological sequence; and
- eliminates unprotected enclaves in an otherwise protected landscape.

Amenity/Utility

The extent to which the area proposed for protection would contribute to the physical and spiritual welfare of the local people, including its contribution to:

- protecting aesthetic coherence and pleasantness;
- conserving soil;
- maintaining water quality and yield;
- providing for recreation or tourism; and
- providing for physical, social, and spiritual renewal.

These criteria have been used in the Fund's application form to encourage applicants to consider the full range of factors affecting the conservation of the site they seek to protect, and to ensure they present sufficient information for effective consideration of their application by the Fund's committee. The criteria also assist the prioritising of the many different applications received by the FHF.

4.5 A FOREST PROTECTION STRATEGY FOR THE WAIKATO CONSERVANCY

This strategy for forest protection in the Waikato Conservancy draws from the methodology and techniques used in the West Coast, Northland, and (existing) Waikato Strategies, and is guided by the criteria established in the Forest Heritage Fund's national strategy. Further information on the theoretical basis of the ranking criteria listed below is contained in the FHF national strategy document (Harding, 1994a).

This strategy for the Waikato Conservancy proposes that unprotected ecosystem remnants be assessed against three sets of criteria, condensed from the FHF national criteria:

- **representativeness;**
- **sustainability; and,**
- **landscape integrity and amenity.**

This assessment will enable agencies to determine the relative importance of each application for nature conservation, and therefore the relative priority of the remnant for funding or any other protection initiative. In addition to assessing the value for nature conservation using this strategy, protection agencies are expected to take into account current opportunities for forest protection, existing threats to forest remnants, and the probable costs of forest management. These issues are discussed further on pages 59 and 60.

Ranking individual protection proposals

This strategy proposes that protection proposals are assessed against nine attributes; three attributes for each of the sets of national criteria.

Representativeness
- modification
- depletion
- habitat

Sustainability
- connectivity
- size and shape
- viability

Landscape Integrity and Amenity
- landscape integrity
- amenity
- importance of site

The ranking of each site or protection proposal could be undertaken by simply allocating a 'high', 'medium', or 'low' ranking, or by allocating a numerical score, for each of the nine attributes. Ranks or scores for each attribute can then be added together to provide a total value or score for the site, enabling a comparison with other sites or protection proposals. Each of the nine attributes, and their suggested application, is discussed on the following pages. Priority scores are intended to guide, rather than rigidly pre-determine, ecosystem protection priorities. Final protection priorities should include consideration of current opportunities and threats, and likely ongoing management costs.

Explanation of Ranking Criteria

I - Ecosystem Modification: This criterion ranks remnants by the extent to which the vegetation at the site is modified, as the aim of this strategy is to protect remnants of original (pre-human) ecosystems. All vegetation in the Waikato Conservancy is modified to some extent, because of the depredations of introduced species. However, for the purposes of this criterion, forest which is structurally intact ranks high. Primary forest which has been logged - usually podocarps or kauri removed - ranks moderate, as it still retains some of the original vegetation and there is, in most cases, a good chance of forest recovery. Regenerating forest ranks low as the original vegetation has been lost. The fact that regenerating forest may be very important as wildlife habitat or for linking existing PNAs is recognised under criteria III and IV respectively.

II - Ecosystem Protection: This criterion ranks remnants according to the amount of the original ecosystem protected in the ecological district, as calculated in section 3.0 of this report. Remnants of ecosystem types that are seriously depleted (less than 5% of the original extent protected) rank high, whereas remnants of ecosystem types that are still relatively widespread (more than 25% of the original extent protected) rank low. Remnants of logged forest, or secondary vegetation, are considered to be representative of the original ecosystem at that site for the purposes of this criterion. For example, logged rimu-tawa forest (ecosystem type N) is given the same depletion ranking as intact rimu-tawa forest (ecosystem type D), as it has the potential to regenerate to its original state. Besides, only the percentage loss of original ecosystems is calculated in section 3.0 of this report.

III - Importance of Habitat: This criterion ranks remnants according to the value of the remnant as wildlife habitat. Remnants rank high if they are within or adjoining the areas identified by DoC as nationally important areas for animal or plant pest control, and rank moderate if associated with regionally important areas (listed in Appendix 2). This criterion recognises the importance of vegetation as wildlife habitat, regardless of how well it represents the original ecosystems.

IV - Connectivity: This criterion ranks remnants according to how well the remnant contributes to the overall sustainability of ecosystem protection by linking or buffering existing PNAs. The linking of PNAs by intact habitat corridors is now considered a fundamental principle of reserve design (Noss and Cooperrider, 1994) and critical for the effective dispersal or seasonal movement of some species. The concept of connectivity has been incorporated into ecosystem protection proposals on a national scale in North America (eg. Noss, 1992) and on a regional scale in the West Coast Conservancy (O'Donnell, 1991). For this criterion, remnants which link PNAs to one another, or to the coast or large waterbodies, rank high, as do areas which are enclaves (surrounded on at least three sides by protected ecosystems) within existing PNAs. Areas adjoining (buffering) PNAs rank moderate, and areas which are isolated rank low.

V - Size and Shape: This criterion ranks remnants according to how well size and shape protects the remnant from edge effects such as plant pest invasion, or exposure to light and wind. Recent studies undertaken in the North Island indicate that the penetration of gross microclimatic edge effects is about 50 metres, and that regularly-shaped remnants smaller than 9 hectares are dominated by edge effects (Young and Mitchell, 1994). For this reason remnants smaller than 10 hectares, or narrow or disjointed remnants smaller than 50 hectares, rank low. Conversely, remnants larger than 100 hectares, or circular-shaped remnants between 50 and 100 hectares, rank high.

VI - Viability: This criterion ranks remnants according to the threat posed by aggressive introduced plants and animals. Although management considerations (such as the cost of fencing or pest control) are expected to be considered alongside (rather than part of) this ranking strategy, it is valuable to consider the long term viability of remnants which are obviously threatened by introduced species. Large intact remnants of original forest are generally considered resilient and rank high. Logged forests, or forests with a high component of broadleaved species, are generally considered only partially resilient and rank moderate. Small isolated forest remnants, coastal forest, secondary vegetation, wetland and estuarine vegetation are generally considered susceptible and rank low, unless the remnants are large and well-buffered.

VII - Landscape Integrity: This criterion ranks remnants according to how well they contribute towards the protection of the character and context of the landscape. Remnants that contribute significantly to maintaining the functional coherence of the original landscape by protecting energy flows, nutrient cycles, hydrological regimes, linkages, and uninterrupted ecological sequences rank high. Conversely those remnants that are not integrated with surrounding landscape components, or are discrete or incongruous, rank low.

VIII - Amenity: This criterion ranks remnants according to the degree to which they contribute to amenity values including: soil and water conservation; water quality and yield, scenery protection, recreation and tourism, scientific use, and spiritual or cultural values. Remnants rank high if they contribute significantly to the protection of these attributes, and rank low if their contribution is insignificant. This criterion is a catch-all for the direct uses made of, or values placed on, remnants by the local and regional community. Remnants in nationally important areas, listed in Appendix 2, rank high, and in regionally important areas rank moderate.

IX - Importance of Site: This criterion ranks remnants according to the value of the site for nature conservation, or the protection of historic or cultural values. Sites that have been selected as Special Sites of Wildlife Interest (SSWI), Wetlands of Regional Importance (WERI), Geopreservation sites, RAPs, urupa, or waahi tapu, rank high. Sites of local importance rank moderate, and sites of no particular value rank low.

Opportunities, Threats, and Other Considerations

Opportunities: This ranking strategy aims to identify priorities for ecosystem protection based on the three main principles of representativeness, sustainability, and landscape/amenity. The opportunities that exist for ecosystem protection are not included in the ranking system because opportunities are usually site-specific and ephemeral. In fact most applications for funding for ecosystem protection arise from particular circumstances, such as the proposed sale of property or the desire of a sympathetic landholder to protect remnants of indigenous vegetation. Furthermore, opportunities are usually quite apparent. It is expected that current opportunities will determine which areas are proposed for protection.

Threats: Threats to indigenous ecosystems are a critical concern of the FHF and DoC; the FHF was established in response to the widespread and continuing loss of native forest. Criterion VI in this strategy assesses the ongoing threats posed by introduced plants and animals. Other threats, such as forest clearance, usually affect particular areas or even specific sites. These threats change with the evolving economic conditions in a region and the development or adoption of new industries or land uses such as dairying, forestry, or coastal subdivision.

Obvious current threats (other than introduced species) to indigenous forest in the Waikato Conservancy include: modification and drainage of land for dairying; establishment of plantation forests on hill country; modification of indigenous forest for timber production; clearance of secondary forest (and original forest in some situations) for firewood; subdivision and clearance of land for lifestyle blocks or holiday resorts, especially on coastal sites; and, further removal or fragmentation of scattered or regenerating forest for farmland. Frequently, restrictions are developed in response to such threats through legislation (such as the Forests Amendment Act 1993) or controls (such as District Plan rules under the Resource Management Act 1991). The best people to predict or assess such threats are usually DoC staff, Council planners, and local conservationists. Furthermore, it is expected that the current degree of threat to a particular remnant will be an important consideration, and a further selection criterion, for decision making by funding agencies.

Management Considerations: During discussions with DoC staff in the preparation of this strategy it was clear that the cost and practicality of reserve management was a very important concern, especially as most areas acquired for nature conservation are eventually administered by DoC. Limited budgets, shortages of field staff, and the extent and complexity of the threats facing forest remnants, mean that the ability to effectively manage PNAs is a major issue. However, it is beyond the scope of this document to predict and cater for operational needs. The strategy does address this concern in part, by giving priority to remnants that are large, well-buffered, and resilient to plant and animal pests. Any further assessment of PNA management will need to be provided by DoC managers, or other applicants, at the time funding applications are prepared (such as is proposed in the existing Waikato strategy 'guidelines').

Forest Restoration: Some ecosystems in the Waikato Conservancy, notably lowland and coastal ecosystems, are dramatically depleted and protected remnants are frequently small and compromised. The key to the long term protection of these, and other more-widespread, ecosystems is restoration. This strategy does not rank restoration prospects except peripherally as part of the assessment of habitat importance (criterion III), connectivity (criterion IV), landscape integrity (criterion VII), and amenity values (criterion VIII). This is not to deny the importance of restoration efforts but, rather, to acknowledge the difficulty of identifying and assessing restoration prospects. This ranking strategy is not intended to rank landforms based on their value for the eventual restoration of 'lost' ecosystems.

National Importance: It is widely acknowledged that certain ecosystems in the Waikato Conservancy are (or were) nationally important for nature conservation. The three most widely recognised ecosystems are:

- lowland floodplain podocarp (kahikatea-dominated) forests;
- central plateau dense podocarp forests; and,
- podocarp hardwood (rimu-tawa) forests on karst in the western King Country.

Also rated as important, though not as important as the above, are coastal forests, especially on the Coromandel Peninsula. This strategy recognises the national importance of those three ecosystems by automatically ranking remnants of these systems, where they are still present, high for importance of habitat (criterion III) - provided they are larger than 10 hectares - and high for amenity value (criterion VIII) due to their cultural, scientific and recreation/tourism value.

Type of Protection: This strategy makes no assessment, in the ranking criteria, of the most appropriate type of protection for forest remnants. The important role of the QEII Trust in the protection of (usually) smaller remnants in more modified landscapes, and the building of awareness and support for forest protection (and dedicated forest management by owners) in rural communities, is acknowledged. Also acknowledged is the increasingly important role of District Councils in the protection of indigenous vegetation, Environment Waikato in the support of Landcare Groups such as the Waitomo Catchment group, and community-based protection and advocacy groups such as the Native Forests Restoration Trust and the Royal Forest and Bird Protection Society. The benefits of retaining large and/or important areas of indigenous vegetation in public ownership for administration and management by a professional and accountable public agency are also recognised.

5.0 GENERAL PRIORITIES FOR FOREST PROTECTION

5.1 INTRODUCTION

This section of the report identifies some general priorities for forest protection in the Waikato Conservancy. It draws from the assessments in section 3.0, and the strategy in section 4.0, to highlight the priorities for protection of a representative and sustainable protected natural areas system in the Waikato Conservancy.

Firstly the extent to which the existing protected natural areas system in the Waikato is representative of the original ecosystems is presented, in summary, in section 5.2. These data are drawn from the anlayses of each ecological district in section 3.0, and are summarised in Table 19. The table also contains a summary of the extent to which ecosystems are protected in each ecological region. The major ecosystems present in the Waikato Conservancy are then discussed separately, and comparisons are made between the seven ecological regions (Figures 21 to 26). General priorities for the protection of representative areas are outlined for each major ecosystem.

Secondly, the priorities for achieving sustainable protection of indigenous ecosystems in the Waikato Conservancy are discussed in section 5.3, based on the requirements outlined in the Forest Heritage Fund's national strategy and on the proposed Waikato Strategy set out in section 4.0.

Finally, a summary of general priorities for protection is presented in section 5.4. This summary is based on the priorities for both representativeness and sustainability (from sections 5.2 and 5.3) and general priorities for landscape and amenity.

Note that this part of the report only proposes general priorities for protection. It is not appropriate to identify specific sites or individual landholdings, especially when the information that forms the basis of this report is largely derived from aerial photography, topographical maps, and published reports. More specific priorities for protection of indigenous ecosystems can be determined by using the strategy in section 4.0 to prioritise specific opportunities for protection identified in section 3.0 of this report, or those identified by some other means. However, the relative value of any sites identified should be confirmed by field surveys, and the current threats to the site and opportunities for protection should be assessed.

5.2 REPRESENTATIVE ECOSYSTEMS:

The extent to which ecosystems are protected in each ecological district and each ecological region is summarised below in Table 19. Note that not all ecosystems are summarised in the table, and that logged kauri forests (A,B,C) are regarded as if they represent the original ecosystem, as outlined in section 2.3. Also note that the data for ecological districts and regions that lie only partly within the Waikato Conservancy cannot be regarded as representative of the whole district or region.

Table 19 - Extent of Original Ecosystems Protected for Ecological Regions and Districts:

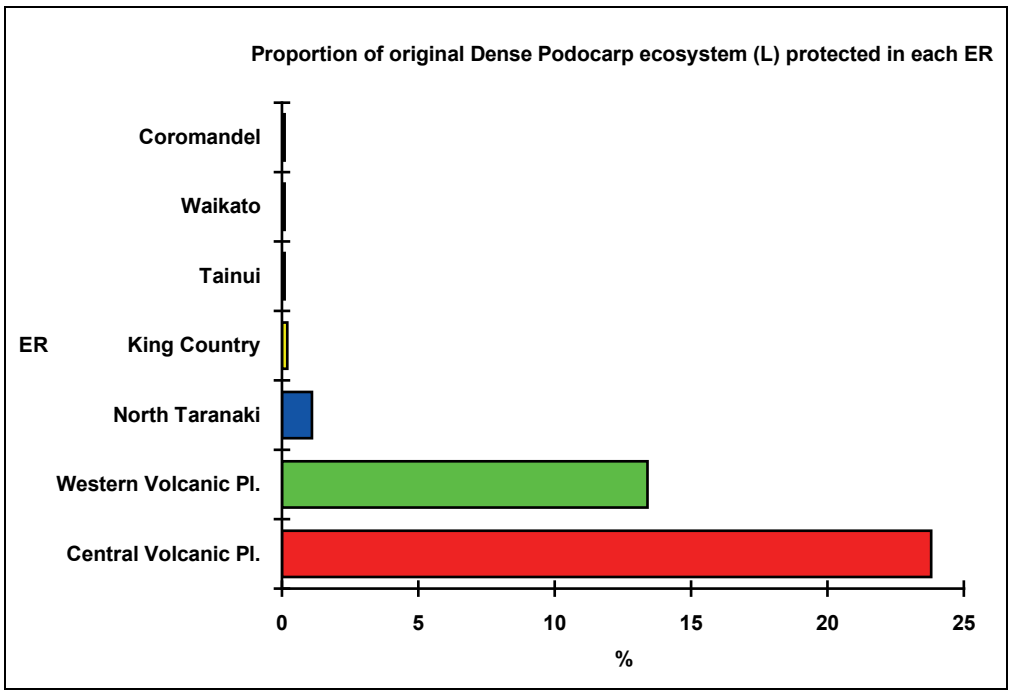
Ecological Region/ District	**Extent of Original Ecosystem Protected (%)**									
	kauri (A,B,C)	rimu - tawa (D)	rimu-broad. (F)	mon-tane (G)	tawa-beech (H)	podo-carp (L)	rimu-matai (M)	coas -tal (P2)	wet-land	Average
Coromandel Ecological Region										
Colville	17.4	75.7		86.9		< 0.1		3.9	< 0.1	30.7
Mercury Is.								25.0		25.0
Thames	36.2	79.8		100.0		< 0.1		0.9	< 0.1	36.2
Tairua	18.5	24.5		46.7		< 0.1		1.4	< 0.1	15.2
Waihi	12.7	24.7		29.6		< 0.1		2.8	< 0.1	11.7
Average for ER	21.2	51.2		65.8		0.1		6.8	0.1	
Waikato Ecological Region										
Meremere	0.3	4.6				0.4			18.6	6.0
Hapuakohe	0.9	35.8				< 0.1			< 0.1	9.2
Hauraki	0.0	0.0				0.2			32.4	8.1
Hamilton	0.5	0.0				0.1			0.3	0.2
Hinuera	0.0					< 0.1			< 0.1	< 0.1
Maungatautari		4.9		100.0		0.0				35.0
Waipa		0.0				< 0.1			< 0.1	< 0.1
Average for ER	0.3	7.6		100.0		0.1			8.6	
Tainui Ecological Region										
Raglan	0.4	1.5				0.4				0.8
Kawhia		13.7		100.0		0.0			14.4	32.0
Herangi		30.1		94.2	1.2	0.0			< 0.1	25.1
Average for ER	0.4	15.1		97.1	1.2	0.1			7.2	
Taranaki Ecological Region										
North Taranaki		22.4		13.6	3.8	1.1				10.2
Average for ER		22.4		13.6	3.8	1.1				
King Country Ecological Region										
Waitomo		4.4			0.5	0.1			< 0.1	1.3
Taumarunui		7.3	16.7	60.0	6.1	0.3	25.0		< 0.1	16.5
Average for ER		5.8	16.7	60.0	3.3	0.2	25.0		0.1	
Western Volcanic Plateau Ecological Region										
Ranginui		6.0		90.0		0.0	0.0			24.0
Pureora		30.0	50.0	90.0		40.0	30.0			48.0
Tokoroa		0.0				< 0.1	0.0		< 0.1	< 0.6
Average for ER		12.0	50.0	90.0		13.4	10.0		0.1	
Central Volcanic Plateau Ecological Region										
Atiamuri		0.0				0.0	0.0		< 0.1	< 0.1
Taupo		25.0	47.5	90.0		47.5	33.0			48.6
Average for ER		12.5	47.5	90.0		23.8	16.5		0.1	
Average	**8.7**	**19.5**	**38.1**	**75.1**	**2.9**	**4.3**	**17.6**	**6.8**	**4.2**	

Dense Podocarp Ecosystem (L):

Even a cursory analysis of the Waikato Conservancy reveals that lowland ecosystems have suffered the greatest depletion, as they have in most other parts of New Zealand. Less than 1% of the original extent of dense podocarp forest (L) is protected in 18 of the 21 ecological districts in the Conservancy that supported this ecosystem (Table 19). In these 18 districts there is little opportunity to protect further remnants as, at the most, only 6.4% of the extent of the original ecosystem remains. The only ecological districts with more than 25% of the original extent of dense podocarp forest remaining are Pureora and Taupo EDs on the central volcanic plateau.

Analysed by ecological region, only the Central Volcanic Plateau and Western Volcanic Plateau ERs have a significant proportion of the original dense podocarp ecosystem protected (Figure 21). While this ecosystem has been extensively depleted in the remaining ERs, the loss has been greatest in the Waikato ER where dense podocarp forest once covered a significant part of the region. Unfortunately opportunities for the further protection of this ecosystem in lowland areas, such as the Waikato ER, are limited to small isolated remnants or to long-term restoration initiatives.

Figure 21 - Extent of the Original Dense Podocarp Ecosystem Protected by Ecological Region:



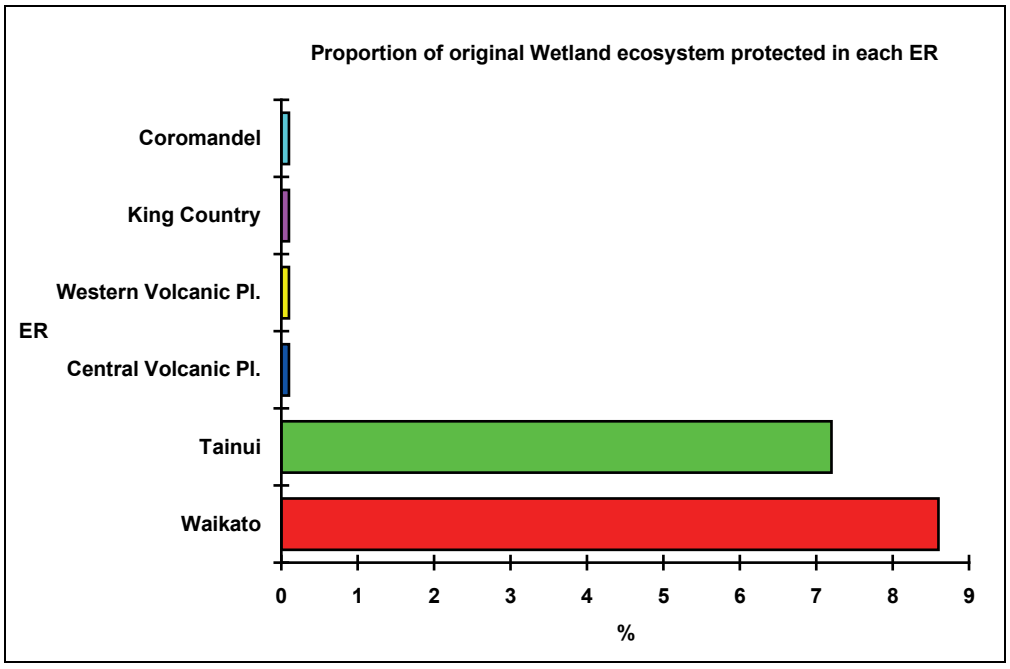
Priorities for the further protection of this ecosystem are lowland remnants larger than 10 hectares or smaller remnants that are linked or very close to other intact (and preferably protected) forests. Also a priority is the re-establishment of lowland dense podocarp forest through long-term restoration programmes. Priority areas for protection or restoration are all EDs within the Waikato ER, low-altitude parts of all EDs within the Coromandel, Tainui, Taranaki, and King Country EDs, and areas adjoining protected forest in the Ranginui ED.

Wetland Ecosystem:

Similarly, wetland vegetation is seriously depleted, with less than 1% of its original extent protected in 13 of the 16 EDs that supported this ecosystem (Table 19). Only in Hauraki ED is more than 25% protected - in the extensive Kopuatai Wetland Management Reserve. Again, there are very limited opportunities for further protection, as the landscape on the lowland floodplains has been almost totally transformed and only scattered remnants of the original ecosystems remain.

Analysed by ecological region, only the Waikato and Tainui ERs have a significant proportion of the original wetland ecosystem protected (Figure 22). However, the extent of the loss in the low-lying Waikato ER has also been the greatest, as this area previously supported extensive wetlands. The extent of the loss in the other ERs is more difficult to quantify, due to the limitations of the data used in this analysis. Again, opportunities for the further protection of wetland ecosystems are very limited. Even though altering hydrological regimes to recreate wetlands is not difficult, these areas generally support highly productive agricultural activities.

Figure 22 - Extent of the Original Wetland Ecosystem Protected by Ecological Region:

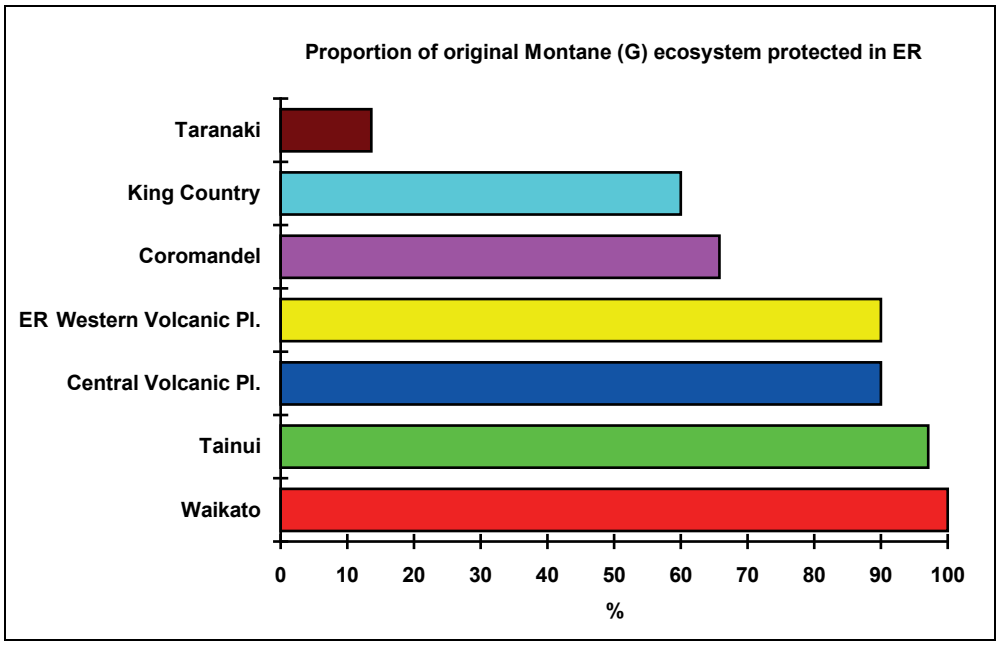


Priorities for the protection or restoration of wetland ecosystems are all areas where the hydrological regime is still relatively intact and introduced species, such as willow, are not dominant. Priority areas for further wetland protection are all EDs in the Coromandel, Waikato, and King Country ERs.

Montane Ecosystem (G):

Conversely, montane and subalpine ecosystems have suffered less. More than 25% of the original extent of montane conifer-broadleaved forest (G) is protected in 11 of the 12 ecological districts that supported this ecosystem, and in some districts 100% is protected. Analysed by ecological region, all ERs have a significant proportion of montane forests protected. However, data for the Waikato and Taranaki ERs is misleading, as only very small areas of this ecosystem were present in the Waikato ER, and only a small part of the Taranaki ER is covered in this analysis.

Figure 23 - Extent of the Original Montane Ecosystem Protected by Ecological Region:



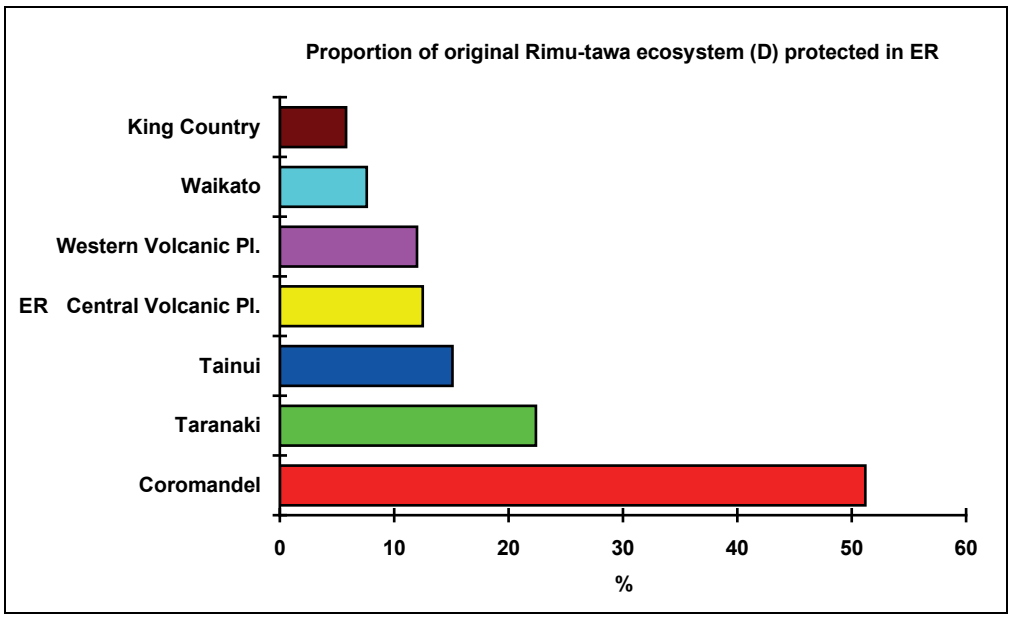
Priorities for further protection of montane ecosystems are enclaves within existing protected areas, and higher-altitude corridors which link protected areas. Priority areas for protection of such montane linkages and enclaves are the northern EDs in the Coromandel ER, and in the Herangi, North Taranaki, Taumarunui, and Taupo EDs,

Rimu-tawa ecosystem (D):

The extent of rimu-tawa forest (D) remaining is more variable, with more than 25% of the original extent of this ecosystem protected in five EDs (in the southwest and on the Coromandel Peninsula) but with less than 5% protected in eight EDs. The best opportunities for further protection are in the Waihi, Raglan, Herangi, and North Taranaki EDs. However, there are other opportunities for the protection of extensive areas of logged rimu-tawa forest (N), notably in the Hapuakohe, Maungatautari, Raglan, Kawhia, Herangi, Waitomo, and Ranginui EDs.

Analysed by ecological region, rimu-tawa forest is best protected in the Coromandel ER, with relatively good protection in the Tainui, Taranaki, and Volcanic Plateau ERs. The King Country and Waikato ERs have suffered the greatest depletion.

Figure 24 - Extent of the Original Rimu-Tawa Ecosystem Protected by Ecological Region:



Priorities for protection are the larger remnants in the Waikato hill country, especially in the west and south. Highest priority are those which link or buffer existing protected areas, and those which are buffered by large areas of logged rimu-tawa forest (N). Priority areas for protection are the more extensive remnants in the western King Country, especially in the Raglan, Kawhia, Waitomo, and Herangi EDs. Also important are areas in the Hapuakohe, Maungatautari, and Ranginui EDs which link existing protected natural areas.

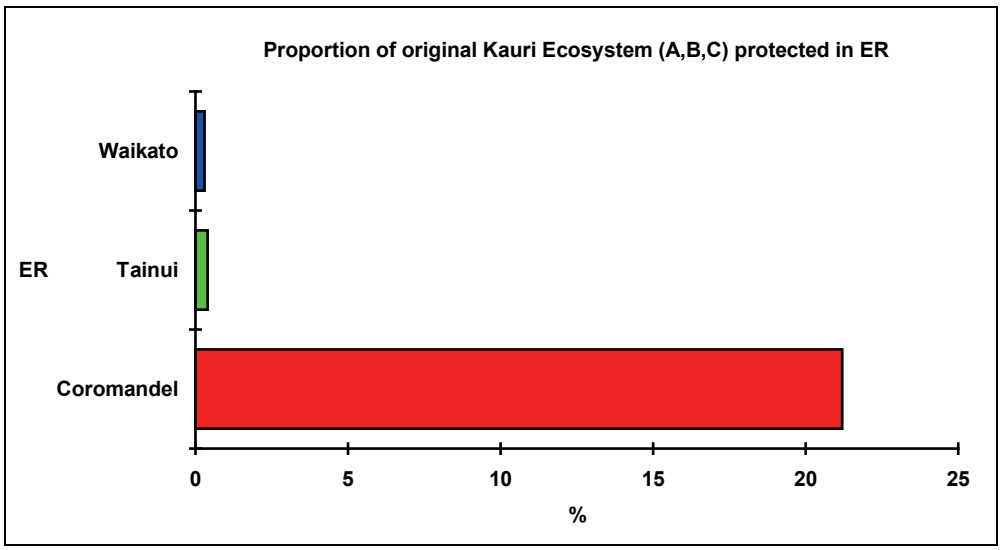
Kauri Ecosystem (A,B,C):

Kauri forests have also suffered severe depletion, with only minor areas of original kauri forest remaining. There are considerable areas of logged (and strongly regenerating) kauri forest protected in the Coromandel ER (more than 5% in four EDs), but less than 1% of kauri forest is protected (and less than 3% remains) in six northeastern EDs (Table 19). Logged kauri forest (A,B,C) has been analysed as if it represents the original ecosystem in these calculations, as original kauri forest is virtually absent and regenerating kauri forest contains many of the components of the original ecosystem.

There are significant opportunities for the protection of further (regenerating) kauri forest in the Colville, Thames, Tairua, Waihi, and Hapuakohe EDs, though opportunties elsewhere are limited to very small remnants.

Analysed by ecological region, only the Coromandel ER has a significant proportion of kauri forest protected. In both the Waikato and Tainui ERs less than 1% is protected. Kauri is at its natural southern distributional limit in the Waikato Conservancy, so no kauri forest was present in the southernmost ERs.

Figure 25 - Extent of the Original Kauri Ecosystem Protected by Ecological Region:



Priorities for the protection of kauri forest area are remnants that link or buffer existing protected natural areas, and especially those at lower altitudes and those rare examples where original old kauri trees are still present. Priority areas for further protection are along the Coromandel Range and, to a lesser extent, on the Hapuakohe Range.

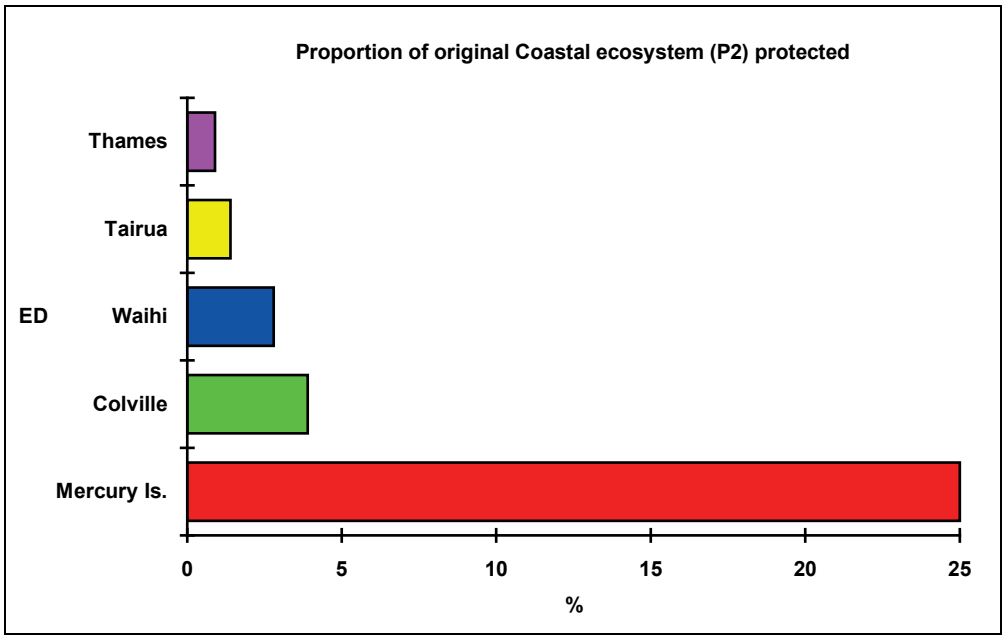
Coastal Forest Ecosystems (P2):

Coastal forest systems (P2) are also depleted, with less than 5% of the original ecosystem protected where it is mapped in four of the five Coromandel Peninsula EDs. Coastal forests on the western coast of the Conservancy are also depleted, though have not been mapped separately for this analysis. The only ecological district where more than 5% of the coastal forest system (as mapped) is protected is the Mercury Islands ED. Elsewhere on the Coromandel Peninsula they are best protected in the Colville ED (3.9%) and Waihi ED (2.8%).

Opportunities for protection of coastal forests are limited to areas on the northern and eastern coasts of the Coromandel Peninsula, and isolated areas along the western coastline.

Analysis by ecological region is not possible, but the extent of depletion of coastal forests on the western coastline of the Conservancy is probably similar to that in the Coromandel ER. The extent of depletion in the ecological districts of the Coromandel ER is compared in Figure 26 below.

Figure 26 - Extent of the Original Coastal Ecosystem Protected in the Coromandel ER:



Priorities for the protection are areas of coastal forest on both the Coromandel Peninsula and the Conservancy's western coast which link other forest systems to the coast.

5.3 SUSTAINABLE PROTECTION

The sustainability or viability of protected natural areas is a key consideration in determining priorities for ecosystem protection. In this section general priorities for sustainable protection are listed. These priorities are based on the concepts and criteria set out in the Forest Heritage Fund's national strategy (Harding, 1994a), comments from DoC staff and other specialists, and from the protection priorities identified in this report. These priorities are listed below, generally from north to south in the order that areas are analysed in section 3.0:

- linkages between, and enclaves within, PNAs along the Coromandel Range;
- linkages between montane areas and the coast on the Coromandel Peninsula;
- estuaries and estuary buffers on the Coromandel Peninsula;
- buffers of regenerating forest or shrubland around intact kauri or rimu-tawa remnants on the Coromandel Peninsula;
- restoration of depleted wetlands in the lower Waikato River basin;
- restoration of dense podocarp forest on islands in the lower Waikato River;
- linkages between PNAs on the southern Hapuakohe Range;
- low altitude buffers of regenerating forest or shrubland around protected forest on the Hapuakohe Range;
- restoration of podocarp forest in wetlands and along rivers on the Hauraki Plains;
- enclave of rimu-tawa forest on Maungatautari Mountain;
- linkages between scattered tawa forest on hill country around Maugatautari Mountain;
- linkages east of Raglan Harbour (around Karakariki SR);
- linkages along and south of the Hakarimata Range;
- restoration of forest around Raglan Harbour;
- low altitude buffers and coastal linkages around Mt Karioi;
- low altitude buffers around Mt Pirongia;
- extensive forest linkages on hill country between the Herangi Range and Mt Pirongia;
- catchment protection around Aotea Harbour;
- forest and shrubland linkages and buffers on the southern Herangi Range;
- low altitude and coastal linkages and buffers on hill country north of the Marokopa R.;
- linkages between the Herangi Range and Moeatoa, Te Marama, and Huikomako SRs;
- linkages and buffers in the Mangaawakino Stream and upper Mokau River catchments;
- buffers and linkages protecting dense podocarp forest along Mangapu Stream;
- linkages between PNAs on hill country within the Waitomo ED;
- catchment protection around Waitomo;
- linkages across Hauhangaroa Mountain;
- linkages between, and buffers around, PNAs around Mapara and Benneydale;
- corridors along the Waipa River linking Pureora CP with Oturu SR;
- buffers north and west of Mangatutu EA;
- linkages between hill country remnants around Ngaroma;
- low altitude buffers around the Hauhangaroa Range;
- enclaves within Pureora CP on Titiraupenga, south of Ketemaringi Mountain, and south of Tuhingamata Mountain; and,
- potential linkages between Pikiariki EA, the Hauhangaroa Range, and Waipapa EA.

5.4 GENERAL PRIORITIES FOR FOREST PROTECTION

The general priorities for forest protection listed below are drawn from the priorities identified sections 5.2 and 5.3. This list is intended to simply highlight important priorities for the Waikato Conservancy. Any assessment of individual proposals for protection should utilise the more detailed analysis in section 3.0, be guided by the strategy in section 4.0, and take into consideration the current opportunities and threats.

First Priority:

- lowland **dense podocarp** remnants greater than 10 hectares, or smaller remnants close to intact forest, in the Waikato, Tainui, and King Country ERs;
- lowland **wetland systems** in the Waikato ER where hydrological regimes are relatively intact and introduced plants are not dominant;
- riparian vegetation buffering **intact estuaries**;
- intact or strongly regenerating **kauri forest** remnants greater than 50 hectares, or smaller remnants linking intact forest, in the Waikato and Tainui ERs;
- intact or strongly regenerating **coastal forest** greater than 50 hectares or smaller remnants linking intact forest to the coast or linking existing PNAs;
- **montane forest** greater than 50 hectares, or smaller remnants linking areas of intact forest in the King Country and Western Volcanic Plateau ERs;
- enclaves within **Pureora CP** (and Waipapa, Mangatutu, and Waihaha EAs), and areas linking or buffering any of these EAs; and,
- intact **montane forest** remnants larger than 100 hectares.

Second Priority:

- **wetland or riparian vegetation** which links or buffers intact forests or wetlands;
- **montane forest** greater than 50 hectares, or smaller remnants linking intact forest, on hill country;
- strongly regenerating forest or shrubland **buffering** existing PNAs in the King Country. Western Volcanic Plateau, and Central Volcanic Plateau ERs;
- **enclaves** within PNAs, or corridors linking PNAs, in the Coromandel, Waikato, Tainui, and Taranaki ERs;
- forests providing protection for **catchments** of major estuaries or cave systems in the Tainui and King Country ERs;
- areas of forest providing critical **habitat for threatened species**; and,
- forest remnants with significant **amenity or landscape** value.

Third Priority:

- isolated areas of montane or coastal forest smaller than 10 hectares;
- regenerating forest or shrubland with long-term conservation potential;
- restoration of wetlands and forests from depleted systems where ongoing management will be required to achieve the desired outcome;
- forests or shrublands that buffer isolated PNAs; and,
- wetland, estuarine, or podocarp vegetation with significant plant pest infestations.

6.0 REVIEW OF EXISTING PROPOSALS FOR PROTECTION

6.1 INTRODUCTION

In this section existing proposals for the protection of indigenous vegetation for nature conservation are reviewed. This review has been undertaken to ensure that earlier recommendations for forest protection are considered when assessing future protection priorities. Proposals reviewed include:

- Forest Heritage Fund applications (s.6.2);
- Land Acquisition Fund (DoC) applications (s.6.2);
- Protected Natural Areas Programme recommendations (s.6.3);
- West Waitomo Conservation Park proposal (s.6.4); and,
- District Plan provisions (s.6.5).

Current applications to QEII for Open Space Covenants are not included in this analysis as information is not readily available for unregistered covenants. Registered Open Space Covenants are analysed, along with other protected natural areas, in section 3.0. Neither are recommendations for additions to scenic reserves analysed, as no Waikato Scenic Reserves reports, such as exist for other parts of the country, could be located through a library literature search.

Proposals for protection are analysed by ecosystem type, and by ecological district. The analysis in this section makes no distinction between proposals for land purchase or land covenanting. However, the majority of existing proposals are for land purchase.

6.2 FOREST HERITAGE FUND and LAND ACQUISITION FUND APPLICATIONS

This section of the report analyses applications to the Forest Heritage Fund (FHF) and the Department's Land Acquisition Fund (LAF) seeking funding for the protection of indigenous vegetation.

Thirty-two applications were analysed. Thirty of these were applications to the FHF, and two were applications to the LAF. Applications totalled 5,955 ha. (4,586 ha. to the FHF, and 1,369 ha. to the LAF). All applications - whether successful or not - have been analysed. Firstly, applications are analysed by ecosystem type, and the results presented in Table 20 and Figure 27. Then, applications are analysed by ecological region, and the results presented in Table 21 and Figure 28.

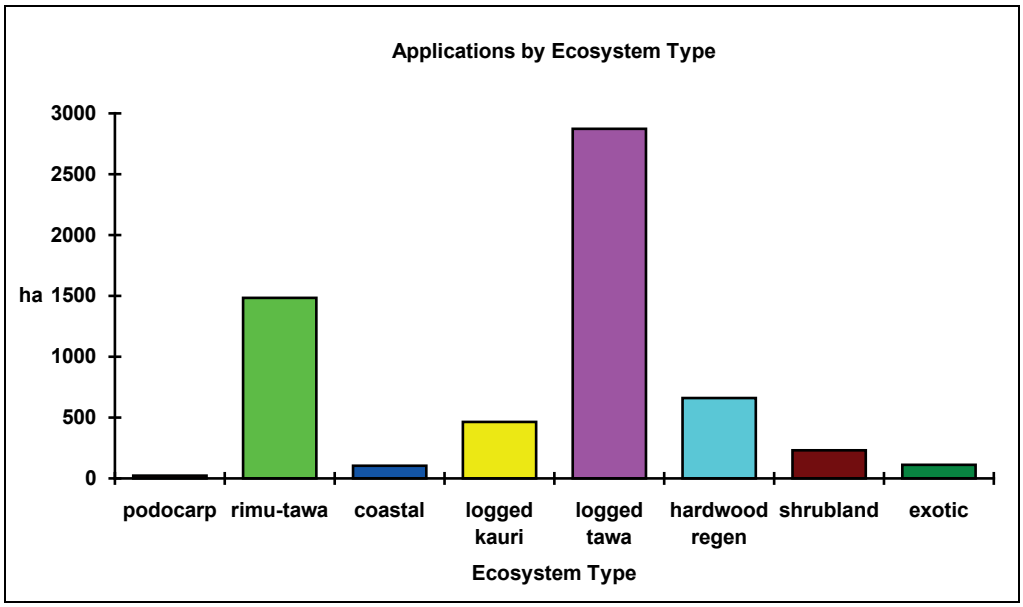
Applications by Ecosystem Type

Applications were predominantly for original (un-logged) rimu-tawa forest (D - 25%), modified (logged) tawa or tawa-taraire forest (N,S - 48%), or kauri forest associations (B,C - 8%). Only very small areas of dense podocarp forest (L - 0.4%) or coastal vegetation (P2,zo,mn - 1.5%) were covered by the applications.

Table 20 - Applications by Ecosystem Type:

Ecosystem Type	Total Hectares	Percentage of Total
Primary vegetation		
dense podocarp (L)	23	0.4
rimu-tawa (D)	1,484	24.9
coastal forest/saline wetland (P2,zo,mn)	105	1.7
Logged forest		
kauri (B,C)	465	7.8
tawa/tawa-taraire (N,S)	2,873	48.2
Secondary or induced vegetation		
hardwood regen. (BS,BL,SL,CB)	661	11.2
shrubland (ts,bs)	232	3.9
exotic vegetation (EX)	112	1.9
TOTALS	**5,955**	**100.0**

Figure 27 - Applications by Ecosystem Type:



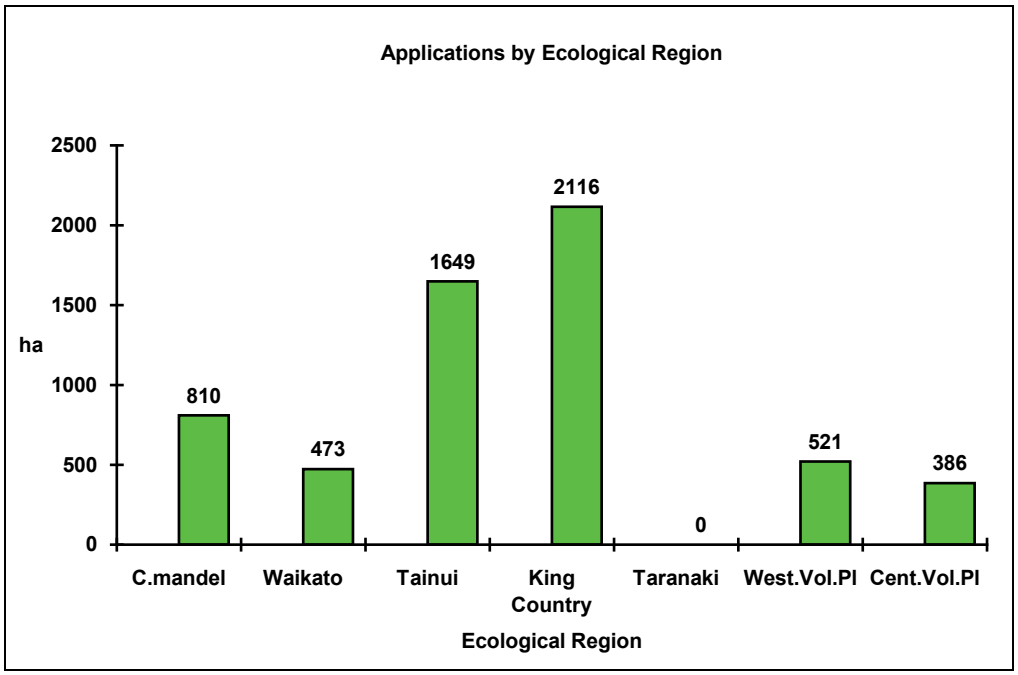
Applications by Ecological Region

Applications were for the protection of areas in six of the seven ecological regions (all except Taranaki ER), and in 14 of the 23 ecological districts, which lie wholly or partly within the Waikato Conservancy. The largest areas covered by the applications were in the King Country Ecological Region (ER) (Waitomo and Taumarunui EDs - 35.6%) and the Tainui ER (Raglan, Kawhia, and Herangi EDs - 27.7%). Applications covered relatively small areas in the predominantly lowland Waikato ER (Hapuakohe, Hamilton, and Waipa EDs - 7.9%), the Western Volcanic Plateau ER (Ranginui, Pureora, and Tokoroa EDs - 8.7%), and in the Central Volcanic Plateau ER (Taupo ED - 6.5%).

Table 21 - Applications by Ecological Region:

Ecological Region	Total Hectares	Percentage of Total
Coromandel	810	13.6
Waikato	473	7.9
Tainui	1,649	27.7
King Country	2,116	35.6
Taranaki	0	0.0
Western Volcanic Plateau	521	8.7
Central Volcanic Plateau	386	6.5
TOTALS	**5955**	**100.0**

Figure 28 - Applications by Ecological Region:



Applications by Nature Conservation Criteria

This analysis has been undertaken using the criteria proposed for the Waikato Forest Protection Strategy, as outlined in section 4.5 of this report. This analysis provides a more accurate assessment of the relative priority of the applications, as it takes into account all of the nature conservation attributes that contribute to the protection of representative and sustainable forest remnants.

Of the 32 applications analysed, 14 were ranked high, 13 moderate, and 5 low. High ranking applications were mostly for areas in the Waitomo, Herangi, and Colville EDs, and tended to be for larger forest remnants. Low ranking applications were scattered across several EDs and were all for smaller, and therefore less sustainable, forest remnants. In between, moderate ranked applications were mostly for areas in the Kawhia and Waitomo EDs, and tended to be for medium-sized remnants. Most recent applications to the FHF and LAF rank high or moderate using the criteria in the Waikato Forest Protection Strategy. The fact that most recent applications that ranked highly were funded illustrates the link between the FHF national criteria and the criteria proposed for the Waikato Conservancy.

6.3 PROTECTED NATURAL AREAS PROGRAMME RECOMMENDATIONS

Two Protected Natural Areas Programme (PNAP) reports have been completed for areas within the Waikato Conservancy. A survey of the Coromandel Ecological Region was undertaken between 1987 and 1989 (Humphreys and Tyler, 1995) and of the North Taranaki Ecological District between 1989 and 1990 (Bayfield *et al*, 1991). Recommendations from these survey reports are analysed separately below. A PNAP survey of the Tainui ER was incomplete at the time of writing, and no recommendations for protection were available.

Coromandel Ecological Region

The Coromandel ER covers all of that part of the Coromandel Peninsula and Kaimai Ranges that lie within the Waikato Conservancy. It includes the Colville, Mercury Islands, Thames, Tairua, and Waihi EDs. The PNAP survey covered all except the Mercury Islands ED.

The deficiencies in the existing protected areas system of the Coromandel ER, identified in the report, are summarised below:

- montane vegetation is adequately protected in all except the Waihi ED, but the full range of diversity is not adequately protected;
- lowland and semi-coastal vegetation is inadequately protected in all EDs;
- coastal vegetation is inadequately protected in all EDs except for coastal forest in the Waihi ED;
- dunelands are almost entirely unprotected;
- freshwater and saline wetlands are entirely unprotected.

Consequently, the areas recommended for protection (RAPs) in the report are concentrated in coastal and semi-coastal environments. RAPs were proposed for areas regardless of land tenure, though the analysis below only covers the RAPs, or the parts of RAPs, for areas that are not already administered by DoC. Thirty-one RAPs are analysed, by ecological district, as follows. Firstly, the proportions of the remaining unprotected ecosystems covered by the RAPs are analysed and presented in tables. Then, the relative proportions of the ecosystems protected (PNAs) and ecosystems proposed for protection (RAPs) are analysed and presented in the column charts.

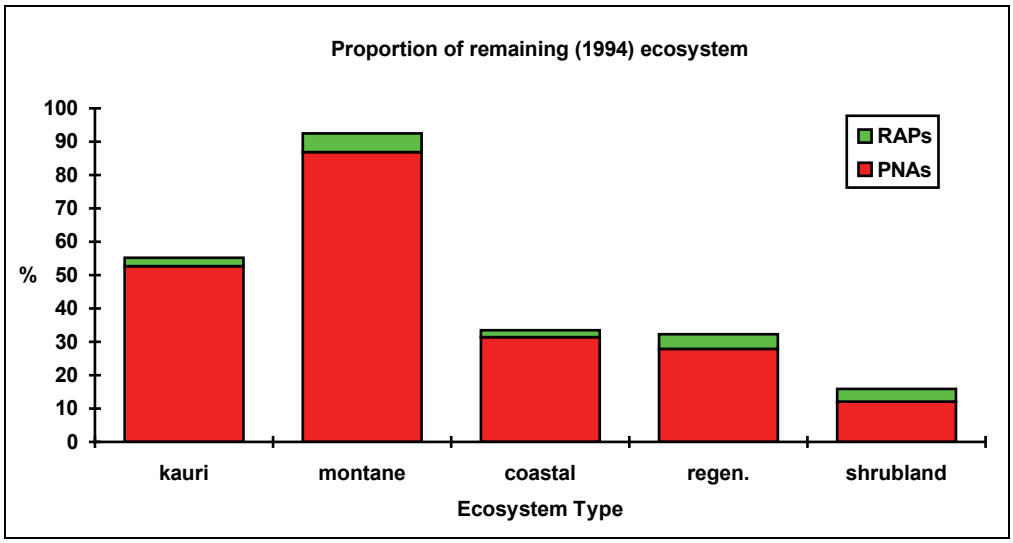
Note that dune systems and saline wetlands are not analysed below, as the available data was difficult to analyse. However, natural dune systems are generally severely modified, and both ecosystem types are largely unprotected. Also, the analysis of dense podocarp remnants (L) is limited by the lack of accurate data.

Colville ED

Table 22 - Applications by Ecosystem Type:

Ecosystem Type	Extent of Remaining (1994) Ecosystem (%)	
	Protected	RAPs
kauri (A,B,S)	52.7	2.5
steepland/montane (G)	86.9	5.6
coastal forest (P2)	31.4	2.1
hardwood regen. (BS,BL)	27.9	4.4
shrubland (bs)	12.1	3.8

Figure 29 - Proportions of Ecosystems Proposed for Protection:

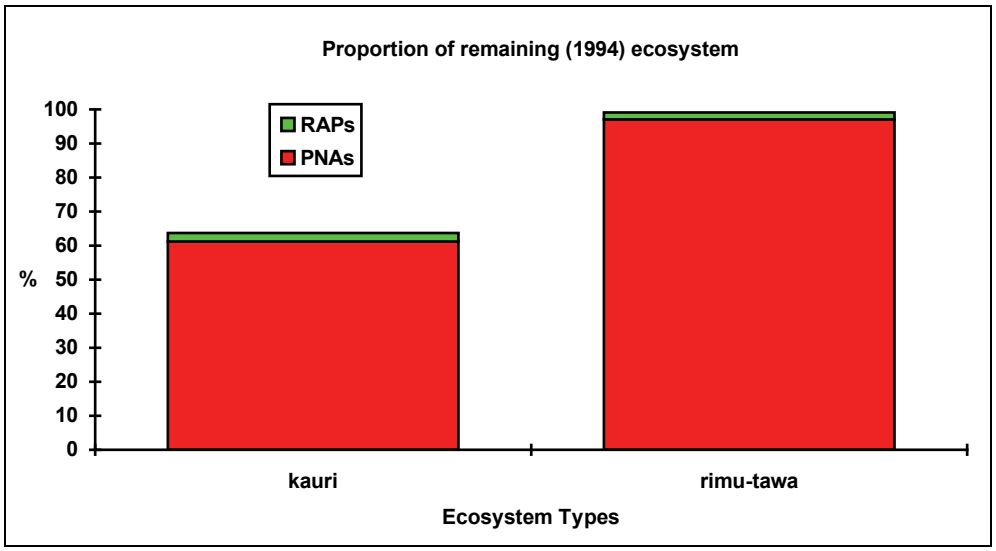


Thames ED

Table 23 - RAPs by Ecosystem Type:

Ecosystem Type	Extent of Remaining (1994) Ecosystem (%)	
	Protected	RAPs
kauri (B)	61.2	2.5
rimu-tawa (D)	97.1	2.0
dense podocarp (L)	?	(20 hectares)

Figure 30 - Proportions of Ecosystems Proposed for Protection:

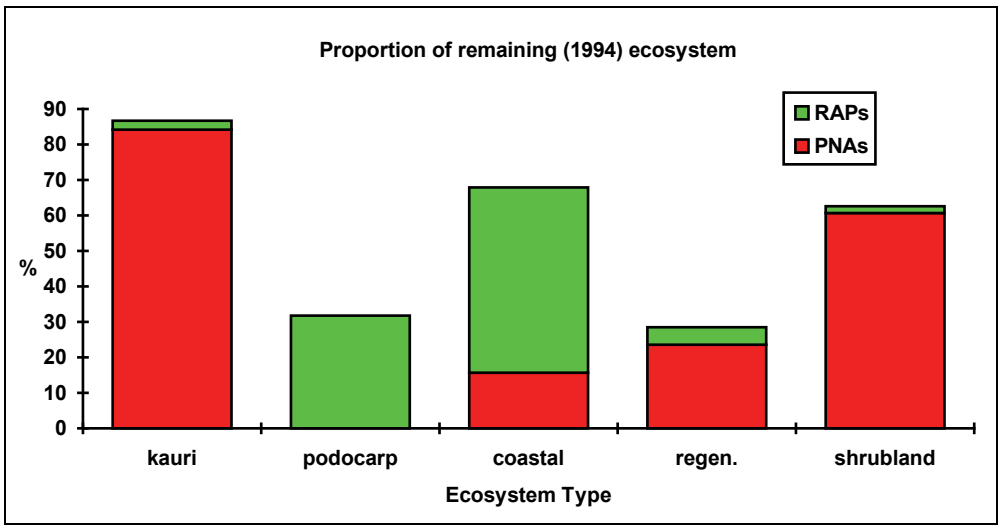


Tairua ED

Table 24 - RAPs by Ecosystem Type:

Ecosystem Type	Extent of Remaining (1994) Ecosystem (%)	
	Protected	RAPs
kauri (A,B)	84.2	2.5
dense podocarp (L)	0	31.8
coastal forest (P2)	15.7	52.2
hardwood regen. (BS,SL)	23.6	4.9
shrubland (bs,sl)	60.7	1.9

Figure 31 - Proportions of Ecosystems Proposed for Protection:

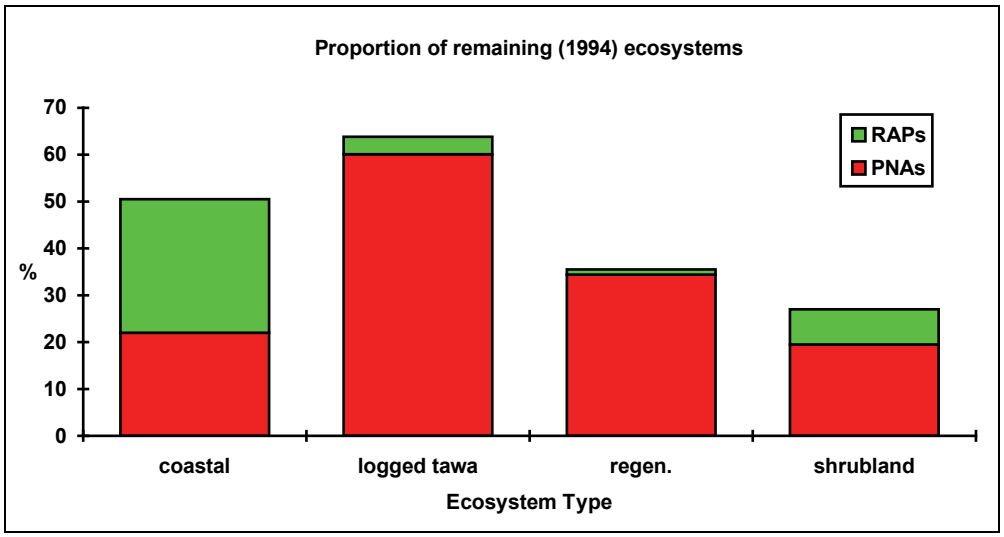


Waihi ED

Table 25 - RAPs by Ecosystem Type:

Ecosystem Type	Extent of Remaining (1994) Ecosystem (%)	
	Protected	RAPs
dense podocarp (L)	?	(25 hectares)
coastal forest)P2)	22.0	28.5
logged tawa (N)	60.1	3.7
hardwood regen. (BS)	34.4	1.1
shrubland (bs)	19.5	7.5

Figure 32 - Proportions of Ecosystems Proposed for Protection:



North Taranaki Ecological District

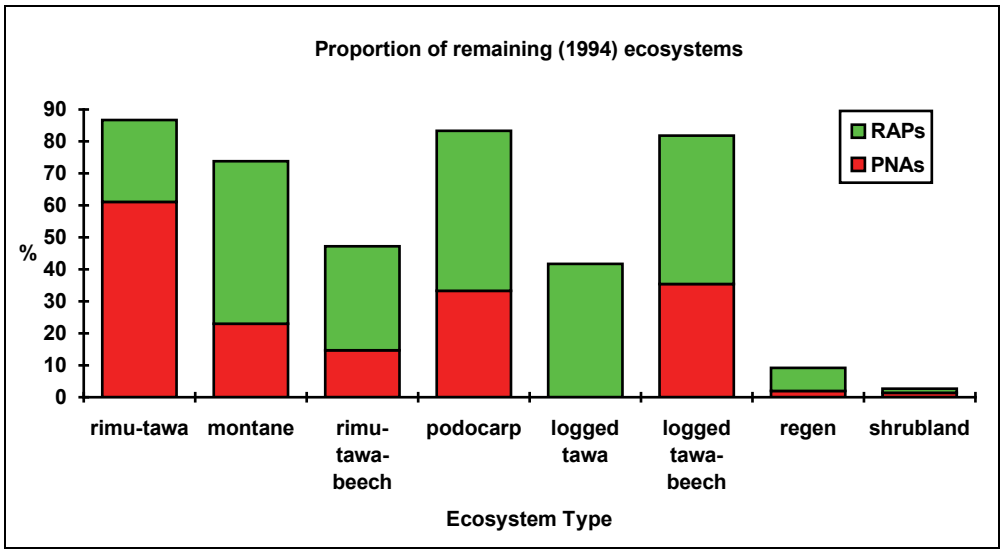
The North Taranaki ED covers broken sedimentary hill country in the southwest of the Conservancy, including the coastal slopes north of the Awakino River and the lower catchment of the Mokau River. It was formerly dominated by rimu-tawa forest (D) and rimu-tawa-beech forest (H), with minor areas of dense podocarp forest (L) along the lower Awakino and Mokau Rivers, localised dune vegetation, and small areas of montane conifer-broadleaf forest at higher altitudes.

Eight RAPs cover the part of the ED that lies within the Waikato Conservancy. These RAPs are analysed and presented in the same way as the RAPs for the Coromandel ER.

Table 26 - Applications by Ecosystem Type:

Ecosystem Type	Extent of Remaining (1994) Ecosystem (%)	
	Protected	RAPs
rimu-tawa (D)	61.1	25.6
steepland/montane (G)	23.0	50.8
rimu-tawa-beech (H)	14.7	32.5
dense podocarp (L)	33.3	50.0
logged tawa (N)	0	41.7
logged tawa-beech (O)	35.4	46.4
hardwood regen. (BS)	2.0	7.2
shrubland (bs,sl)	1.4	1.3

Figure 33 - Proportions of Ecosystems Proposed for Protection:



6.4 WEST WAITOMO CONSERVATION PARK PROPOSAL

Protection for areas surrounding existing Crown land in the western King Country was originally suggested by the Department of Lands and Survey in 1980, and formally proposed by the Royal Forest and Bird Protection Society in 1989 (Forest and Bird, *pers.comm*). Forest and Bird developed this conservation park proposal through fieldwork, research, consultation, and the production of a draft report. This report was provided to DoC to enable its release as a public discussion document, but there appears to have been no further action since that time.

The proposed park covers a large area of Crown and private land stretching from Te Kauri (east of Kawhia Harbour) in the north to the Awakino River in the south. It includes the Pirongia South, Hauturu, Mahoe, Taumatatotara, Tawarau, and Whareorino stewardship lands (ex State Forests), the Moeatoa Scenic Reserve, and the intervening areas that link these Crown lands. A significant proportion of the lands proposed for protection are in Maori ownership.

The ecosystem types covered by the park proposal are predominantly rimu-tawa forest (D), and logged tawa forest (N), with areas of rimu-tawa-beech forest (H), and logged tawa-beech forest (O), in the south. Smaller areas of dense podocarp forest (L) and montane conifer-broadleaved forest (G) are also included. The park proposal covers areas within the Kawhia, Waitomo, Herangi, and North Taranaki EDs.

It is not easy, or even particularly revealing, to undertake a detailed analysis of the ecosystem types covered by the park proposal. However, the park would protect a significant proportion of the remaining unprotected indigenous forest in the southwestern part of the Conservancy. Also, importantly, it would link and buffer the existing protected forest remnants by protecting large areas of modified (logged) tawa and tawa-beech forest. It would also protect a contiguous area of forest over a wide altitudinal range, linking subalpine ecosystems with lowland and coastal ecosystems, a prospect that is not possible in most other parts of the North Island. If successful, this conservation park would protect some of the extensive forest corridors which are identified as a high priority for protection in section 5.0 of this report.

6.5 DISTRICT PLAN PROVISIONS

The territories of twelve district or city councils - listed below and illustrated in Figure 34 - are partly or fully covered by the Waikato Conservancy.

- Thames - Coromandel
- Hauraki
- Franklin
- Waikato
- Hamilton City
- Matamata - Piako
- Waipa
- Otorohanga
- South Waikato
- Waitomo
- Taumarunui
- Taupo

The Resource Management Act 1991 requires district councils to recognise and provide for Matters of National Importance (s.6), including the following:

- "*The protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development*" (s.6(b)); and,
- "*The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna*" (s.6(c)).

As part of their obligations under the Act, district councils are required to prepare district plans which outline how the council proposes to meet these obligations. At the time of the preparation of this report, no district plans had completed the public process required for them to become final operative plans. Therefore, the district plan provisions relating to the protection of indigenous forest could not be usefully analysed in this report.

However, planning staff at most district councils were contacted during the preparation of this report to ascertain what provisions were likely to be contained in district plans. All planners consulted indicated that the district council proposed some form of protection for indigenous forest in the district plan (as required by the Act). Furthermore, some district councils appear likely to propose protection for ecosystem linkages, buffers, scenic backdrops, and stream catchments. The assessment of protection priorities was also being considered by some councils. Also, in some cases finance was available from the district council for covenanting, fencing, and maintenance of indigenous forest remnants.

District plan provisions are likely to become increasingly important for the protection of indigenous forests throughout the country. The extent to which these provisions will eliminate direct threats to indigenous forest remnants, or encourage protection initiatives by district councils, is still unclear. District plan provisions, and the interpretation of the requirements of the Resource Management Act 1991, are still being debated and challenged as part of the process of district plan preparation. In any case, the extent to which a particular forest remnant is already protected by a district plan should be an important consideration during the assessment of forest protection proposals.

Figure 34 - Boundaries of District Councils within the Waikato Conservancy:

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APPENDIX 1 SCIENTIFIC NAMES OF SPECIES CITED IN TEXT

beech	*Nothofagus* spp.
broadleaf	*Griselinia littoralis*
flax	*Phormium* spp.
hard beech	*Nothofagus truncata*
hinau	*Elaeocarpus dentatus*
kahikatea	*Dacrycarpus dacrydioides*
kaikawaka	*Libocedrus bidwillii*
kamahi	*Weinmannia racemosa*
karaka	*Corynocarpus laevigatus*
kauri	*Agathis australis*
kohekohe	*Dysoxylum spectabile*
maire	*Nestegis* spp.
mangeao	*Litsea calicaris*
mangrove	*Avicennia resinifera*
marram	*Ammophila arenaria*
matai	*Prumnopitys taxifolia*
miro	*Prumnopitys ferruginea*
monoao	*Dracophyllum subulatum*
mountain beech	*Nothofagus solandri* var. *cliffortioides*
mountain toatoa	*Phyllocladus alpinus*
mountain totara	*Podocarpus hallii*
northern rata	*Metrosideros robusta*
pingao	*Desmoschoenus spiralis*
pohutukawa	*Metrosideros excelsa*
pokaka	*Eleaocarpus hookerianus*
pukatea	*Laurelia novaezelandiae*
puriri	*Vitex lucens*
quintinia	*Quintinia acutifolia*
raupo	*Typha orientalis*
red beech	*Nothofagus fusca*
rewarewa	*Knightia excelsa*
rimu	*Dacrydium cupressinum*
silver beech	*Nothofagus menziesii*
spinifex	*Spinifex sericeus*
tanekaha	*Phyllocladus trichomanoides*
taraire	*Beilschmiedia tarairi*
tawa	*Beilschmiedia tawa*
toatoa	*Phyllocladus glaucus*
totara	*Podocarpus totara*
towai	*Weinmannia silvicola*
tussock	*Chionochloa* spp.
willow	*Salix* spp.

APPENDIX 2 NATIONALLY AND REGIONALLY IMPORTANT AREAS

Nationally Important Areas:

Area	Ecological District
Castle Rock Blk (pt.Coromandel CP)	Colville
Kennedy Bay Blk (pt.Coromandel CP)	Colville
Kopuatai Wetland Mgmt.Res.	Hamilton
Manaia S	Colville
Mangatutu EA (pt.Pureora CP)	Ranginui
Mapara WMR and Mapara Forest	Taumarunui
Maratoto Blk (pt.Coromandel CP)	Tairua/Waihi
Moeatoa SR	Herangi
Moehau EA	Colville
Mt Karioi Blk (pt.Pirongia CP)	Kawhia
Mt Pirongia (pt.Pirongia CP)	Kawhia
Otama Beach RR & Otama SR	Colville
Papa Aroha SR	Colville
Papakai EA	Thames
Pikiariki EA (pt.Pureora CP)	Pureora
Pureora Mountain EA (pt.Pureora CP)	Pureora/Taupo
Puriri SR	Tairua
Ratanunui EA (pt.Pureora CP)	Pureora
Tawarau (pts.Tawarau Forest)	Waitomo
Waihaha EA (pt.Pureora CP)	Taupo
Waipapa EA (pt.Pureora CP)	Ranginui
Whangamarino Wetland Mgmt.Res.	Meremere
Whareorino Forest	Herangi

Regionally Important Areas

Area	Ecological District
Aldermen Islands NR	Mercury Islands
Awaroa SR/Pts.Hauturu Forest	Kawhia
Cuvier Islands NR	Mercury Islands
Grand Canyon NR	Waitomo
Hakarimata SR	Raglan
Hapuakohe Ecological Area	Hapuakohe
Hot Water Beach RR	Tairua
Kauaeranga Valley Block (pt.Coromandel CP)	Thames/Tairua
Lake Okowhao WMR	Meremere
Lake Rotomanuka WMR	Hamilton
Lake Serpentine WMR	Hamilton
Mahurangi Island RR	Tairua
Middle Island	Mercury Islands
Mohoenui Giant Weta Sci.Res.	Waitomo
Motutapere Island SR	Colville
Opoutere Beach RR	Tairua
Patetonga Lake WMR	Hauraki
Port Jackson RR	Colville
Red Mercury Island NR	Mercury Islands
Ruakuri Caves and Bush SR	Waitomo
Stanley Island NR	Mercury Islands
Tainui SR	North Taranaki
Waiau Falls SR (Waiau Kauri Grove)	Colville
Waikawau Bay RR	Colville
Waimonoa EA (pt.Pureora CP)	Taupo
Waiomu EA	Thames
Waitomo Catchment reserves	Waitomo
Waitomo Caves SR	Waitomo
Waiwawa S	Tairua
Whanganui A Hei MR	Tairua
Whenuakite Block (pt.Coromandel CP)	Tairua
Whenuakura EA	Taupo

APPENDIX 3 ABBREVIATIONS USED IN TEXT

CMS	Conservation Management Strategy
cov.	covenant
CP	Conservation Park
DoC	Department of Conservation
EA	Ecological Area
ED	Ecological District
ER	Ecological Region
est.	estimated
FHF	Forest Heritage Fund
ha.	hectares
HR	Historic Reserve
LAF	Land Acquisition Fund
PNA	Protected Natural Area
PNAP	Protected Natural Areas Programme
QEII	Queen Elizabeth II National Trust
RAP	Recommended Area for Protection
RR	Recreation Reserve
SR	Scenic Reserve
WMR	Wildlife Management Reserve

Supplementary report

CRITERIA FOR THE STRATEGIC ASSESSMENT OF FOREST PROTECTION PRIORITIES

REPRESENTATIVENESS

I - Ecosystem Modification

original vegetation present ..... score 1
modified (eg. logged) original vegetation ..... score 2
secondary or induced vegetation ..... score 3
score A ..... _____

II - Ecosystem Protection

poorly protected (< 5% in PNAs) ..... score 1
partly protected (5 to 25% in PNAs) ..... score 2
well protected (> 25% in PNAs) ..... score 3
score B ..... _____

III - Importance of Habitat

nationally important ..... score 1
regionally important ..... score 2
locally important ..... score 3
score C ..... _____

SUSTAINABILITY

IV - Connectivity

enclave within a PNA; or,
links two separate PNAs; or,
links a PNA to coast or waterbody ..... score 1
adjoins (buffers) a PNA; or,
isolated but part of intact (unprotected) linkage ..... score 2
isolated and unconnected ..... score 3
score D ..... _____

V - Size and Shape

area > 100 ha., or 50 to 100 ha. and rounded in shape .... score 1
area 10 to 50 ha. and rounded in shape; or,
area 50 to 100 ha. but narrow in shape ..... score 2
area < 10 ha.; or,
area 10 to 50 ha. but narrow in shape ..... score 3
score E ..... _____

VI - Viability

resilient to intro. species and natural disturbance ..... score 1
susceptible to intro. species and disturbance ..... score 2
very susceptible to intro. species and disturbance ..... score 3
score F ..... _____

LANDSCAPE AND AMENITY

VII - Landscape Integrity

significant contribution to landscape integrity ..... score 1
locally significant contribution to landscape integrity ..... score 2
no significant contribution to landscape integrity ..... score 3
score G ..... _____

VIII - Amenity

significant contribution to amenity values ..... score 1
moderate contribution to amenity values ..... score 2
no significant contribution to amenity values ..... score 3
score H ..... _____

TOTAL SCORE ..... _____

Explanation of Ranking Criteria

I - Ecosystem Modification: This criterion ranks remnants by the extent to which the vegetation at the site is modified, as the aim of this strategy is to protect remnants of original (pre-human) ecosystems. All vegetation in the Waikato Conservancy is modified to some extent, because of the depredations of introduced species. However, for the purposes of this criterion, forest which is structurally intact scores high (1). Primary forest which has been logged - usually podocarps or kauri removed - scores moderate (2), as it still retains some of the original vegetation and there is, in most cases, a good chance of forest recovery. Regenerating forest scores low (3) as the original vegetation has been lost. The fact that regenerating forest may be very important as wildlife habitat or for linking existing PNAs is recognised under criteria III and IV respectively.

II - Ecosystem Protection: This criterion ranks remnants according to the amount of the original ecosystem protected in the ecological district, as calculated in section 3.0 of this report. Remnants of ecosystem types that are seriously depleted score high (1), whereas remnants of ecosystem types that are still relatively widespread score low (3). Remnants of logged forest, or secondary vegetation, are considered to be representative of the original ecosystem at that site for the purposes of this criterion. For example, logged rimu-tawa forest (ecosystem type N) is given the same depletion ranking as intact rimu-tawa forest (ecosystem type D), as it has the potential to regenerate to its original state. Besides, only the percentage loss of original ecosystems is calculated in section 3.0 of this report.

III - Importance of Habitat: This criterion ranks remnants according to the value of the remnant as wildlife habitat. Remnants score high (1) if they are within or adjoining the areas identified by DoC as nationally important areas for animal or plant pest control, and score moderate (2) if associated with regionally important areas (listed in Appendix 2). This criterion recognises the importance of vegetation as wildlife habitat, regardless of how well it represents the original ecosystems.

IV - Connectivity: This criterion ranks remnants according to how well the remnant contributes to the overall sustainability of ecosystem protection by linking or buffering existing PNAs. The linking of PNAs by intact habitat corridors is now considered a fundamental principle of reserve design (Noss and Cooperrider 1994) and critical for the effective dispersal or seasonal movement of some species. The concept of connectivity has been incorporated into ecosystem protection proposals on a national scale in North America (eg. Noss 1992) and on a regional scale in the West Coast Conservancy (O'Donnell 1991). For this criterion, remnants which link PNAs to one another, or to the coast or large waterbodies, score high (1), as do areas which are enclaves (surrounded on at least three sides by protected ecosystems) within existing PNAs. Areas adjoining (buffering) PNAs score moderate (2), and areas which are isolated score low (3).

V - Size and Shape: This criterion ranks remnants according to how well size and shape protects the remnant from edge effects such as plant pest invasion, or exposure to light and wind. Recent studies undertaken in the North Island indicate that the penetration of gross microclimatic edge effects is about 50 metres, and that regularly-shaped remnants smaller than 9 hectares are dominated by edge effects (Young and Mitchell 1994). For this reason remnants smaller than 10 hectares, or narrow or disjointed remnants smaller than 50 hectares, score low (3). Conversely, remnants larger than 100 hectares, or circular-shaped remnants between 50 and 100 hectares, score high (1).

VI - Viability: This criterion ranks remnants according to the threat posed by aggressive introduced plants and animals. Although management considerations (such as the cost of fencing or pest control) are expected to be considered alongside (rather than part of) this ranking strategy, it is valuable to consider the long term viability of remnants which are obviously threatened by introduced species. Large intact remnants of original forest are generally considered resilient and score high (1). Logged forests, or forests with a high component of broadleaved species, are generally considered only partially resilient and score moderate (2). Small isolated forest remnants, coastal forest, secondary vegetation, wetland and estuarine vegetation are generally considered susceptible and score low (3), unless the remnants are large and well-buffered.

VII - Landscape Integrity: This criterion ranks remnants according to how well they contribute towards the protection of the character and context of the landscape. Remnants that contribute significantly to maintaining the functional coherence of the original landscape by protecting energy flows, nutrient cycles, hydrological regimes, linkages, and uninterrupted ecological sequences score high (1). Conversely those remnants that are not integrated with surrounding landscape components, or are discrete or incongruous, score low (3).

VIII - Amenity: This criterion ranks remnants according to the degree to which they contribute to amenity values including: soil and water conservation; water quality and yield, scenery protection, recreation and tourism, scientific use, and spiritual or cultural values. Remnants score high (1) if they contribute significantly to the protection of these attributes, and score low (3) if their contribution is insignificant. This criterion is a catch-all for the direct uses made of, or values placed on, remnants by the local and regional community. Remnants in nationally important areas, listed in Appendix 2, score high (1), and in regionally important areas score moderate (2).

Opportunities, Threats, and Other Considerations

Opportunities: This ranking strategy aims to identify priorities for ecosystem protection based on the three main principles of representativeness, sustainability, and landscape/amenity. The opportunities that exist for ecosystem protection are not included in the ranking system because opportunities are usually site-specific and ephemeral. In fact most applications for funding for ecosystem protection arise from particular circumstances, such as the proposed sale of property or the desire of a sympathetic landholder to protect remnants of indigenous vegetation. Furthermore, opportunities are usually quite apparent. It is expected that current opportunities will determine which areas are proposed for protection.

Threats: Threats to indigenous ecosystems are a critical concern of the FHF and DoC; the FHF was established in response to the widespread and continuing loss of native forest. Criterion III in this strategy assesses the ongoing threats posed by introduced plants and animals. Other threats, such as forest clearance, usually affect particular areas or even specific sites. These threats change with the evolving economic conditions in a region and the development or adoption of new industries or land uses such as dairying, forestry, or coastal subdivision.

Obvious current threats (other than introduced species) to indigenous forest in the Waikato Conservancy include: modification and drainage of land for dairying; establishment of plantation forests on hill country; clearance of secondary forest (and original forest in some situations) for firewood; subdivision and clearance of land for lifestyle blocks or holiday resorts, especially on coastal sites; and, further removal or fragmentation of scattered or regenerating forest for farmland. Frequently restrictions are developed in response to such threats, through legislation (such as the Forests Amendment Act 1993), or controls (such as District Plan rules under the Resource Management Act 1991). The best people to predict or assess such threats, are usually DoC staff, Council planners, and local conservationists. Furthermore, it is expected that the current degree of threat to a particular remnant will be an important consideration, and a further selection criterion, for decision making by funding agencies.

Management Considerations: During discussions with DoC staff in the preparation of this strategy it was clear that the cost and practicality of reserve management was a very important concern, especially as most areas acquired for nature conservation are eventually administered by DoC. Limited budgets, shortages of field staff, and the extent and complexity of the threats facing forest remnants, mean that the ability to effectively manage PNAs is a major issue. However, it is beyond the scope of this document to predict and cater for operational needs. The strategy does address this concern in part, by giving priority to remnants that are large, well-buffered, and resilient to plant and animal pests. Any further assessment of PNA management will need to be provided by DoC managers, or other applicants, at the time funding applications are prepared (such as is proposed in the existing Waikato strategy ‘guidelines’).

Forest Restoration: Some ecosystems in the Waikato Conservancy, notably lowland and coastal ecosystems, are dramatically depleted and protected remnants are frequently small and compromised. The key to the long term protection of these, and other more-widespread, ecosystems is restoration. This strategy does not rank restoration prospects except peripherally as part of the assessment of habitat importance (criterion III), connectivity (criterion IV), landscape integrity (criterion VII), and amenity values (criterion VIII). This is not to deny the importance of restoration efforts but, rather, to acknowledge the difficulty of identifying and assessing restoration prospects. This ranking strategy is not intended to rank landforms based on their value for the eventual restoration of 'lost' ecosystems.

National Importance: It is widely acknowledged that certain ecosystems in the Waikato Conservancy are (or were) nationally important for nature conservation. The three most widely recognised ecosystems are:

- lowland floodplain podocarp (kahikatea-dominated) forests;
- central plateau dense podocarp forests; and,
- podocarp hardwood (rimu-tawa) forests on karst in the western King Country.

Also rated as important, though not as important as the above, are coastal forests, especially on the Coromandel Peninsula. This strategy recognises the national importance of those three ecosystems by automatically scoring remnants of these systems, where they are still present, high (1) for importance of habitat (criterion III) - provided they are larger than 10 hectares - and high for amenity value (criterion VIII) due to their cultural, scientific and recreation/tourism value.

Type of Protection: This strategy makes no assessment, in the ranking criteria, of the most appropriate type of protection for forest remnants. The important role of the QEII Trust in the protection of (usually) smaller remnants in more modified landscapes, and the building of awareness and support for forest protection (and dedicated forest management by owners) in rural communities, is acknowledged. Also acknowledged is the increasingly important role of District Councils in the protection of indigenous vegetation, Environment Waikato in the support of Landcare Groups such as the Waitomo Catchment group, and community-based protection and advocacy groups such as the Native Forests Restoration Trust and the Royal Forest and Bird Protection Society. The benefits of retaining large and/or important areas of indigenous vegetation in public ownership for administration and management by a professional and accountable public agency are also recognised.

TRIAL OF RANKING CRITERIA

This table listing recent funding applications is drawn from section 6.2 of the main report.
It is set out to illustrate how the ranking criteria have been applied to achieve a final score (in bold in the final column) for each remnant.
The calculations for the priority ranking scores are set out in the sixth column, from criterion I to criterion VIII, ie. the first three scores in each row are from criteria I, II, and III respectively, and so on.
This breakdown is provided to assist in the peer review of the ranking criteria.

Application Number	Reference	Ecological District	Ecosystem Types	Total Hectares	Ranking Calculation	Priority Ranking
94/22	Gower, Ngaroma	Ranginui	D,N	245	1,2,1 - 2,1,1 - 1,1	**10**
ACQ-026*	Roach, Tawarau	Waitomo	N	866	2,1,1 - 2,1,1 - 1,1	**10**
ACQ-014*	Gunson, Mokauiti	Waitomo	D,N	503	1,1,2 - 2,1,1 - 1,1	**10**
93/71	Tawa Park, Waimihia	Pureora	D,N	259	1,3,1 - 2,1,1 - 1,1	**11**
93/61	Hawkes, Paparahia Farms	Herangi	D,N,BS	703	1,3,1 - 2,1,1 - 1,1	**11**
92/183	Tregoweth, Awakino	Herangi, Waitomo	D,N,EX	798	1,3,1 - 2,1,1 - 1,1	**11**
94/16	Mohring, Hapuakohe	Hapuakohe	D,C,BS	255	1,1,2 - 2,1,1 - 1,2	**11**
93/04	Jackson, Te Toto Gorge	Kawhia	D	32	1,2,1 - 1,2,2 - 1,2	**12**
91/02	Mist Pres.Soc., Moehau	Colville	B,BS	142	2,2,1 - 2,1,1 - 1,2	**12**
95/42	McClunie, Pirongia	Kawhia	D	60	1,2,1 - 2,1,1 - 2,2	**12**
93/60	Kay, Waitomo	Waitomo	N	261	2,1,1 - 3,1,2 - 1,1	**12**
93/18	Oborn, Waikawau Bay	Colville	P2,BS	98	1,1,2 - 2,1,2 - 1,2	**12**
93/01	Self Block, Tihoi	Taupo	BL,bs,ts	385	3,2,1 - 1,1,2 - 1,1	**12**
92/40	Stock, Manaia	Colville	S,B,BS	279	2,2,1 - 1,1,2 - 1,2	**12**
94/24	Swann, Mt Karioi	Kawhia	D	27	1,2,1 - 2,2,1 - 2,2	**13**
95/39	Gray, Waitomo	Waitomo	N	60	2,1,2 - 1,1,2 - 2,2	**13**
90/92	Papa Aroha, Coromandel	Colville	B,S,BL,SL	195	2,2,2 - 1,1,2 - 1,2	**13**
92/184	Tortonson, Tairua	Tairua	B	83	2,2,1 - 1,1,2 - 2,2	**13**
90/169	Hapuakohe	Hapuakohe	C,BS	75	2,1,2 - 2,1,2 - 2,2	**14**

Application Number	Reference	Ecological District	Ecosystem Types	Total Hectares		Priority Ranking
95/26	Turner, Kaitaringa	Waitomo	N	121	2,1,2 - 2,1,2 - 2,2	**14**
95/25	Allerby, Mapara	Taumarunui	N	64	2,2,1 - 2,1,2 - 2,2	**14**
94/25	Smith, Karioi	Kawhia	N	48	2,2,1 - 2,2,2 - 2,2	**15**
90/164	Kowhai Reserve, Kawhia	Kawhia	N	106	2,2,2 - 2,1,2 - 2,2	**15**
94/23	Barrett, Pirongia	Kawhia	N	48	2,2,1 - 2,2,2 - 2,2	**15**
90/166	Yarndleys Bush	Hamilton	L	14	1,1,1 - 3,2,3 - 3,1	**15**
90/71	Waotu Bush	Tokoroa	L,N	16	1,1,2 - 3,2,3 - 3,1	**16**
90/35	Tapunakohounuku. Otor.	Kawhia	N	52	2,2,1 - 3,2,2 - 2,2	**16**
94/57	Waipa DC, Mt Kakepuku	Waipa	SL	64	3,1,3 - 2,1,3 - 2,2	**17**
95/38	Adams, Coromandel	Colville	zo,mn	14	1,2,2 - 3,2,3 - 2,2	**17**
92/252	Whitehead, Piopio	Waitomo	L	1	1,1,3 - 3,3,3 - 3,2	**19**
90/86	Parkinson, Miranda	Hapuakohe	D	66	1,3,3 - 3,2,2 - 2,3	**19**
93/76	WDC,Waingaro Forest	Raglan	CB	15	3,1,3 - 3,2,3 - 3,3	**21**
TOTALS		**32**		**5955**		