

FORUM ARTICLE

Ecological areas – premier protected natural areas

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Abstract: The establishment of ecological areas, a network of predominantly forest reserves, was initiated by the former New Zealand Forest Service (NZFS) in the 1970s within the context of large-scale utilisation and exotic conversion proposals for indigenous State forest lands on the West Coast and in Southland. Unlike other types of protected natural area, ecological areas were primarily selected to be representative of the natural features within ecological districts. Although 112 ecological areas covering 344 753 ha (1.29% of New Zealand's land area) have now been established, their geographic distribution is uneven with disproportionately large numbers in the West Coast, Waikato and East Coast Bay of Plenty Department of Conservation conservancies. While the intent of the NZFS in gazetting ecological areas was that they would receive the highest level of protection possible, they have not been afforded this level of protection under the Conservation Act 1987 and the Crown Minerals Act 1991, or under conservation management strategies. The identification and protection of ecological areas has not extended beyond former State forest land. With two exceptions, all ecological areas are open to mining despite their high values. Ecological areas are on a par with national parks in terms of their ecological values and they warrant the highest level of protection and management. Specific actions to recognise the special value of ecological areas in legislation, policy and management are recommended.

Keywords: Department of Conservation New Zealand; ecological districts; ecosystem; forest; New Zealand Forest Service; representativeness

Introduction

Up until the late 20th century, selection of protected natural areas (PNAs) on the New Zealand mainland was strongly biased towards areas with little or no productive economic value, usually areas of scenic beauty or grandeur (McCaskill 1972; Roche 1981). Ecological values rarely took precedence, and when they did, the areas involved were usually small (e.g. scientific reserves). Classic examples of the predominance of low productive economic values in PNA selection range from the large upland national parks (e.g. Nelson Lakes and Aoraki Mount Cook) to small roadside-corridor scenic reserves. Although approximately one-third of New Zealand's land surface is now protected within the public conservation estate, this is far from representative of New Zealand's natural ecosystems, and it especially has a lowland/upland imbalance and under-representation of tussock grasslands and wetlands (Mark 1985; NZ PNA Programme TAG 1986; Ogle 1989; Cromarty & Scott 1996; Norton 1999). Similar issues with a lack of representativeness in PNA networks occur more widely (e.g. Margules & Pressey 2000; Scott et al. 2001).

Atkinson (1961) was the first to suggest the need for a representative PNA system in New Zealand, although the concept of reserving representative areas had been advocated as early as 1903 (Roche 1981). The preservation of a representative area of indigenous vegetation for scientific purposes was a principal objective of reservation for Waipoua Forest expressed by the Waipoua Kauri Forest Preservation Committee in 1946 (Roche 1990, p. 409). (The Waipoua Forest Sanctuary was gazetted in 1952.)

Atkinson (1961) argued that New Zealand should be subdivided into conservation districts, based on similarities in climate, landforms, geology and biology, and that these be used as the basis for selecting representative PNAs. He proposed a provisional classification of the North Island based on a genetic New Zealand soil map that reflects these factors (Soil Bureau 1959). In the 1970s, John Nicholls of the Forest Research Institute, New Zealand Forest Service (NZFS), used the concept of ecological districts and regions as a basis to recommend a set of biological reserves in the northern West Coast beech management region (Nicholls 1974b, 1977; Bassett & Miers 1984). He defined ecological districts based on vegetation pattern, local climate, geomorphology and soils.

The ecological region and district framework was subsequently formalised and expanded to cover all of New Zealand (Nicholls 1979; Simpson 1982; NZ PNA Programme TAG 1986; McEwen 1987). New Zealand has been classified into 85 ecological regions and 268 ecological districts, reflecting the small-scale variability of its ecological patterns. An ecological district is a land area where topographic, climatic, soil and biological features, and the broad cultural patterns, produce a characteristic landscape and range of biological communities. An ecological region comprises adjacent ecological districts with closely related characteristics, or may include only one ecological district with very distinctive features.

The development of the ecological region and district framework has been central to the establishment of a representative PNA system in New Zealand. The rationale

for representativeness has been widely discussed (see references in O'Connor et al. 1990) and is endorsed within the Reserves Act 1977 (section 3(b)). The Protected Natural Areas Programme (PNAP) was established in 1983 specifically to conduct surveys and provide recommendations for the creation of additional PNAs in order to enhance the degree of representativeness within the New Zealand PNA system (NZ PNA Programme TAG 1986). This same framework provided the basis for the selection of ecological areas on State forest lands (Bassett & Miers 1984). The primary objective of identifying and protecting ecological areas was to establish a representative network of predominantly forest reserves of high scientific value representing the topography and vegetation typical of each ecological district. In several PNAP surveys, ecological areas were taken into consideration in developing proposals for fully representative protected area sequences.

The establishment of ecological areas was first made possible under the Forests Amendment Act 1973. This permitted the Minister of Forests to set apart any State forest land for any purpose or purposes, and required that such land be dedicated for the purpose or purposes for which it was set apart and not be used or developed for any purpose inconsistent with that purpose or those purposes. 'Dedicated areas' could be set aside to protect a variety of values including (following enactment of the Forests Amendment Act 1976) scientific, ecological, geological, archaeological, wildlife, educational, recreation and amenity values. Revocation or varying of dedicated area status required public notification of not less than one month and consideration of all objections received.

Ecological areas are now administered under the Conservation Act 1987, but this provides only weak guidance on how they are to be managed. Under section 18(4), the gazettal notice that formalises the establishment of an ecological area is required to specify the particular scientific value for which the ecological area is held. Under section 21, 'every ecological area shall so be managed as to protect the value for which it is held'. The revocation or varying of ecological area status requires public notification under section 49.

Ecological areas previously gazetted under the Forests Act 1949 (as amended in 1973 and 1976) are 'deemed' under section 61(6) of the Conservation Act to be ecological areas, and are managed so as to protect the value or values for which they were dedicated under the Forests Act, if any such value was specified at the time, or for their ecological value in every other case.

The purpose of this paper is to evaluate how ecological areas are managed, and in particular to assess if current management reflects the reasons why these areas were initially protected. We review the ecological thinking that underlay the establishment of ecological areas, summarise the ecological areas present in New Zealand, and consider past suggestions for ecological area management. We present a case that ecological areas are as relevant to conservation efforts now as they were 40 years ago when they were first mooted, and make recommendations for their future management. A list of all current ecological areas is appended.

Criteria for selecting ecological areas

Ecological areas were primarily established for scientific, particularly ecological values, to meet one or more of the following objectives (NZFS 1985, p. 5):

- (a) to protect representative portions of natural ecosystems;
- (b) to protect rare or unique features including native plants and animals;

- (c) as areas available for study aimed at understanding and explaining natural processes;
- (d) as benchmarks for assessing changes associated with various forms of development within the region;
- (e) as genetic pools for native plants and animals.

Criteria for selecting ecological areas were first outlined by Nicholls (1974a, 1983). Nicholls (1974a) suggested that the establishment of biological reserves (ecological areas) on the West Coast and in Southland was fully justified as each region contained unique ecological features and because both regions had been drastically changed in many areas by human activities. He suggested that reserves 'should be large and ecologically comprehensive areas undisturbed by logging', although he noted that reserves are also needed in disturbed areas 'either because the "virgin" communities have been too greatly reduced or because interference has resulted in types of vegetation which are themselves of particular value for scientific comparisons'.

Criteria for selecting ecological areas were formally developed in the mid-1970s by the Scientific Coordinating Committee for Beech Research (Thomson 1974, 1983b; Bassett & Miers 1984; Bassett 1987). The seven criteria adopted were outlined in the draft 'Ecological Areas General Policy' (NZFS 1985, pp. 7–8):

1. *(An ecological area) should represent the full range of land forms, soil sequences, animal communities, and unmodified vegetation of the ecological district. The inclusion of some modified vegetation may sometimes add to the value of an ecological area.*
2. *It should be large with, say, a minimum of 1000 ha; a single large reserve is preferable to two or more smaller reserves of the same total area. This is particularly true for preserving the greatest diversity of bird populations.*
3. *It is considered legitimate to create small reserves to preserve unique features or special values, although these could present special problems in protection.*
4. *It should include at least one complete undisturbed catchment of a permanent waterway.*
5. *It should have a compact shape, with the minimum perimeter for the area involved.*
6. *Wherever possible, its boundaries should be clearly defined by natural features.*
7. *It should be unroaded, at least within the main catchment.*

These criteria drew heavily on the rapidly developing national and international conservation literature on PNA design at that time (e.g. Diamond 1975; Harris 1984; McIntyre et al. 1984), and were the first time that formal ecological principles were included in the design of a PNA system in New Zealand. Of particular significance is the incorporation of the idea of representativeness in the first criterion. This emphasis in many ways foreshadowed the more recent application of the land environments framework (Leathwick et al. 2003) for assessing conservation priorities in New Zealand. There was an implied recognition in these criteria that ecological areas would allow for the dynamic nature of natural ecosystem processes, and ecological areas were not seen as isolated 'islands' (Nicholls 1983; Bassett & Miers 1984).

The majority of ecological areas selected using these guidelines are large (>1000 ha), especially on the West Coast (e.g. Mokihinui Forks, 24 074 ha), and include complete

catchments containing relatively unmodified lowland forest and sequences of plant and animal communities along natural geological, geomorphological, climatic and topographical gradients. However, flexibility was applied to ensure that other important ecological features were protected. For example, the Slab Hut Creek Ecological Area (331 ha) near Reefton protects an important pakihi wetland.

The New Zealand Wildlife Service promoted the concept of linking ecological areas in northern Westland by setting aside wildlife corridors to mitigate the effects of ecological area insularity for wildlife populations (Best & Harrison 1976; New Zealand Wildlife Service 1986; O'Donnell 1991). These corridors might be logged, but only subject to it being essential and to careful and restrictive selection logging that retained the basic structure and integrity of the wildlife habitat.

Development of ecological areas system

Selection of ecological areas was first undertaken in the mid-1970s within the context of widespread historical clearance of lowland indigenous forests (Anon. 1978; Roche 1990), and of proposals for large-scale utilisation and exotic conversion of lowland beech forests on the West Coast and in Southland (Kirkland 1973) and public pressure for the protection of these forests (Searle 1975). In response to major controversy, the government amended the legislation and policy governing the management of State forests to provide for the perpetuation of indigenous forests, recognition of the multiple (including scientific) values of indigenous forests, greater reliance on exotic afforestation for national wood supplies, and greater public participation in management proposals (NZFS 1977). The initial intention to protect proposed biological reserves as forest sanctuaries was replaced by provision for dedicated ecological areas under the Forests Amendment Act 1973.

Formal selection of ecological areas was undertaken by multidisciplinary scientific advisory committees of the NZFS (Scientific Coordinating Committee for Beech Research and State Forests Scientific Reserves Advisory Committee; these committees were replaced in 1985 by the interdepartmental Protected Areas Scientific Advisory Committee with the wider mandate of advising on the reservation of all Crown-owned land). There was also strong input from the Forest Research Institute as well as from NZFS conservancies. Most ecological areas were identified during management planning for State forests under the NZFS philosophy of balanced use (as mandated in the Forests Amendment Act 1976), often accompanied by great public interest (e.g. Nicholls 1978) and strong advocacy by both non-governmental organisations and government agencies such as the New Zealand Wildlife Service and Botany Division and Ecology Division, Department of Scientific and Industrial Research (e.g. Anon. 1986). Not all areas recommended by the advisory committees were gazetted. For example, of the 18 areas between the Hokitika and Buller rivers proposed as biological reserves (Nicholls 1974a), two were subsequently approved as amenity reserves, and two did not proceed.

Restructuring of New Zealand's environmental administration in the mid-1980s, and the subsequent allocation of nearly all State-owned indigenous forest in New Zealand to the Department of Conservation (DOC; Roche 1990), greatly reduced the impetus for establishment of ecological areas. The Protected Areas Scientific Advisory Committee was disestablished at this time. An initiative by the Government of

the time in 1990 to gazette then formally approved ecological areas was not completed. With the exception of the Aramoana Ecological Area (361 ha of saltmarsh near Dunedin) in 1998, gazettals of new ecological areas since the establishment of DOC in 1987 have been confined to ecological areas and ecological area extensions on the West Coast that were approved following the 1986 West Coast Accord (West Coast Forests Working Party 1986) and the transfer to DOC management in 2000 of Crown (i.e. State or publicly)-owned indigenous forest previously managed for timber production by Timberlands West Coast (Watson et al. 2000). Large numbers of ecological areas that had been formally approved or recommended at the time of environmental restructuring have not since been gazetted.

Ecological areas system

The area figures that follow (and others in this paper) refer to boundaries specified by graphical GIS area data supplied by Peter Hiemstra (DOC Geospatial Analyst), with some subsequent corrections and amendments. There are many differences between these area figures, the 'conservation unit area' specified in these files, and area figures in gazettal notices. Most differences are minor and probably result from updated spatial definition. However, larger differences, up to several hundred hectares, may have resulted from the process of land allocations to DOC and State-Owned Enterprises (SOEs) following the disestablishment of the NZFS and Department of Lands and Survey in the late 1980s.

As at 31 December 2010, there are 112 ecological areas in New Zealand, covering an area of 344 753 ha (c. 1.29% of New Zealand land area; Table 1, Figure 1, Appendix 1). The largest number and total area in any DOC conservancy (boundaries are as at 31 December 2010) is on the West Coast (46 ecological areas, total area 216 166 ha, 62.7% of the New Zealand total). Other conservancies with substantial numbers of ecological areas are Waikato and East Coast Bay of Plenty. Several conservancies have very few ecological areas (Auckland, Tongariro Whanganui Taranaki, Wellington Hawke's Bay, and Nelson Marlborough). The greatest number of ecological areas (48) and greatest area (110 281 ha) was gazetted in the period 1981–1985 (Figure 2). The average size of New Zealand's ecological areas is 3078 ha, and the range is 33 to 24 074 ha. Twenty-eight of the 112 ecological areas (25.0%) are less than 500 ha, and seven are larger than 10 000 ha (Table 2). The largest are in the Waikato and West Coast conservancies.

Many ecological areas lie within land that was at the time or was subsequently declared to be forest park (now conservation park under the Conservation Act 1987), or within land now subject to conservation park proposals. In these cases, the same parcel of land has both specially-protected-area categories: ecological area and conservation park. This 'double' status is a contributing reason why the list of ecological areas recently published by the Parliamentary Commissioner for the Environment (PCE; 2010) is smaller than presented here as the data used in the Commissioner's report did not include most ecological areas that were also classified as other types of conservation land (Grant Blackwell pers. comm., September 2010). Conservation parks are managed so that their natural and historic resources are protected and (subject to this requirement) to facilitate public recreation and enjoyment (section 19, Conservation Act 1987).

Table 1. Number and sizes of gazetted ecological areas and extensions in Department of Conservation conservancies.

Conservancy	Ecological areas	Extensions	Area (ha)	% of total area
Northland	6	0	7884.7	2.3
Auckland	2	0	1347.6	0.4
Waikato	19	1	42 335.9	12.3
East Coast Bay of Plenty	20	0	31 761.8	9.2
Tongariro Whanganui Taranaki	2	0	2141.0	0.6
Wellington Hawke’s Bay	2	0	3615.8	1.0
Nelson Marlborough	1	0	1419.8	0.4
West Coast	46	31	216 165.6	62.7
Canterbury	4	0	8143.7	2.4
Otago	4	0	15 826.3	4.6
Southland	6	0	14 110.9	4.1
TOTAL	112	32	34 4753.1	100

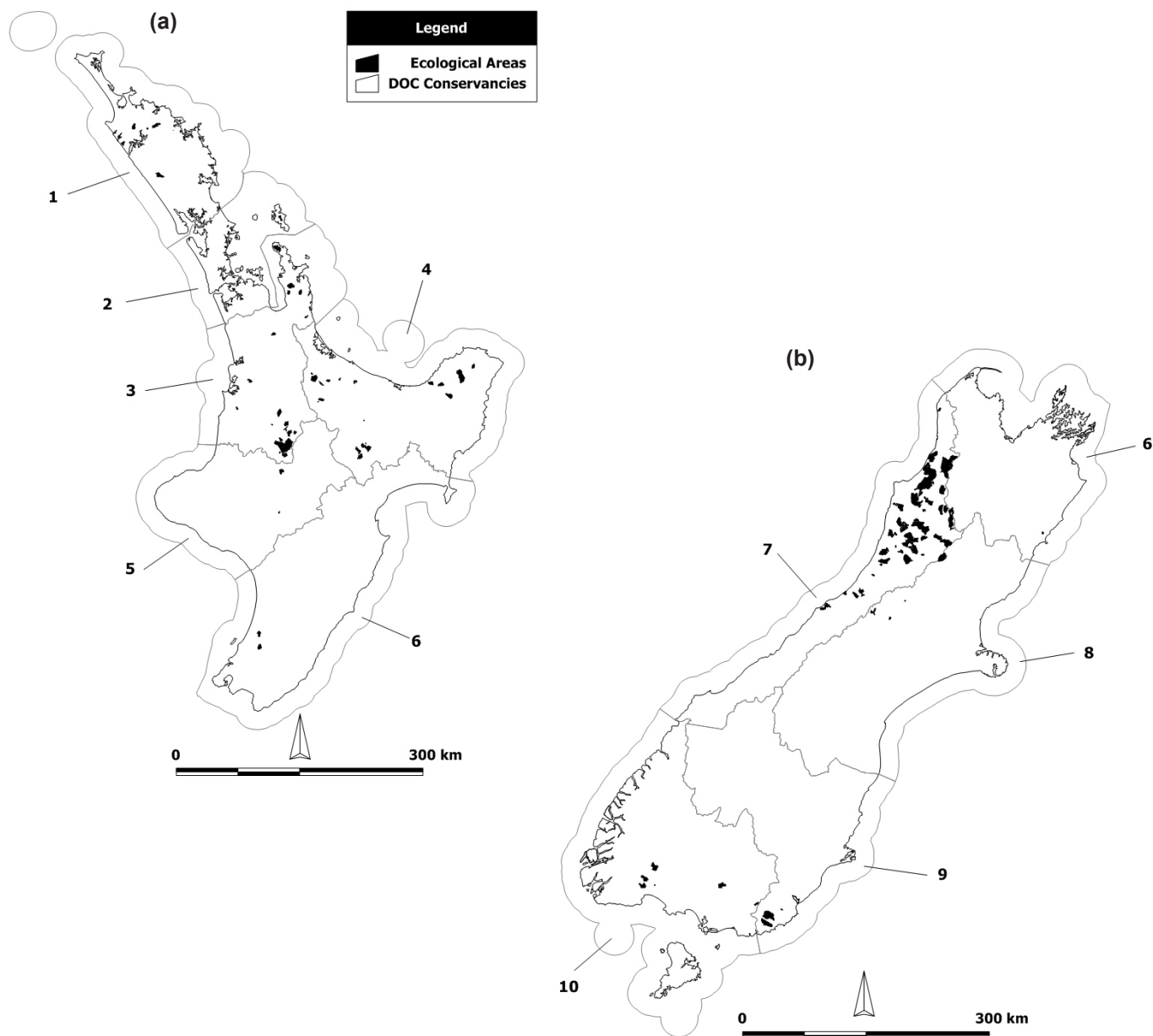


Figure 1. Distribution of ecological areas within (a) North Island and (b) South Island DOC conservancies (from north to south): Northland, Auckland, Waikato, East Coast Bay of Plenty, Tongariro Whanganui Taranaki, Wellington Hawke’s Bay, Nelson/Marlborough, West Coast, Canterbury, Otago, and Southland.

Table 2. Size distribution of gazetted ecological areas by Department of Conservation Conservancy.

Conservancy	<499	-999	-1999	-4999	-9999	>10 000	Mean area (ha)
Northland	2	1	1	2	0	0	1314.1
Auckland	1	0	1	0	0	0	673.8
Waikato	5	3	5	4	1	1	2228.2
East Coast Bay of Plenty	5	3	6	6	0	0	1588.1
Tongariro Whanganui Taranaki	1	0	1	0	0	0	1070.5
Wellington Hawke's Bay	0	0	2	0	0	0	1807.9
Nelson/Marlborough	1	0	0	0	0	0	1419.8
West Coast Tai Poutini	8	5	5	13	9	6	4699.3
Canterbury	2	1	0	0	1	0	2035.9
Otago	2	0	0	2	0	0	3956.6
Southland	1	1	0	4	0	0	2351.8
Total	28	14	21	31	11	7	3078.2

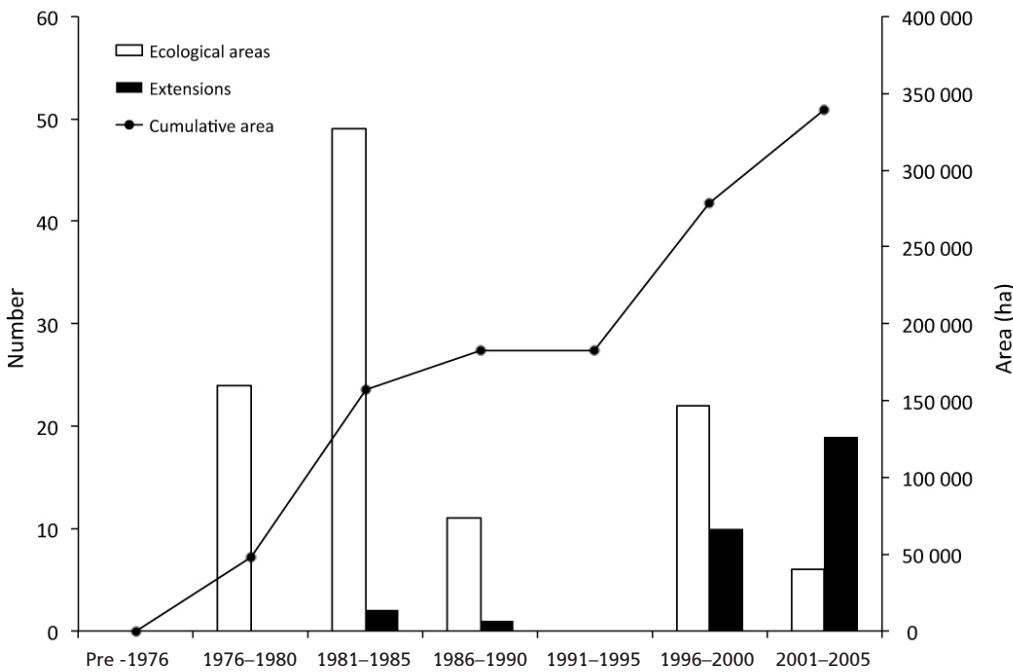


Figure 2. Growth in the number of gazetted ecological areas and extensions, and the total area of these in 5-year periods.

Several ecological areas have had their status changed since gazettal. The Pororari Ecological Area and most of the Tiropahi Ecological Area formed the nucleus of Paparoa National Park, and the Heaphy (part) and Kohaihai ecological areas, and several other approved but not gazetted ecological areas (Kohaihai Extension, Little Wanganui, Oparara, Tony Creek, Break Creek), were included within the boundaries of Kahurangi National Park in 1994. Six small ecological areas in Auckland and Northland were reduced during land allocation processes in the late 1980s to covenants between the Crown Forest Land lessors and the Crown. Two ecological areas, Okarito Forks and Oroko Swamp, were added to Westland Tai Poutini National Park in 2010. An earlier Northland national park proposal (New Zealand Conservation Authority 1995) contained ecological areas, although the current proposed Kauri National Park that is centred on Waipoua Forest Sanctuary (New Zealand Conservation Authority 2010) does not.

Minor areas have been excluded from three ecological areas after their initial gazettal: Mangatutu (1.1 ha in 1983), Roaring Meg (1.5 ha in 1984) and Opuiaiki (2.1 ha in 2007). Parts of two ecological areas (Ngakawau and Oririkaka) that had been approved by government as part of the 1986 West Coast

Accord were removed prior to gazettal. An addition to the Big River Ecological Area in August 2010 (*New Zealand Gazette* 2010, p. 2904) was revoked in November 2010 because of an error in the original gazettal notice (*New Zealand Gazette* 2010, p. 3845).

Many areas that had been ‘approved in principle’ as ecological areas by the Minister of Forests (and gazettal plans prepared), or that had been recommended or proposed for that status by NZFS advisory committees prior to the environmental restructuring, remain in abeyance (Table 3). The substantial numbers and areas of these in some conservancies that currently have very few ecological areas (Tongariro Whanganui Taranaki, Wellington Hawke’s Bay, and Nelson Marlborough) arise from the incomplete consideration of ecological area proposals by former NZFS conservancies, although several have subsequently had their status changed under other processes (e.g. Mapara, Mt Hikurangi). There are now approximately 56 approved and recommended ecological areas covering over 158 000 ha that have not been gazetted. Numerous other ecological areas have been proposed, in particular by Shaw (1989) and in various conservation park management plans, but no national compilation of these is known.

Table 3. Approximate numbers and sizes of 'approved-in-principle' and recommended ecological areas and ecological area extensions in Department of Conservation conservancies.

Conservancy	Approved in principle			Recommended			Total		
	No.	Extensions	Area (ha)	No.	Extensions	Area (ha)	No.	Extensions	Area (ha)
Northland	1	0	185	1	0	1000	2	0	1185
Auckland	0	0	0	2	0	724	2	0	724
Waikato	5	4	19 584	0	0	0	5	4	19 584
East Coast Bay of Plenty	5	0	7926	0	0	0	5	0	7926
Tongariro Whanganui Taranaki	12	1	21 951	1	0	205	13	0	22 556
Wellington Hawke's Bay	11	0	36 250	0	0	0	11	0	36 250
Nelson Marlborough	0	0	0	8	0	35 231	8	0	35 231
West Coast	0	0	0	5	0	14 380	5	0	14 380
Canterbury	1	0	7952	2	0	2908	3	0	10 860
Otago	0	1	1490	0	0	0	0	1	1490
Southland	1	0	4388	1	0	3644	2	0	8032
NZ Total	36	5	100 126	20	0	58 091	56	5	158 217

There is no single repository of information on the values for which all ecological areas were established. A principal reference, and of legal significance, is the formal notice in the *New Zealand Gazette*. Except for some early gazettals, each gazette notice has a summary of the values of the ecological area. Nicholls (1983), conservation management strategies, and the Register of Protected Natural Areas (Wassilieff & Timmins 1984) provide additional information for many ecological areas. More detailed but less available information is recorded in the papers and records of the NZFS PNA scientific advisory committees, and in compilations of reserve proposals (e.g. Anon. 1986). The original Forest Research Institute proposals for ecological areas are in the FRI 31/6 file now catalogued and archived at Landcare Research, Hamilton.

Management policy for ecological areas

The most recent compilation of management guidelines for ecological areas is outlined in the draft NZFS 'Ecological Areas General Policy' (NZFS 1985), which is based on earlier recommendations made by the Scientific Coordinating Committee in 1976 and approved by the Minister of Forests in 1977 (Bassett & Miers 1984). The management guidelines are directed towards the protection of the values for which the areas were originally set aside. Although they do allow for some intervention to ensure protection of particular values (e.g. seral vegetation), the general emphasis is on absolute protection. The first management prescription is (NZFS 1985, p. 14): 'Management will primarily be directed towards facilitating natural processes, in recognition of the dynamic nature of ecosystems and the natural development and redevelopment of communities.

The management guidelines specifically prohibit exploitation of plant and animal species for commercial purposes (e.g. sphagnum moss harvesting) and the salvage of timber. Grazing by domestic stock and the establishment of apiaries are prohibited. The guidelines consider use of ecological areas and provision of recreational facilities and in general allow for the careful use so long as 'ecological values do not become subordinate to recreational or education use and that users are made aware of the special values of the area' (NZFS 1985).

The management guidelines consider major developments in ecological areas (NZFS 1985, p. 25): 'Major developments such as water supply structures, power lines, (and) communication facilities will generally be excluded from ecological areas.' The guidelines conclude with a detailed discussion of mining, prospecting and mineral exploration in ecological areas. This discussion is couched in terms of the relevant Acts of Parliament at that time and, while these have since changed, its general sentiments remain relevant today.

Subsequent legislative changes have, to an extent, strengthened the legislative protection of ecological areas from mining. Where previously the Minister of Forests' consent to mine an ecological area was sought under an Act that promoted mining (Mining Act 1971), conservation values are now required to be considered in making decisions on access arrangements for mining under the Crown Minerals Act 1991. Section 61 of this Act provides:

- (2) *In considering whether to agree to an access arrangement in respect of Crown land, the appropriate Minister shall have regard to -*
- (a) *The objectives of any Act under which the land is administered; and*
 - (b) *Any purpose for which the land is held by the Crown; and*
 - (c) *Any policy statement or management plan of the Crown in relation to the land; and*
 - (d) *The safeguards against any potential adverse effects of carrying out the proposed programme of work; and*
 - (e) *Such other matters as the appropriate Minister considers relevant.*

Debate in the 1990s on mining in protected areas culminated in new legislation (Crown Minerals Amendment Act (No. 2) 1997) that prohibited the Minister of Conservation from accepting any application for an access arrangement to mine conservation lands listed in a new Schedule 4 of the Crown Minerals Act. Schedule 4 lists many protected areas encompassing approximately 40% of all conservation land (PCE 2010), including all national parks, scientific and nature reserves, wilderness areas, sanctuaries, marine reserves, RAMSAR wetlands, and conservation land on most islands. However, it lists only one ecological area (Otahu Ecological

Area, located on the Coromandel Peninsula), while one further ecological area (Blackwater River Ecological Area) is protected by virtue of its inclusion within the Paparoa Wilderness Area that was added in 2008. (The 'Parakowhai Quarry Ecological Area', as listed in Schedule 4 of the Crown Minerals Act 1991 and also located on the Coromandel Peninsula, was protected primarily for its geological values as the 'Parakowhai Geological Area'; *New Zealand Gazette* 1980: 2408.) Mining can be prohibited in other ecological areas, subject to a consultation process and assessment of their scientific and Crown (State-owned) mineral values. Ecological areas listed in the Fourth Schedule of the Conservation Act 1987 (i.e. those approved as part of the 1986 West Coast Accord) may not be closed to mining.

Ecological areas and the future

Ecological areas are special among New Zealand's PNAs in that they have been specifically selected to be representative of natural features within ecological districts (note that 'Recommended Areas for Protection' from Protected Natural Area Programme surveys (NZ PNA Programme TAG 1986) are also selected as representative protected natural areas, but these are typically smaller, on private land and where on public land they have not been allocated a protected area category of their own). Ecological areas are generally large and contain relatively unmodified natural ecosystems, and the emphasis on managing these areas is on facilitating natural ecosystem processes. Most have been selected through an independent scientific review process. Ecological areas occur throughout New Zealand (Thomson 1983a, b; Figure 1, Appendix 1). In some regions of New Zealand, especially central and northern parts of the West Coast, they provide a comprehensive, representative system of lowland forest PNAs. Taken together, ecological areas provide the foundation for a system of PNAs representative of lowland forest ecosystems in New Zealand. This is notwithstanding the major increase in the national protected area system through the protection of most natural lands of the Crown through allocation to DOC during the environmental restructuring of the late 1980s. (Just over 32% of New Zealand's land area is now legally protected for conservation purposes, either as public conservation land or through conservation initiatives on private land; Ministry for the Environment 2007).

As the previous management agency, the NZFS clearly intended that ecological areas receive the highest level of protection possible and that they be managed to ensure natural ecological processes occurred as free from human interference as possible. The draft management guidelines indicate that the NZFS (1985, p. 29) considered major developments should be excluded from ecological areas and mining, which was covered by its own statutes,

'... may be permitted in ecological areas only after an environmental impact report and economic feasibility study, prepared for the Ministers of Energy and Forests, has been subject to public comment. Mining will only be consented to where economic gains can be demonstrated to be in the greater national interest than the protection of ecological values within the ecological area (which is itself protected in the national interest).'

Public debate over mining on public conservation land including ecological areas was renewed in early 2010 by proposals to remove some areas from Schedule 4 of the

Crown Minerals Act, including the single ecological area specifically listed (Otahu Ecological Area; MED & DOC 2010). In compensation, some other areas were proposed for addition to Schedule 4, although no ecological areas were included in this proposal. Subsequently (July 2010), the government decided not to proceed with the exclusion of areas from Schedule 4. However, access to conservation land for mining would no longer be decided by the Minister of Conservation alone, but jointly with the Minister of Energy and Resources (PCE 2010).

Two proposals to improve the legal protection of conservation lands in relation to mining (PCE 2010) would significantly improve the protection of ecological areas. First, an amendment to the Crown Minerals Act 1991 is warranted to provide for public submissions into decisions on access arrangement applications for ecological areas (as was envisaged in the draft Ecological Areas General Policy). Second, a common standard is required that provides access to conservation land for all commercial uses only if consistent with the purpose for which the land is managed. Currently, the test for granting an access arrangement for mining (the Minister must 'have regard to' the purposes for which the conservation land is held; section 61(2) of the Crown Minerals Act) is lower than for other activities on conservation land that almost invariably have lower impacts. When considering a request for access for other commercial uses by granting a concession (e.g. guided tours), 'the Minister *shall not grant* an application for a concession if the proposed activity is contrary to the provisions of the Conservation Act or the purposes for which the land concerned is held' (section 17U).

Despite their management now by a single-purpose government agency (DOC) and their location frequently within a matrix of extensive other PNAs, the high values of ecological areas are threatened by the lack of a strong focus on ecological areas within the mandate and operations of that department. For example, none of the current conservation management strategies provide explicitly for the management of ecological areas, while few ecological areas receive focused management reflecting the specific values they were gazetted for. Ecological areas are not mentioned in the Statement of Conservation General Policy under the Conservation Act 1987 and related legislation (DOC 2005). Nine ecological areas are reported to have operational mines (DOC, pers. comm., 2010).

Other than on the West Coast, there has been an almost nationwide failure to progress Ministerial-approved ecological areas to gazettal. Over 100 000 ha of land in approximately 36 approved ecological areas remain without the legal protective status most appropriate to its conservation values; many other recommended and proposed ecological areas similarly remain without adequate legal protective status. (Because the Ministerial approvals for these ecological areas were obtained under the Forests Act 1949 and do not transfer to the approvals required under the Conservation Act 1987, a new process under section 18, including public notification, is now required). A particular result of the lack of progress on approved and recommended ecological areas is geographical inconsistency in the coverage of ecological areas in New Zealand. Protection or proposals for protection of some approved and recommended ecological areas as conservation park or as part of larger management units (e.g. West Dome) will facilitate conservation management, but should not proceed as a substitute for ecological area status that would specifically recognise the particular ecological values of the site.

The current lack of specific focus on ecological areas in

conservation management in New Zealand highlights a more general problem with the protected area classification system. New Zealand has a large and confusing system of PNAs, ranging from national parks to a miscellany of special-purpose reserves. The current system reflects a century of activity by several government agencies, resulting in a range of different types of conservation tenure. Because of historical legacies, it is common today to find different types of conservation land (e.g. forest park and scenic reserve) abutting each other, reflecting tenure boundaries of past government agencies rather than underlying ecosystem patterns or threats to indigenous biodiversity. While government has considered revising the categories of protected land (e.g. DOC 1988; W. Devine & L. Daniel, DOC, internal discussion paper, 1992), this process has never been carried through to legislation. As a result there is potential for confusion among both conservation managers and the general public about the values associated with and the management goals for different types of conservation land. A review of conservation tenure categories would address this issue and result in more focused management, and promote clarity in the debate over the appropriateness of mining on different types of public conservation land.

A major oversight in the development of the national ecological areas system has been its application just to former State forest lands. There has been only limited review of the values of other lands allocated to DOC from its parent organisations, principally Crown lands held by the former Department of Lands and Survey. The NZFS ecological area process incidentally reviewed and recommended protection for non-State-owned lands such as water supply catchments, but these recommendations also remain in abeyance.

Because of their distinctiveness, and especially because of the explicit consideration of ecological features in their design, it is appropriate to view ecological areas as being among the most important PNAs in New Zealand for biodiversity conservation, being on a par with national parks:

I consider that, hectare for hectare, the ecological areas have greater intrinsic scientific value than the national parks. National parks are predominantly at high altitudes, isolated and of broken topography... In contrast, ecological areas have been selected to cover the range of scientific values irrespective of locale, (albeit) within the constraint of having a limited amount of lowland forest to choose from (Bassett 1987).

As such, ecological areas deserve the highest level of protection and management. At present there is insufficient legislative and organisational support for this, and the above risks and threats have the potential to seriously compromise the integrity of the ecological area system. Concerted action is required to ensure that ecological areas are properly recognised and receive appropriate protection. In order to achieve this, it is our view that government, DOC and the conservation community need to take action within the next five years (2012–2016) to recognise the special value of ecological areas in New Zealand, and in particular to:

(a) Amend section 21 of the Conservation Act 1987 to recognise that ecological areas may have many ecological values, not just a singular value.

(b) Complete and adopt the draft 'Ecological Areas General Policy' to ensure that management of ecological areas is appropriate for the values they protect.

(c) *Either*: Add all ecological areas to Schedule 4 of the Crown Minerals Act 1991 (except any areas that have lost their ecological area values since gazettal);

Or (less preferably): provide legal opportunity under

the Crown Minerals Act 1991 for public notification and submissions regarding access-arrangement applications for mining in ecological areas, and assess applications for mining access arrangements against the same test as concessions (i.e. the activity must not be contrary to the purposes for which the land is held).

(d) Recognise the high conservation values of ecological areas in the Conservation General Policy and in conservation management strategies.

(e) Simplify the 17 protected area classifications available under the current protected area legislative system, while elevating ecological areas to be a foundation stone in a revised system.

(f) Complete the establishment of a national ecological area system by:

(i) reviewing 'approved-in-principle', recommended and proposed ecological areas, and gazetting these as ecological areas or with another appropriate level of protection where a change of status is warranted to improve the protection of identified high conservation values;

(ii) extending the NZFS ecological area selection process to conservation lands other than former State forests allocated to DOC at the time of environmental restructuring, and to other publicly owned natural lands (e.g. land managed by regional councils).

(g) Securely archive and make readily available the extensive background information collected by the NZFS during the development of proposals for ecological areas, much of it unique and providing critical baseline data, as has been done with the Forest Research Institute files. Archiving this information will ensure that it can be used in the future management of ecological areas.

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Appendix 1. Gazetted ecological areas in New Zealand by ecological district. Significant parts only of ecological areas in other ecological districts are listed. Parts of ecological areas in different Department of Conservation conservancies are shown separately (Station Creek Ecological Area only). Initial reservation/extension/exclusion areas are given where these have occurred.

Ecological Area	Ecological District (McEwen 1987)	Gazetted (date.month.year)	Gazetted page number	Initial reservation/ extension/exclusion area	Total area
Manganuiowae	Maungataniwha	09.07.1981	1981_1910		1752.6
Onekura	Maungataniwha, Eastern Northland and Islands	09.07.1981	1981_1909		2439.1
Pukekohe Stream	Maungataniwha	04.06.1981	1981_1569		267.2
Te Hura	Maungataniwha	22.04.1982	1982_1392		987.9
Kaihu	Tutamoe	17.05.1984	1984_1605		2404.9
Pukewhau	Eastern Northland and Islands	13.04.1978	1978_1082		33.0
Hirakimata/Kaitoke					
Swamp	Great Barrier	22.08.1985	1985_3631		1089.9
Omaha	Rodney	25.11.1982	1982_4108		257.6
Moehau	Colville	17.03.1977	1977_631-2		3625.0
Papakai	Thames	06.05.1982	1982_1632-3		3316.7
Waiomu	Thames	06.06.1985	1985_2462		1066.1
Kapowai	Tairua	06.05.1982	1982_1504		1465.6
Otahu	Waihi	23.03.1976	1976_654		397.0
Hapuakohe	Hapuakohe	22.08.1985	1985_3630		967.7
Oparau	Kawhia	11.09.1980	1980_2697-8		1040.2
Mangatutu	Ranginui	18.12.1980	1980_4054	2601.7	
Mangatutu Exclusion	Ranginui	16.06.1983	1983_1855	-1.1	
Mangatutu Total					2600.6
Raepahu Fernbird	Ranginui	30.06.1983	1983_2030		126.0
Maramataha	Pureora	31.01.1985	1985_537		7164.8
Pikiariki	Pureora	12.07.1979	1979_2096		426.2
Pureora Mountain	Pureora	30.01.1986	1986_317		2074.2
Rata-Nunui	Pureora	13.03.1986	1986_1123		945.9
Waipapa	Pureora	12.07.1979	1979_2096	1707.2	
Waipapa Extension	Pureora	15.01.1981	1981_19	132.3	
Waipapa Total					1839.5
Waihaha	Taupo	21.02.1985	1985_600		12093.5
Waimonoa	Taupo	24.01.1985	1985_252		790.4
Whenuakura	Taupo	14.03.1985	1985_1164		1766.2
Taumatatawhero	Waitomo	17.03.1977	1977_631		414.4
Nga Morehu	Taumarunui	26.01.1984	1984_215		215.9
Mangapapa	Otanewainuku	11.07.1985	1985_2990		623.4
Mangorewa	Otanewainuku	24.03.1983	1983_866		866.2
Onaia	Otanewainuku	22.08.1985	1985_3631		315.5
Opuiaki	Otanewainuku	25.10.1984	1984_4606	3823.2	
Opuiaki Exclusion	Otanewainuku	01.02.2007	2007_219	-2.1	
Opuiaki Total					3821.0
Pongakawa	Otanewainuku	11.07.1985	1985_2990		750.9
Rapurapu	Otanewainuku	21.07.1983	1983_2316		224.3
Mokaihaha	Tokoroa	11.07.1985	1985_2990		1452.0
Pukerimu Stream	Tokoroa	21.07.1983	1983_2317		112.8
Oruatawehi	Kaingaroa	21.07.1983	1983_2316		75.9
Kopuapounamu	Motu	01.05.1986	1986_1897		1163.0
Maungawaru	Motu	01.05.1986	1986_1897		2675.5
Paraumu	Motu	01.05.1986	1986_1897		1595.6
Puketotetoe	Motu	01.05.1986	1986_1898		1919.2
Raukokore	Motu	01.05.1986	1986_1898		3721.2
Whanokao	Motu	01.05.1986	1986_1897		4230.5
Oriuwaka	Whirinaki	30.06.1983	1983_2029		1656.5
Otupaka	Whirinaki	26.09.1985	1985_4222		1897.1
Tauranga Basin	Whirinaki	30.06.1983	1983_2029		104.9
Te Kohu	Whirinaki	30.06.1983	1983_2029		2211.9
Tuwatawata	Whirinaki, Ikawhenua	31.01.1985	1985_398		2344.4
Pukepoto	Tongariro, Taumarunui	04.09.1980	1980_2616		1901.3
Rotokura	Tongariro	03.02.1977	1977_182-3		239.7
Manakau	Tararua	09.10.1986	1986_4272		1696.5
Penn Creek	Tararua	09.10.1986	1986_4272-3		1919.3
Station Creek (Part)	Rotorua	28.06.2001	2001_1560		955.7

Ecological Area	Ecological District (McEwen 1987)	Gazettal (date.month.year)	Gazettal page number	Initial reservation/ extension/exclusion area	Total area
Waimangarara	Hundalee	03.02.1977	1977_183		464.1
Heaphy	Heaphy	10.04.1986	1986_1497		723.8
Glasseye Creek	Karamea	17.04.1997	1997_881		2874.8
Karamea Bluff	Karamea	17.04.1997	1997_881		4489.5
Mokihinui Forks	Wangapeka, Matiri	17.04.1997	1997_881		24074.3
Ngakawau	Ngakawau	07.03.2002	2002_602	477.6	
Ngakawau Extension	Ngakawau	07.08.2003	2003_2483	13369.8	
Ngakawau Total					13847.4
Radcliffe	Ngakawau	17.04.1997	1997_881	380.3	
Radcliffe Extension	Ngakawau	07.03.2002	2002_603	1151.8	
Radcliffe Total					1532.1
Orikaka	Ngakawau, Buller, Reefton	08.10.1998	1998_4068-9	14696.6	
Orikaka Extension	Buller, Reefton	28.06.2001	2001_1561	6445.5	
Orikaka Total					21142.1
Berlins Bluff	Buller	07.03.2002	2002_602		1359.3
Blackwater River	Buller	10.01.1980	1980_16-17		9002.7
Capleston	Reefton	10.01.1980	1980_16-17	150.4	
Capleston Extension	Reefton	27.02.1986	1986_868	33.1	
Capleston Extension	Reefton	07.03.2002	2002_601	391.7	
Capleston Total					575.2
Central Maruia	Reefton	28.07.1983	1983_2408		6626.2
Coal Creek	Reefton	10.01.1980	1980_16-17	3039.8	
Coal Creek Extension	Reefton	17.04.1997	1997_883	1315.2	
Coal Creek Total					4355.1
Deepdale	Reefton	17.04.1997	1997_881		5100.4
Maruia West Bank	Reefton	17.04.1997	1997_881		12507.5
Atbara-Nile	Punakaiki, Foulwind	17.04.1997	1997_881		4225.7
Tiropahi	Punakaiki	22.05.1980	1980_1493		523.1
Fletcher Creek	Maimai	10.01.1980	1980_16-17	2629.6	
Fletcher Creek Extension	Maimai	17.04.1997	1997_883	657.5	
Fletcher Creek Total					3287.1
Otututu	Maimai	17.04.1997	1997_881	1608.7	
Otututu Extension	Maimai	28.03.2002	2002_807	3407.5	
Otututu Total					5016.3
Saxton	Maimai	27.03.1980	1980_910		4107.3
Te Wharau	Maimai	17.04.1997	1997_881		480.5
Big River	Totara Flat	10.01.1980	1980_16-17	6800.2	
Big River Extension	Totara Flat	10.08.2000	2000_2186	7228.9	
Big River Extension	Totara Flat	28.06.2001	2001_1561	1149.8	
Big River Total					15178.9
Granville	Totara Flat	07.03.2002	2002_603		7349.4
Mount Harata	Totara Flat	17.04.1997	1997_881		2445.7
Slab Hut Pakihi	Totara Flat	17.04.1997	1997_881		331.5
Waipuna	Totara Flat	27.03.1980	1980_909		1918.1
Moonlight	Blackball	17.04.1997	1997_881	258.1	
Moonlight Extension	Blackball	07.03.2002	2002_603	239.0	
Moonlight Total					497.1
Roaring Meg	Blackball	27.03.1980	1980_909	3618.6	
Roaring Meg Exclusion	Blackball	24.05.1984	1984_1701	-1.5	
Roaring Meg Total					3617.1
Ahaura Terraces	Hochstetter	17.04.1997	1997_881	1229.1	
Ahaura Terraces Extension	Hochstetter	07.03.2002	2002_603	452.2	
Ahaura Terraces Total					1681.3
Bell Hill – Granite Hill	Hochstetter	28.06.2001, 16.08.2001	2001_1560, 2001_2325	6913.4	
Bywash Pakihi	Hochstetter	17.04.1997	1997_881	316.6	
Bywash Pakihi Extension	Hochstetter	07.03.2002	2002_603	597.8	
Bywash Pakihi Total					914.4
Deadman	Hochstetter	27.03.1980	1980_909	243.2	
Deadman Extension	Hochstetter	07.03.2002	2002_603	10.4	
Deadman Total					253.6
Deep Creek	Hochstetter	19.02.1981	1981_343	607.0	

Ecological Area	Ecological District (McEwen 1987)	Gazettal (date.month.year)	Gazettal page number	Initial reservation/ extension/exclusion area	Total area
Deep Creek Extension	Hochstetter	17.04.1997	1997_883	226.9	
Deep Creek Extension	Hochstetter	07.03.2002	2002_603	336.3	
Deep Creek Total					1170.3
Flagstaff	Hochstetter	27.03.1980	1980_909, 2000_3745	1588.0	
Flagstaff Extension	Hochstetter	17.04.1997	1997_883	533.2	
Flagstaff Extension	Hochstetter	07.03.2002	2002_603	2876.1	
Flagstaff Total					4997.3
Lake Hochstetter	Hochstetter	19.02.1981	1981_343	1771.5	
Lake Hochstetter Extension	Hochstetter	17.04.1997	1997_883	1387.8	
Lake Hochstetter Extension	Hochstetter	07.03.2002	2002_603	354.1	
Lake Hochstetter Total					3513.4
Nancy's Clearing	Hochstetter, Hope	17.04.1997	1997_881		444.4
Card Creek	Brunner	21.04.1983	1983_1166	2862.1	
Card Creek Extension	Brunner	17.04.1997	1997_883	1855.6	
Card Creek Extension	Brunner	07.03.2002, 13.06.2002	2002_603, 2002_3960	676.0	
Card Creek Total					5393.7
Greenstone	Brunner	27.03.1980	1980_909	1185.9	
Greenstone Extension	Brunner	17.04.1997	1997_883	1990.2	
Greenstone Extension	Brunner	28.03.2002	2002_807	1648.2	
Greenstone Extension	Brunner	04.09.2003	2003_3403	21.4	
Greenstone Total					4845.7
Three Mile Hill	Brunner	27.03.1980	1980_909	170.3	
Three Mile Hill Extension	Brunner	17.04.1997	1997_883	90.7	
Three Mile Hill Extension	Hokitika	07.03.2002	2002_603	124.3	
Three Mile Hill Total					385.4
Lake Christabel	Ella, Reefton	18.05.1981	1981_1432		10679.8
Station Creek (Part)	Rotoroa, Ella	28.06.2001	2001_1560		8155.6
Kaniere	Hokitika	17.04.1997	1997_881		472.7
Doctor Hill	Hokitika	17.04.1997	1997_881	1585.8	
Doctor Hill Extension	Hokitika, Whitcombe	28.06.2001	2001_1561	937.5	
Doctor Hill Total					2523.4
Upper Totara	Hokitika	17.04.1997	1997_881		2131.2
Kakapotahi	Harihari	17.04.1997	1997_881	656.5	
Kakapotahi Extension	Harihari	28.06.2001	2001_1561	319.5	
Kakapotahi Total					976.0
Lower Poerua	Harihari	28.03.2002	2002_808		350.6
Saltwater	Harihari	19.02.1981	1981_343	1430.3	
Saltwater Extension	Harihari	24.01.1985	1985_251	283.7	
Saltwater Extension	Harihari	08.10.1998	1998_4068	1459.3	
Saltwater Total					3173.3
Upper Hope	Hope	02.10.1986	1986_4146		5971.9
Lagoon Saddle	Arthur's Pass	18.10.1984	1984_4513		139.6
Mt Algidus	Mathias	16.01.1986	1986_316		487.8
Mathias	Browning, Mathias	05.07.1984, 31.01.1985	1984_2432, 1985_398		1544.4
Aramoana	Dunedin	04.06.1998	1998_1701		361.3
Ajax	Tahakopa	12.01.1984	1984_14		9425.5
Craig Rankin	Tahakopa	24.05.1984	1984_1701		218.6
Tautuku	Tahakopa	13.12.1984	1984_4675		5820.8
Slopedown	Tahakopa	31.01.1985	1985_537		899.6
Diggers Ridge	Te Anau, Tuatapere	23.09.1982	1982_3118		4060.3
Dunsdale	Hokonui	12.01.1984	1984_14		3237.7
Lillburn	Tuatapere, Preservation	23.09.1982	1982_3117		2937.3
Waikoau	Waitutu	23.09.1982	1982_3117-8		2848.9
Lindsay	Tuatapere	16.02.1984	1984_422		126.9