The Conservation Requirements of New Zealand's Nationally Threatened Vascular Plants

THREATENED SPECIES OCCASIONAL PUBLICATION No. 13

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Abstract

A significant proportion (20%) of New Zealand's flora is considered to be under some degree of threat. This document details the highest priority recovery actions required to halt the decline of New Zealand's 223 most threatened vascular plants (c. 10% of the native flora). Information, including details of the threats, conservation work to date, priority sites for survey, objectives and priority sites for monitoring, research questions, and high-priority management needs are provided for each of the 223 plants in the form of a plant profile. Where available, an illustration is also included in the profile. This document will assist Department of Conservation staff to set national priorities for threatened plant recovery programmes, and serve to provide interim guidance on the key conservation actions that can be initiated while more detailed recovery plans are being produced for these critically threatened plants.

l. Purpose

This document provides information on the key conservation requirements of the threatened vascular plants[1] of highest priority for conservation action, as identified by the Department of Conservation's Species Priority Ranking System (Molloy & Davis 1994). The purpose of this document is to assist Department of Conservation staff to set national priorities for threatened plant recovery programmes and to establish key recovery actions.

2. Objectives

The objectives of this document are:

1. To provide descriptive information on each threatened plant including its conservation status, habitat, threats, and conservation work undertaken to date.

2. To describe the key conservation actions needed to initiate or continue the recovery of each threatened plant.

3. To identify any significant themes arising from analysis of the information collated to meet objectives 1 and 2.

3. Background

3. 1 SIZE OF THE NEW ZEALAND FLORA

New Zealand's vascular flora is believed to consist of 2300-2470 species (Webb et al. 1988; Wardle 1991; de Lange & Norton 1998), of which 82-85% are endemic (Cockayne 1967; Webb et al. 1990; Wardle 1991; de Lange & Norton 1998). Approximately 20% of this flora remains unnamed (P.J. de Lange, pers. comm. 1997) and many of these unnamed taxa will be threatened and thus require management.

New Zealand has a unique native flora, with higher levels of endemism occurring in areas that arc geologically diverse and stable, i.e.,, the northern North island and the northwest South Island. Areas that are younger and less stable (i.e., southern North Island, central South Island) have significantly lower

[1] The term plants is used in a descriptive sense throughout this document and should be taken as meaning species, subspecies, varieties, and forma of vascular plants. Vascular plants are defined here as plants with an internal vascular conducting system (Section 4.1).

[2] The categories of threatened plants covered by this document are described in Section 4.2.

numbers of endemic species (Cockayne 1917; Wardle 1963; Burrows 1965; McGlone 1985).

3.2 THE THREATENED NEW ZEALAND FLORA

A significant proportion of New Zealand's flora (20%) is considered to be under some form of threat (Cameron et al. 1995), and approximately 86% of these threatened plants are endemic, reflecting the proportion of endemism in the flora as a whole. The threats to New Zealand's native flora come from a range of processes which are mostly the result of human activities or actions.

3.3 THREATENED SPECIES RECOVERY PLANNING

The Department of Conservation has responsibility for protecting and conserving New Zealand's indigenous plants and animals (Native Plants Protection Act 1934, Wildlife Act 1953, Reserves Act 1977, Marine Mammal Protection Act 1977, National Parks Act 1980, Conservation Act 1987). Planning for the recovery of threatened plants and animals occurs through the production of species recovery plans. These are ten year plans which describe the course of action needed to meet stated recovery goals for a species or group of species.

The Department's Strategic Business Plan (Department of Conservation 1998) requires planning documents to be prepared for all Category A, B, and C species by the year 2002. The type of recovery planning documents that will be used to meet this objective (Objective 1.1.2, Strategic Business Plan) are being developed at the time of writing ("Standard Operating Procedure-Species Recovery Planning" (Brown & Molloy 1999). *The Conservation Requirements of New Zealand's Nationally Threatened Vascular Plants* document serves to provide interim guidance on the key conservation actions that can be initiated while more detailed recovery plans are being produced.

This document identifies the key conservation actions required for the highest priority threatened plants. These key conservation actions are not prioritised, as they are all considered high-priority actions. Although this document focuses on the conservation management requirements of the plants, most conservation recovery actions should be co-ordinated with ecosystem/habitat conservation initiatives.

4. Scope

4.1 VASCULAR PLAN'T'S

This document covers only vascular plants, which are defined as plants with an internal conducting system of xylem and phloem; they include the ferns, fern allies, conifers, and flowering plants. As knowledge of New Zealand's non-vascular flora (i.e., lichens, mosses, liverworts, and hornworts) improves, a document similar to this could be produced.

4.2 PRIORITY PLANTS

The resource for this document was *Setting priorities for the conservation of New Zealand's threatened plants and animals* (Molloy & Davis 1994), also known as the Department's Species Priority Ranking System. A description of this system is given in Appendix 9.1. The Species Priority Ranking System assessed a subset of the plants listed in the New Zealand Botanical Society's threatened and local plant list (Cameron ct al. 1993, 1995) against a set of criteria and assigned the plants to one of seven categories:

A = highest priority for conservation action;

B = second priority for conservation action;

C = third priority for conservation action;

I = plants about which little information exists but which are considered threatened;

M = plants that are rare or localised and of cultural importance to Maori;

O = plants which are threatened in New Zealand but are thought to be secure in other parts of their range outside New Zealand;

X = plants which have not been sighted for a number of years, but which may still exist.

Categories A (Appendix 9.3), B (Appendix 9.4), I (Appendix 9.5), and X (Appendix 9.6) are covered by this document. A number of unranked and lower ranked (i.e. C, O) plants have been found to be under severe threat since the publication of Molloy & Davis (1994) and have therefore been added as Appendix 9.7.

Information on the status, habitat, past conservation efforts, and key recovery actions required (for explanations, see Appendix 9.1) is provided for each Category A (36 vascular plants); B (68 vascular plants); Category X (10 vascular plants); and lower-ranked plants (16 vascular plants) in the form of "plant profiles". Category 1 (92 vascular plants) plant information is contained in abbreviated profiles because of a lack of information on the plants in this category.

4.2.1 Category I

Under the Department's Species Priority Ranking System (Molloy & Davis 1994), plants that are suspected to be under some form of threat are placed in Category I (Indeterminate) where there is insufficient information to place them in any of the other categories (A, B, C, O, M, or X). In most Category I cases, the plant's taxonomic status requires clarification and/or field survey is required to establish distribution and abundance. To facilitate the necessarv work on these plants so that their conservation status can be ascertained and appropriate management actions taken, they have been divided into four categories of priority action (Appendix 9.5):

- high = high priority for reconnaissance work;
- med. = medium priority for reconnaissance work;
- low = low priority for reconnaissance work;
- rem. = can be removed from threatened plants lists as the plant is no longer considered threatened.

These orders of priority were establised at a threatened plant workshop, held by the Department of Conservation in 1997. Threats were assessed on the basis of field experience of the relevant local botanists and were based on decline in the population(s). Category I high-priority plants could be considered to have equal priority for conservation action to Category A plants, while medium-priority Category I plants could be considered on par with Category B, and low-priority Category I with Category C plants.

4.2.2 Other categories

Plants which fall into the other three Molloy & Davis categories (i.e., Categories C, M, and O) are not covered in this document because:

1. 'they are lower priority for conservation action (C).
2. Management needs are more appropriately decided at a local level in consultation with iwi (M).
3. They are known to be the same as overseas counterparts and they are not under threat in overseas parts of their range (O).

4.3 USERS OF THIS DOCUMENT

Although the primary users of this document will be Department of Conservation staff, it is hoped that others involved with plant conservation will use it during. the planning phase of plant conservation programmes. Examples of organisations with staff who may find this document of use include universities, botanical societies, botanic gardens, nurseries, non-government organisations, CRIB, and district and regional councils.

5. Development of the plant profiles

Information specified in objectives 1 and 2 is presented in the form of plant profiles (Appendices 9.3, 9.4, 9.6, 9.7) and abbreviated plant profiles (Appendix 9.5). This information is of two types. The first type includes background information on each plant: scientific, family, and common names; regions to which the plant is endemic or indigenous: current DOC and IUCN rankings; brief description of plant form; present day and historic conservancy distribution; whether or not the plant is in cultivation from a known provenance; general description of the present day habitat type(s) in which the plant can be found; key threats; and recent conservation work undertaken.

The second type of information relates to priority actions required: survey and monitoring requirements; research questions that need to be answered to assist conservation work; and key management tasks. For a more detailed explanation of the fields, see Appendix 9.2. All of the information described above was obtained from a panel of DOC botanists. Final additions were made by the authors.

It is worthwhile noting that there are a number of plants listed in the various threat categories that are considered to be vagrant to New Zealand, i.e., they are naturally transitory in the New Zealand botanical region and often fail to establish beyond their introduction point (de Lange & Norton 1998). These plants commonly originate in Australia and, on the whole, tend not to be threatened there. Plants identified as vagrant are not of high conservation concern. These plants have been identified as vagrants in the relevant plant profiles.

6. Analysis of the data in the plant profiles

Collation and analysis of the information contained in the Category A and B plant profiles in Appendices 9.3 and 9.4 revealed some themes which may be of relevance to resource allocation decisions for threatened plant conservation. The plant, profiles provide information on: the distribution of Category A and B threatened plants; the plant forms; the typical habitat types; the threats; the survey requirements; the research requirements; and the management requirements. This section presents the results of this analysis.

6.1 CONSERVANCY DISTRIBUTION OF CATEGORY A AND B THREATENED PLANTS

During restructuring of the Department of Conservation in 1997 some changes to conservancy boundaries were made. The principal changes were the shift of the Chatham Islands from the Canterbury to the Wellington Conservancy; and the amalgamation of the East Coast and Hawke's Bay Conservancies (now East Coast/Hawke's Bay Conservancy), with the western Ruahine Range being shifted from Hawke's Bay Conservancy to Wanganui Conservancy. The combined present day totals of the Category A and B threatened plants by conservancy (Fig. 1) range from 8 (West Coast) to 38 (Nelson/Marlborough), and three groups can be separated out:

- Nelson/Marlborough has a total of 38 Category A and B plants. This is considerably more than any other conservancy.
- A middle group had combined totals ranging from 21 to 31. In order of decreasing numbers they are Otago, Canterbury, Wellington (including the Chatham Islands), Northland and Wanganui, and Southland Conservancies.
- The final group had the lowest combined totals, ranging from 8 to 16. In order of decreasing numbers they are East Coast/Hawke's Bay, Auckland and Waikato, Tongariro/Taupo and Bay of Plenty, and West Coast Conservancies.

Numbers of Category A and B plants recorded historically in a conservancy (i.e., not recorded since 1984 and therefore possibly extinct at the conservancy level) are also presented in Fig. 1. These possible extinctions range from 1 (Tongariro/Taupo, Wanganui, West Coast) to 11 (Wellington).

6.2 PLANT FORMS

Figure 2 represents the proportions of the plant forms in Categories A and B, separated into the following forms and subforms (following Druce et al. 1987):

dicotyledons: composite herbs, non-composite herbs, trees and shrubs, lianes and related trailing plants (vines);

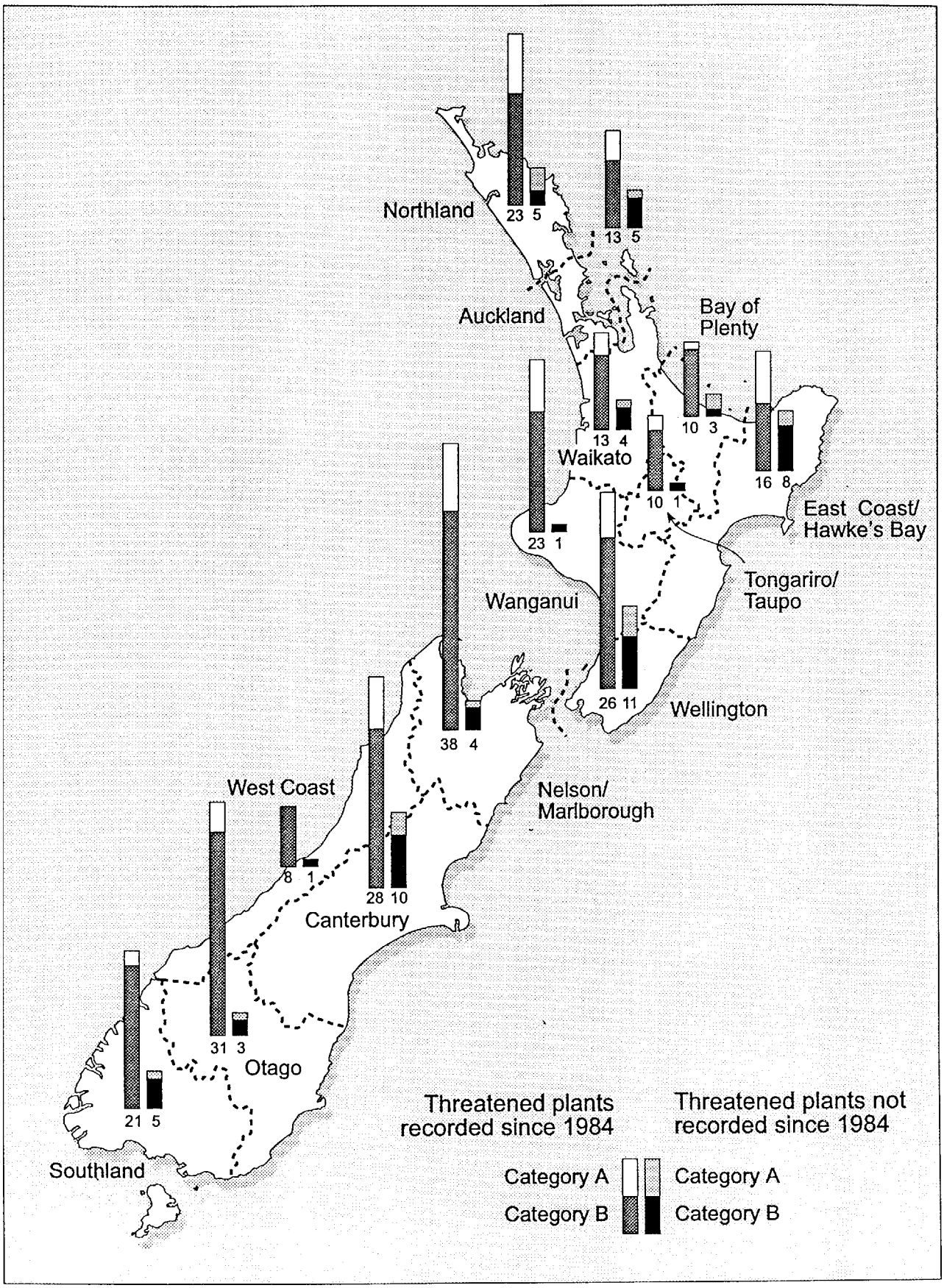

FIGURE 1. PRESENT (POST-1984) AND HISTORIC (PRE-1984) DISTRIBUTIONS OF CATEGORY A AND B PLANTS IN THE 13 CONSERVANCIES OF THE DEPARTMENT OF CONSERVATION. THE TOTALS AT THE BOTTOM OF THE BARS ARE THE COMBINED TOTALS FOR CATEGORY A AND B PLANTS PRE- AND POST-1984.

- monocotyledons: orchids, grasses, sedges, other herbs, and palms;
- pteridophytes: ferns and fern allies.

While dicotyledons are heavily represented, this is a reflection of the high proportion of dicotyledons in the New Zealand vascular plant flora. There are approximately 42 woody plants (trees and shrubs), 66 non-woody plants (i.e., herbs, grasses, etc.), and 5 ferns and fern allies.

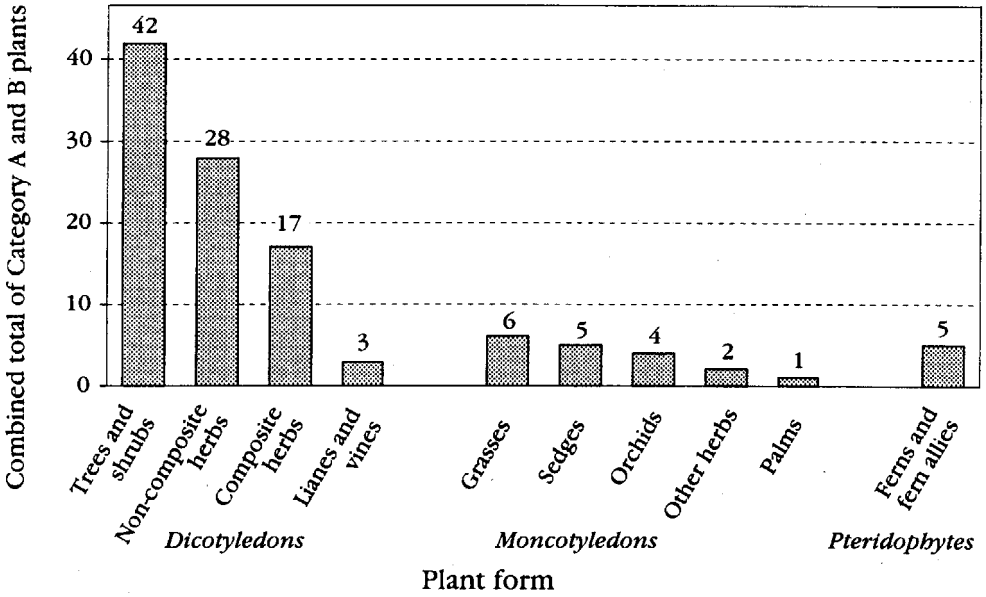

FIGURE 2. BREAKDOWN OF CATEGORY A AND B PLANTS BY PLANT FORM. PLANT FORMS FOLLOW THOSE OF DRUCE ET AL. 1987.

6.3 HABITAT TYPES

The analysis of the habitat types in which Category A and B plants occur was undertaken by allocating each plant to eight broad habitat types (Fig. 3). A plant could be scored in more than one habitat type provided that those habitat types were typical for the plant, that is, plants were not allocated to habitat types in which they are found only occasionally. The present habitats where threatened plants are found are not necessarily their preferred ones, but may be where these plants have managed to survive after having been marginalised from more favourable habitats.

The eight broad habitat types for Category A and B threatened plants were:

- outcrops, bluffs, and cliffs;
- lowland forests;
- wetlands (including aquatic, swamps, swamp and lake edges (wave-wash margins), water channels, flushes, and peat and bog sites);
- shrublands (including coastal shrublands, and scrublands);
- coastal herbfields and dunes (including dune slacks, shorelines, and turfs);

- riparian (including eyots in braided rivers, and floodplains);
- montane forest; and
- coastal forest.

There were a further five habitat types identified: upland grassland; scree; salt-pans; alpine herbfields; and other-but these contained less than 5% of the Category A and B plants and therefore are not shown in Figure 3.

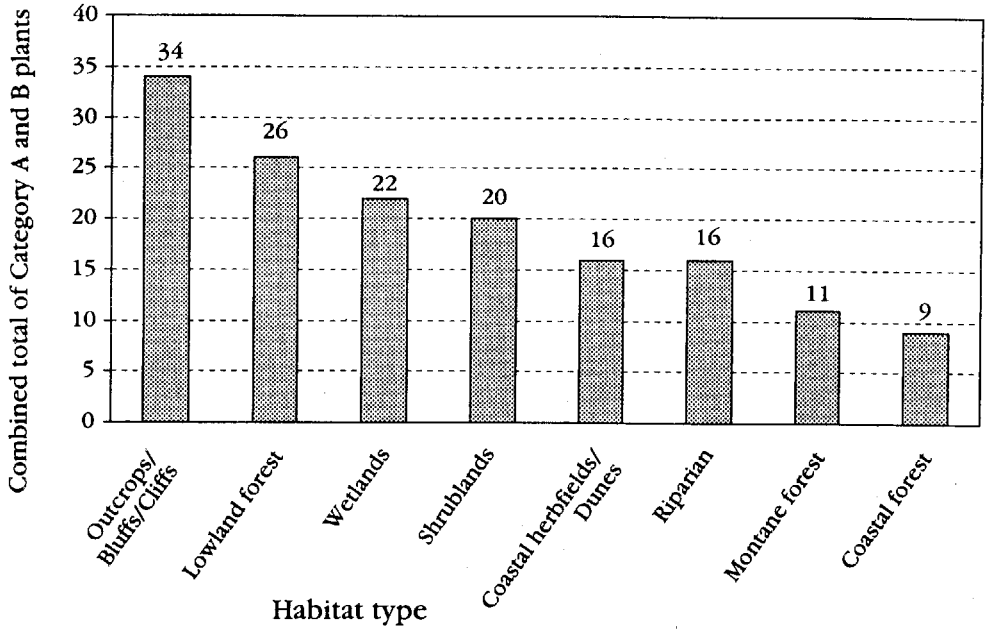

FIGURE 3. MAIN HABITAT TYPES OCCUPIED BY CATEGORY A AND B PLANTS (COMBINED). PLANTS CAN BE SCORED IN MORE THAN ONE HABITAT TYPE, PROVIDED THAI' THAT HABITAT IS TYPICAL FOR THE PLANT. HABITATS THAI' A PLANT ONLY OCCASIONALLY OCCURS IN WERE NOT SCORED.

6.4 THREATS

The types of threats which arc common to the Category A and B plants were determined by allocating each plant to the threat types that affected it, and then amalgamating those threats into seven broad threat categories (Fig. 4). Plants could occur in more than one threat type:

- habitat loss due to destruction and/or degradation;
- browsing and grazing;
- weed encroachment;
- lack of legal land protection;
- trampling by animals;
- reproductive disruption; and
- collection.

Other threat types identified, but less significant, were (in descending order): catastrophic events; disease; hybridism; competition from native plants (i.e., succession); inappropriate weed control; vandalism; and recreational use of land.

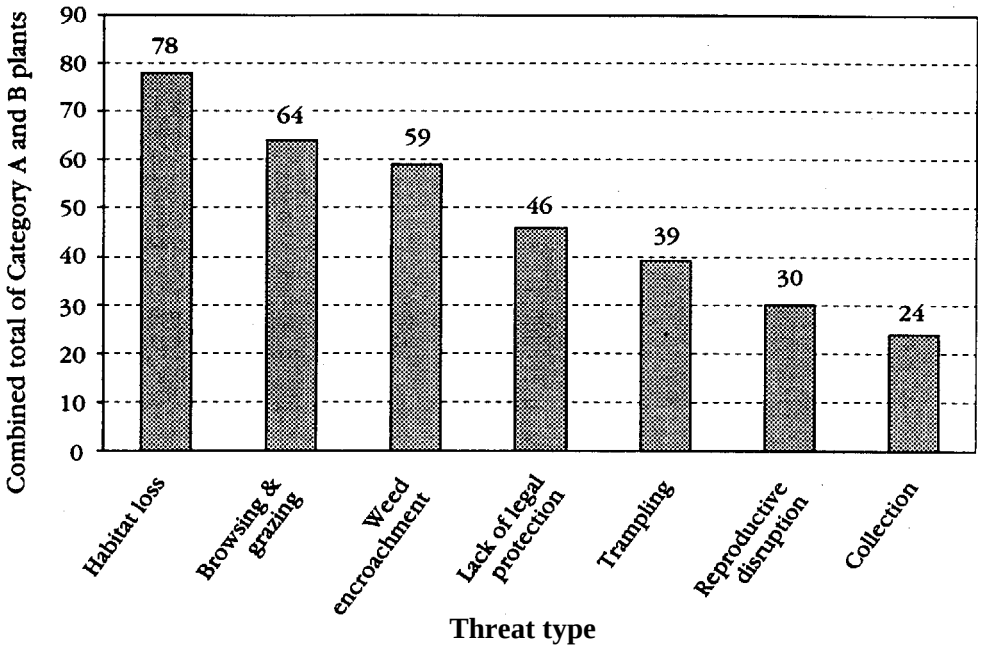

FIGURE 4. SUMMARY OF THREATS FACED BY CATEGORY A AND B PLANTS (COMBINED). PLANTS CAN BE SCORED IN MORE THAN ONE THREAT TYPE.

Table 1 shows the threats which affect Category A and B plants in different habitats. A brief summary of each threat is given below.

Habitat destruction/degradation

Habitat loss due to destruction and degradation (e.g., resulting from fire, flooding, erosion, land use, drainage, changes in water levels, etc.) affect 75% (78 out of 104 plants) of all Category A and B plants e.g., *Leptinella nana, Gnaphalium luteo-album* var. *compactum*. Habitat loss is predominant in wetlands; lowland forest; outcrops, bluffs, and cliffs; and shrublands.

Browsing and grazing

Browsing and grazing (including ringbarking) by introduced wild and domestic animals, and invertebrates, is a threat for 62% (64) of the Category A and B plants, e.g., *Mueblenbeckia astonii, Pittosporum patulum*. Browse usually impacts on plant populations by inhibiting the plants' ability to reproduce, and is the most common threat to plants on outcrops, bluffs, and cliffs; and in lowland forest habitats (Table 1).

Weed encroachment

Weed encroachment, including competition, affects 57% (59) of the Category A and B plants, e.g., *Pterostylis micromega, Crassula hunua.* Weeds affect threatened plants by out-competing them for resources, and/or altering their habitats to such an extent that they are no longer habitable by the threatened plants (e.g., forming dense swards through which germinating seedlings cannot penetrate). Weed encroachment most commonly affects threatened plants on outcrops, bluffs, and cliffs; and in wetland habitats (Table 1).

Lack of legal land protection

Lack of legal land protection affects 44% (46) of the Category A and B plants, e.g., *Olearia pachyphylla, Eleocharis neozelandica.* Threatened plants in lowland forests; on outcrops, bluffs, and cliffs; and in shrubland habitats are most commonly affected. Lack of protection is not itself a threat, but it greatly increases the likelihood of other threats being manifested. Currently, there is no effective legislation which protects native plants per se.

Trampling

Trampling, including pugging, rooting, and disturbance, affects 38% (39) of the Category A and B plants, e.g., *Metrosideros bartlettii, Embergeria grandifolia.* Trampling, predominantly by stock (cattle), can affect plants in two ways: by compacting the soil, making root establishment and penetration difficult, and/or damaging and killing establishing plants and damaging older plants. Category A and B plants in lowland forests; wetlands; on bluffs and cliff tops; and coastal herbfields and dunes are most commonly affected (Table 1). As well as directly causing damage to plants, stock can also be significant weed vectors.

Reproductive disruption

Lack of ability to reproduce and/or regenerate is a threat for 29% (30) of the Category A and B plants, e.g., *Gunnera hamiltonii, Hebe brevirecemosa.* Many different processes can affect a plant's ability to reproduce (e.g., lack of pollinating and seed-dispersing vectors, infertility, and imbalanced or separated populations of male and female plants of dioecious species). Lack of ability to reproduce and/or regenerate is prevalent in the Category A and B plants in lowland forests (Table 1).

Collection

Collection of plant specimens is a problem for 23% (24) of the Category A and B plants, e.g., *Melicytus drucei, Pterostylis micromega.* Unfortunately, the rarer or more specialised a plant is, the higher the chances are of it being a desired specimen for collection. Collection is most commonly a problem for plants on outcrops, bluffs, and cliffs; in lowland forests; and in wetlands (Table 1).

Other threats

Catastrophic events (including storm damage) could potentially affect 12% (12) of the Category A and B plants. The smaller and more discrete a population is, the more susceptible it is to a catastrophic event, e.g., *Pennantia baylisiana, Tecomantbe speciosa.*

Disease affects 10% (10) of the Category A and B plants. It is noteworthy that the majority of threatened plants known to be affected by disease belong to the genus *Lepidium*. The disease agent is the same in all cases-the white rust *Albugo candida.* Some threatened plants not known to be affected by *A. candida* in the wild become so in cultivation.

Hybridism could potentially affect 8% (8) of Category A and B plants. Hybridism usually occurs when the niches of related species overlap. As a rule, hybrids are common in the New Zealand flora and are of little consequence. However, in

some recently studied situations (e.g., *Acaena rorida, Senecio scaberulus)* hybridism within these seriously depleted threatened species populations has been considered detrimental for the long-term viability of the species.

Natural succession and competition from native plants affects 6% (6) of the Category A and B plants. Succession is a process whereby certain seral/early coloniser plants are replaced over time by later colonising/successional plants. Although succession is a natural event, this process becomes an additional threat to threatened seral plants (e.g., *Clianthus puniceous)* if new sites are not being opened up for them to colonise.

Inappropriate weed control (for example, roadside spraying, e.g., *Hebe bisbopiana;* control of threatened plants misidentified as weeds, e.g., *Senecio scaberulus, Urtica linearifolia)* affects 4% (4) of the Category A and B plants. Vandalism affects 3% (3) of the Category A and B plants (e.g., loranthaceous mistletoes). Recreational use of land (e.g., four-wheel drive use on beaches and dunes, skiers, trampers) affects 2% (2) of the Category A and B plants, e.g., *Australopyrum calcis* subsp. *optatum*.

TABLE 1. THREATS AFFECTING CATEGORY A AND B PLANTS ACCORDING TO HABITAT TYPE.

THREAT	Outcrops, bluffs, and cliffs	Lowland forest	Wetlands	Shrublands	Coastal herbfields and dunes	Riparian	Montane forest	Coastal forest
Habitat destruction and degradation	18	20	20	17	14	12	5	8
Browsing and grazing	24	20	8	17	9	12	9	7
Weed encroachment	18	11	16	9	14	10	1	5
Lack of legal land protection	12	14	10	12	10	7	1	4
Trampling	9	11	10	6	9	5	2	4
Reproductive disruption	6	13	2	7	3	6	4	4
Collectors	9	6	6	1	4	4	2	2

Threats affecting plants in each habitat type

The five habitat types that were predominantly affected by the seven major threat types were: outcrops, bluffs, and cliffs; lowland forest; wetlands; shrublands; and coastal herblands and dunes (Table 1). This result corresponds directly with the five most common habitat types for category A and B plants (Fig. 3)

Thirty three percent (33 out of 104 plants) of all the Category A and B plants occur in outcrops, bluffs, and cliff habitats (Fig. 3). The predominant threats to the threatened plants in these habitats are (in order of severity): browsing and grazing; habitat loss and weed encroachment (Table 1). Twenty five percent (26) of all the Category A and B plants occur in lowland forests (Fig. 3) and the predominant threats to the plants in this habitat are browsing and grazing, and habitat loss (Table 1).

Twenty one percent (22) of all the Category A and B plants occur in wetlands (Fig. 3) where the predominant threats are habitat loss, and weed encroachment (Table 1). Nineteen percent (20) of all the Category A and B plants occur in shrublands (Fig. 3) and are predominantly threatened by habitat loss, and browsing and grazing (Table 1). Fifteen percent (16) of all the Category A and B

plants occur in coastal herbfields and dunes, and riparian habitats (Fig. 3). The predominant threats in coastal herbfields and dunes are habitat loss and weed encroachment (Table 1). The predominant threats in riparian habitats are habitat loss; browsing and grazing; and weed encroachment.

Eleven percent (11) of all Category A and B plants occur in montane forest (Fig. 3) and are predominantly threatened by browsing and grazing (Table 1). Nine percent (9) of all Category A and B plants occur in coastal forests forest (Fig. 3) and are predominantly threatened by habitat loss (Table 1).

6.5 SURVEY REQUIREMENTS

Those conservancies with the highest numbers of Category A and B plants (Fig. 1) also have the highest number of threatened plants requiring survey. Seventy eight percent of Category A, and 94% of Category B plants require survey. Primarily, survey work needs to be done to provide and extend information on threatened plant distributions and abundances. Survey of historical sites (i.e., sites where a plant has previously been recorded) is an important component of this work. Survey also assists in identifying the types of habitat where threatened plants occur, and identifies potential sites for translocation work.

6.6 RESEARCH REQUIREMENTS

Research requirements were grouped into nine broad questions (Table 2). The plants could be scored in more than one research question. A further seven research questions were identified that affected less than 5% of the Category A and B plants and are therefore not shown in Table 2. Three fundamental research questions are common to two-thirds of all Category A and B plants (Table 2). The question, "What is the taxonomic status of the plant?" needs to be answered for 22% (23 out of 104 plants) of these plants; "What are the habitat requirements of the plant?" is a research question for 21% (22) of the plants; and, "What is the general ecology of the plant?" needs to be determined for 18% (19) of the plants.

TABLE 2.RESEARCH THEMES FOR CATEGORY A AND B THREATENED PLANTS. PLANTS CAN BE SCORED IN MORE THAN ONE RESEARCH QUESTION.

RESEARCH THEME	A	B	TOTAL
What is the taxonomic status of the plant?	9	14	23
What are the habitat requirements of the plant?	11	11	22
What is the general ecology of the plant?	7	12	19
What are germination/seedling establishment requirements of the plant?	9	8	17
What threats is the plant exposed to?	4	10	14
What is the reproductive ecology of the plant?	6	8	14
How can weeds best be controlled around the plant?	4	10	14
What is the role and effect of disturbance to the plant's population?	2	9	11
How may the plant be cultivated and propagated *ex situ*?	3	7	10

6.7 MANAGEMENT REQUIREMENTS

Management requirements for Category A and B plants were ascertained by allocating them into one or more of eight management type categories (Fig. 5). Of the four top management requirements for Category A and B plants, 58% (60 out of 104 plants) require weed control; 58% (60) require advocacy work; 57% (59) require animal control; and 49% (51) require legal land protection.

Weed control is required to assist in restoring habitats and to prevent competition. Advocacy is required to mitigate threats such as habitat destruction, and to increase awareness of threatened plants and the threats that face them. Animal control is required to prevent browsing, grazing, trampling, pugging, and weed dispersal. Securing legal land protection in itself does not help conserve and recover the plants in question, but is often the first step required to conserve and restore plant populations by immediately limiting the number of potential threats.

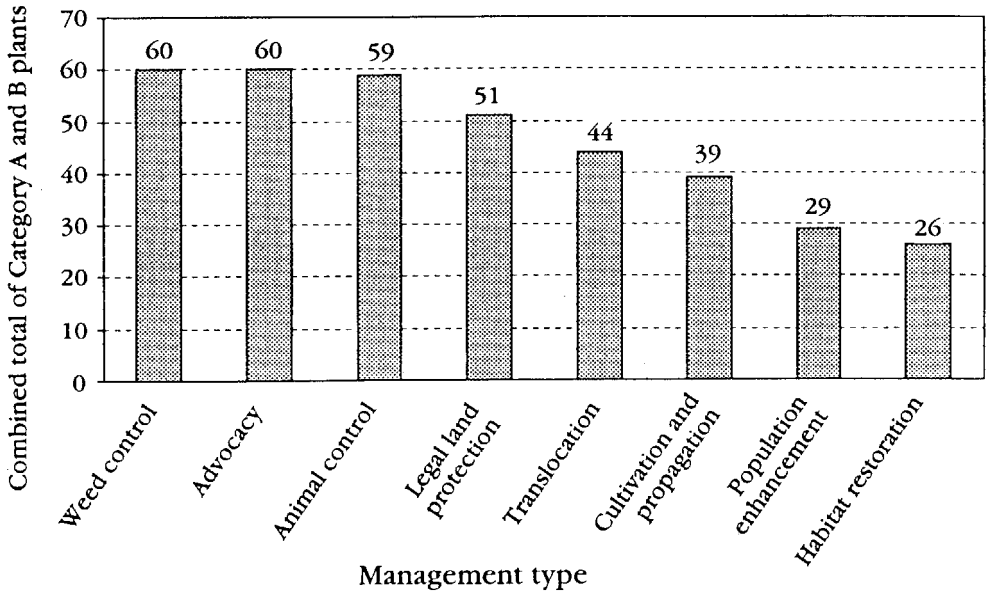

FIGURE 5. MANAGEMENT NEEDS FOR CATEGORY A AND B PLANTS (COMBINED). PLANTS CAN BE SCORED IN MORE THAN ONE MANAGEMENT TYPE.

6.8 CATEGORY I PLANTS

Of the 92 Category I vascular plants, 41 (45%) are considered high priority, 13 (14%) medium priority, and 28 (30%) low priority for reconnaissance work (see Section 4.2.1. Ten (11%) of the 92 plants were recommended for removal from threatened plant lists as they are no longer considered threatened. The majority of the Category I plants occur in the Nelson/Marlborough (54%), Otago (26%), Canterbury (24%), and Southland (18%) Conservancies (Fig. 6). This order was roughly the same for the individual priority categories.

Nelson/Marlborough Conservancy had the highest number of high-priority plants (22 out of 41, 54%), followed by Canterbury (13, 32%), and Otago (11, 27%) Conservancies (Fig. 6). Nelson/Marlborough Conservancy had the

highest number of medium-priority plants (8 out of 13, 62%), followed by Otago (4, 3%), and Canterbury and Southland Conservancies (3, 2% each) (Fig. 6). Nelson/Marlborough Conservancy also had the highest number of low-priority plants (17 out of 28, 61 %), followed by Southland (7, 25%), and Otago Conservancies (6, 21%) (Fig. 6).

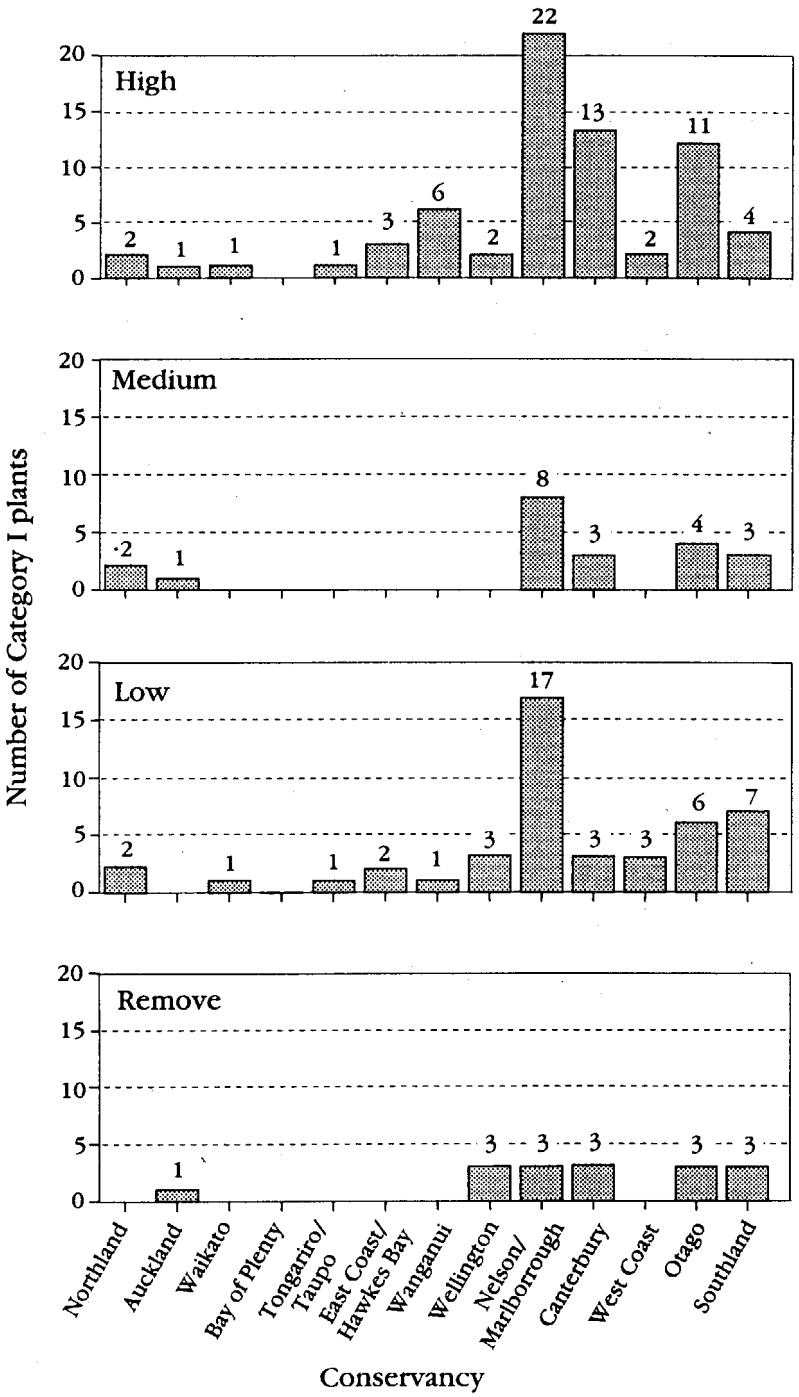

FIGURE 6. NUMBER OF CATEGORY I PRIORITISED PLANTS WITHIN EACH CONSERVANCY.
HIGH = HIGH PRIORITY FOR RECONNAISSANCE WORK. THE PLANTS I N THIS CATEGORY SHOULD BE CONSIDERED ON A PAR WITH CATEGORY A TAXA;
MEDIUM = MEDIUM PRIORITY FOR RECONNAISSANCE WORK. THE PLANTS I N THIS CATEGORY SHOULD BE CONSIDERED ON A PAR WITH CATEGORY B TAXA;
LOW = LOW PRIORITY FOR RECONNAISSANCE WORK. THE PLANTS I N THIS CATEGORY SHOULD BE CONSIDERED ON A PAR WITH CATEGORY C TAXA;
REMOVE = CAN BE REMOVED FROM THREATENED PLANTS LISTS AS THE PLANTS ARE NO LONGER CONSIDERED THREATENED.

PLANTS THAT OCCUR IN SPLIT CATEGORIES (E.G., MEDIUM/HIGH) HAVE BEEN SCORED IN THE HIGHER-PRIORITY CATEGORY (SEE APPENDIX 9.5).
THOSE PLANTS THAT ARE RECORDED AS EXTINCT IN A CONSERVANCY ARE ALSO SCORED, AS WORK IS STILL REQUIRED, E.G., SURVEY AT HISTORIC SITES.

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8. References

Brown, A.; Molloy, J. *1999. Standard Operating Procedure - Species Recovery Planning.* Department of Conservation, Wellington.

Brummitt, R.K.; Powell, C.E. *1992. Authors of plants names.* Kew Royal Botanic Gardens, Suffolk.

Burrows, C.J. *1965.* Some discontinuous distributions of plants within New Zealand and their ecological significance. 11: Disjunctions between Otago-Southland and Nelson-Marlborough and related distribution patterns. *Tuatara 13: 9-29.*

Cameron, E.K.: de Lange, P.J.; Given, D.G.; Johnson, P.N.; Ogle, C.C. *1993.* New Zealand Botanical Society Threatened and Local Plant Lists *(1993* Revision). *New Zealand Botanical Society Newsletter 32: 14-28.*

Cameron, E.K.; de Lange, P.J.; Given, D.G.; Johnson, P.N.; Ogle, C.C. *1995.* New Zealand Botanical Society Threatened and Local Plant Lists *(1995* Revision). *New Zealand Botanical Society Newsletter 39: 15-28.*

Cockayne, L. *1917.* Notes on New Zealand floristic botany, including descriptions of new species. *Transactions and Proceedings of the New Zealand Institute 49: 56-65.*

Cockayne, L. *1967. New Zealand Plants and their Story*. Government Printer, Wellington.

de Lange, P.J.; Norton, D.A. *1998.* Revisiting rarity: a botanical perspective on the meanings of rarity and the classification of New Zealand's uncommon plants. *Royal Society* of *New Zealand Miscellaneous Series 48: 145-160.*

Department of Conservation *1998. Restoring the Dawn Chorus. Department of Conservation Strategic Business Plan.* Department of Conservation, Wellington.

Druce, A.P.; Williams, P.A.; Heine, J.C. *1987.* Vegetation and flora of Tertiary calcareous rocks in the mountains of western Nelson, New Zealand. *New Zealand Journal of Botany 25: 41-78.*

Mace, G.; Collar, N.; Cooke, J.; Gaston, K.; Ginsberg, J.; Leader-Wilhams, N.; Millner-Gulland, E.J. *1993.* The development of new criteria for listing plant on the IUCN red list. *Plant 19: 16-22.*

McGlone, M.S. *1985.* Plant biogeography and the late Cenozoic history of New Zealand. *New Zealand Journal of Botany Vol. 23: 723-749.*

Molloy, J.; Davis, A. *1994. Setting priorities for the conservation of New Zealand's threatened plants and animals.* Department of Conservation, Wellington.

Wardle, P. *1963.* Evolution and distribution of the New Zealand flora, as affected by Quaternary climates. *New Zealand,journal of Botany 1: 3-17.*

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

Webb, C.J.; Sykes, W.R.; Garnock Jones, P.J. *1988. Flora of New Zealand, Volume IV*. Botany Division, DSIR, Christchurch.

Webb, C.J.; Johnson, P.; Sykes, W.R. *1990. Flowering Plants of New Zealand.* Botany Division, DSIR, Christchurch.

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