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Department of Conservation guidelines for assessing significant ecological values

M. Davis, N.J. Head, S.C. Myers and S.H. Moore

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Te Papa Atawhai

Cover: Cultivated land and remnant indigenous vegetation, Lake Heron. *Photo: Nicholas Head*

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Abstract

The Department of Conservation (DOC) has a core responsibility to halt the decline of indigenous biodiversity, and understanding how to properly assess ecological values is fundamental to achieving this. These guidelines reflect accepted good practice and have been prepared to promote a consistent approach by DOC staff to assessing terrestrial sites of ecological value. Government policies, Resource Management Act (RMA) plans and non-statutory policies are explained, and their relationships to DOC's statutory responsibilities are clarified. The distinction between significance and importance is explained. Assessing ecological values at the local scale is reinforced, with the Ecological District (ED) framework being endorsed as the critical scale for assessments. Other national assessment frameworks and ecosystem/habitat classifications are also discussed. A full range of ecological assessment criteria are described and promoted. The importance of recognising the 'commonplace' is emphasised within the key criterion of representativeness, in contrast to the historically narrow focus of 'best examples' or rarity assessments. The importance of context is highlighted so that assessments recognise the fundamental value of induced and secondary ecosystems in present-day New Zealand. Significance thresholds are discussed and examples provided to show how significance assessments vary in different contexts. Appendices include case studies of significance assessments, and case law examples (e.g. the Horizons One Plan) with key points and added commentary.

Key words: ecological assessment, ecological context, Ecological Districts, assessment criteria, assessment examples, case law.

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1. Preface

Halting the decline of indigenous biodiversity is a core responsibility for the Department of Conservation (DOC). To achieve this, DOC staff require a sound understanding of how to assess ecological values present at a particular site.

These guidelines are aimed at assisting staff to assess terrestrial ecological values (including wetlands) in a consistent and robust way. Their use should help DOC to meet its statutory obligations to halt the decline of indigenous biodiversity and to raise awareness of nature conservation generally.

Key DOC users of the guidelines are anticipated to be rangers, technical advisors, partnerships staff, science advisors, permissions staff, planners, policy advisors and managers. However, the guidelines are not specific to DOC, as the approach outlined can be used by others involved in ecological assessments (e.g. councils).

It is essential that all staff involved in assessing ecological values become familiar with these guidelines so they can undertake their assessments effectively. For many situations this will require input from appropriate technical staff, particularly while people become familiar with the guidelines, where issues are more complex and where freshwater ecosystems are involved.

Manager approvals for specific activities should only be made when it is clear that the required assessment matters outlined in the guidelines have been met. To assist with this, a checklist is provided at Appendix 1. This checklist should be used for every activity that potentially affects ecological values.

2. Introduction

The decline of indigenous biodiversity was identified as New Zealand's most pervasive environmental issue (Taylor & Smith 1997), and halting this on-going decline is a matter of national importance. DOC has a core statutory responsibility to achieve this in managing public conservation land and through advocating for indigenous biodiversity generally. These responsibilities are specified in DOC's Intermediate Outcome 1 (IO1), i.e. **the diversity of our natural heritage is maintained and restored**, which is closely aligned to the New Zealand Biodiversity Strategy (3.2 below). One of the key methods for achieving IO1 is given in DOC's Statement of Intent (2015–2019), i.e. **advocate for protection** and this is where these guidelines have a major role to play. The full outcome is provided in Appendix 2. It should also be recognised that other agencies have important roles, such as local authorities who have a Resource Management Act 1991 (RMA) responsibility to maintain indigenous biodiversity.

DOC staff are often required to assess and identify ecological values, and to determine the effects of various development proposals on public conservation land and private land. They are also asked to determine which sites are more important and to prioritise them for a variety of reasons. It is obvious that these tasks need to be done properly and consistently; if outdated or incorrect approaches are used to identify ecological values it will undermine DOC's ability to meet its core statutory function of protecting indigenous biodiversity.

3. The context

3.1 The state of indigenous biodiversity

Before discussing significance it is essential to understand the context for assessing significance, including the state of New Zealand's indigenous biodiversity. Several reports were produced over the last decade or so which provide detailed information about the state of New Zealand's indigenous biodiversity. The most useful are Taylor & Smith (1997), DOC & MfE (2000), MfE (2000a, b), Davis (2002), Green & Clarkson (2005), Walker et al. (2006) and the World Wildlife Fund (2012).

The reports reached broadly similar conclusions, the key ones being:

- The decline of indigenous biodiversity is New Zealand's most pervasive environmental issue.
- In terrestrial environments approximately 60–70% of threatened vascular plant species appear to be dependent on private land.
- Past losses and fragmentation of biodiversity have been most severe on flat lowland or coastal land, and the condition of what remains there continues to decline.
- On private land the main causes of decline are habitat destruction or modification through the removal, fragmentation and degradation of ecosystems, wetland drainage and the effects of pests and weeds.
- Habitat loss and destruction is still occurring, with agricultural intensification being a prime causal factor, especially associated with dairy farming. This has resulted in further pollution and degradation of water in rivers and lakes, and further loss of habitat for indigenous biodiversity.

3.2 The New Zealand Biodiversity Strategy (NZBS)

The NZBS (DOC & MfE 2000) was prepared in response to the on-going decline of indigenous biodiversity and to fulfil commitments made under the international Convention on Biological Diversity in 1992. The purpose of the NZBS was to establish a strategic national approach to halt this decline and sustainably manage New Zealand's biodiversity.

The four goals of the NZBS are aspirational, with Goal 3 (Halt the decline in New Zealand's indigenous biodiversity) being specifically relevant to these guidelines:

> *Maintain and restore a full range of remaining natural habitats and ecosystems to a healthy functioning state, enhance critically scarce habitats, and sustain the more modified ecosystems in production and urban environments; … and do what else is necessary to maintain and restore viable populations of all indigenous species and subspecies across their natural range and maintain their genetic diversity.*
>
> (DOC & MfE 2000)

The focus of this goal is to maintain indigenous biodiversity and, as the lead government department, DOC has a crucial role in taking actions that help to achieve the goal.

The NZBS is also useful for providing information about the character and state of our indigenous biodiversity, and its importance internationally. It highlights New Zealand's physical isolation, its high level of endemism, and the subsequent impacts of human colonisation and settlement. It outlines the state of our indigenous biodiversity, providing some statistics, figures and specific examples. A key issue is that our least-modified and most protected land is in mountainous areas, while lowland biodiversity is much more modified and least protected. The NZBS identifies the key threats and notes that 70% of New Zealand is privately owned.

3.3 Ecological significance and importance

It is essential to understand the context within which ecological values need to be assessed. In simple terms, assessments need to reflect the underlying importance of local settings, whilst taking account of broader guidance provided by national frameworks. Too often, sites that appear to be of little ecological value to non-ecologists are subject to development or loss, yet when considered in the appropriate ecological context they have significant ecological values and should be protected. Examples include depleted short tussock grasslands or scrub on low-altitude alluvial fans and valley floors, and degraded lowland wetlands.

A related issue is the relative value of different types of public conservation land for indigenous biodiversity. It may be expected that higher-value areas would generally have a 'higher status', such as national parks or nature reserves, but this is not always the case. At the other end of the spectrum are those lands with a 'lesser status', including stewardship areas, local purpose reserves, recreation reserves, conservation parks and some conservation areas. Schedule 4 of the Crown Minerals Act 1991 lists public conservation land that is excluded from mining on the basis of its high conservation values, and one might assume this would provide useful guidance. However, the list does not include the National Reserve, Reserves Act scenic reserves, Conservation Act conservation parks or ecological areas, many of which support highly significant biodiversity values. Additionally, some recreation reserves and stewardship areas can support highly significant biodiversity values (e.g. Molesworth Recreation Reserve and some riverbeds). There are also examples of local purpose reserves supporting indigenous remnants that are otherwise rare in lowlands.

The implication of this is that public conservation land that has a perceived 'lower value' classification could, in fact, support significant indigenous biodiversity. Note, however, that lands designated under the Conservation Act as conservation parks and stewardship areas must be managed so that their natural and historic resources are protected. Applications or concessions that could adversely affect such areas require the areas to be carefully assessed to determine the actual indigenous biodiversity values present. This should be done by following the methods described in these guidelines.

Before the context for assessing significance is addressed, the distinction between 'significance' and 'importance' requires clarification. Significance has a specific statutory meaning derived from s6(c) of the Resource Management Act 1991 (RMA), i.e. the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna. This subsection applies to private and public conservation land, as significant sites on either land type can be modified or destroyed by a variety of threats, although they are especially vulnerable on private land. These areas are formally protected on public conservation land by the Conservation Act and other relevant Acts administered by DOC. However, they can still be modified or destroyed by activities on or adjacent to public conservation land (e.g. mining, drainage or irrigation).

A definition of significance was provided in the Proposed National Policy Statement (NPS) (see section 6.1 of these guidelines), which is similar to those used by Walker et al. 2008a, b. These definitions have been refined as follows to reflect the importance of assessing significance at the local (Ecological District) level, as explained in section 8 of these guidelines:

> *An area of significant indigenous vegetation or a significant habitat of indigenous fauna is an area or habitat whose protection contributes to the maintenance of indigenous biological diversity at the Ecological District level.*

This definition makes the important link between s6(c) and ss30 & 31 of the RMA, which state that one of the functions of local authorities is the maintenance of indigenous biological diversity.

In contrast, 'importance' is about the relative value of areas, habitats, species or ecosystems and priorities for their protection and management. For example, a particular district may contain 200 significant sites, but some sites are considered to be more important than others. Importance may be determined on the basis of several factors, such as their inherent ecological values, their proximity to other sites, their degree of modification, their vulnerability to threats, or the extent to which similar ecosystems are formally protected. As a result, a small degraded indigenous shrubland on a lowland plain may be rated more highly than a substantial, good-quality beech remnant in nearby hill country, even though both are significant. This primarily reflects the rarity of the former, compared with the more common occurrence of beech forests, which are better protected and less threatened by development and loss. On public conservation land, importance is often used to determine work priorities for indigenous biodiversity in response to limited funding.

A related issue is that areas are also assessed to determine their management requirements (e.g. to improve their condition or viability). While this can be done at the same time as assessing an area's significance, it is often done in more detail as a separate assessment. Either way it is important to recognise that assessments for significance and management requirements are separate concepts, and that management requirements should not influence whether an area is identified as being significant or not.

Ecosystems considered to be important will almost always be ecologically significant, whereas an ecosystem that meets ecological significance criteria can sometimes be rated as less important compared with other significant ecosystems. Where significant ecosystems are considered to be particularly important, adverse effects of activities on them should be avoided altogether. Where significant ecosystems are considered to be less important, significant adverse effects should be avoided, while other adverse effects should be avoided, remedied or mitigated.

4. DOC statutory responsibilities for indigenous biodiversity

DOC has statutory obligations under several acts and government policies. When using specific terms from legislation, government policies and council plans, particular attention should be given to their definitions. Their meanings need to be clearly understood so the terms are correctly used. Some important definitions and interpretations are provided in Appendix 3.

Conservation Act

DOC has key responsibilities to manage land and natural resources for conservation purposes, to preserve indigenous freshwater fish and their habitats and to advocate for the conservation of natural resources generally. The use of natural resources for recreation and tourism is to be fostered, providing it is consistent with their conservation.

DOC is required to manage conservation values on public conservation land or on private land by agreement with the owner. In other circumstances, advocacy is the main means by which DOC is able to promote conservation on private land (e.g. submissions on RMA plans).

Reserves Act

In administering this Act, DOC can promote the preservation of areas of ecological, natural and scientific value, and seek to ensure the survival of all indigenous species of flora and fauna, both rare and commonplace, in their natural communities and habitats. There is also an obligation to promote the preservation of the natural character of the margins of lakes and rivers, (which is also carried through to the RMA).

Another key aspect is to preserve representative samples of all the classes of natural ecosystems and landscape that originally gave New Zealand its own distinct character. This recognises the unrepresentative nature of New Zealand's protected natural area system and is directed at improving the situation. While this approach remains relevant today, as our understanding of the importance and plight of indigenous biodiversity has evolved, the focus is no longer on protecting representative examples. This is illustrated by the RMA and relevant case law where there is now an obligation to maintain our overall indigenous biodiversity.

Resource Management Act 1991 (RMA)

Under s6(c) of the RMA, the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna is a matter of national importance. This matter must be recognised and provided for to achieve the purpose of the RMA (i.e. the sustainable management of natural and physical resources—s5(1) RMA). The RMA does not define 'significant', but these guidelines provide a definition (see section 3.3) that makes the important link between s6(c) and s30 & s31 of the RMA, which includes the maintenance of indigenous biodiversity. Section 7 of the RMA provides further context for the evaluation of indigenous biodiversity, including having particular regard to the intrinsic values of ecosystems (s7(d)), the maintenance and enhancement of the quality of the environment (s7(f)), and any finite characteristics of natural and physical resources (s7(g)). It is common for people to interpret the requirement for maintaining indigenous biodiversity as solely relying on the protection of significant areas of indigenous biodiversity. However, maintaining indigenous biodiversity includes much more than giving effect to s6(c) RMA. It also includes giving effect to s5 and other parts of s6 and s7, as they all contain provisions relating to the maintenance of indigenous biodiversity.

Under s6(a), preserving the natural character of wetlands is a matter of national importance. While natural character is not a consideration for significance assessments[1], indigenous biodiversity is an important component of natural character.

Case law recognises the importance of ecosystem services and the need for councils to consider s5 to s8 of the RMA when assessing effects on ecosystems (see [2011] NZEnvC129 in Appendix 4).

There are a number of processes associated with the RMA that require the consideration and/or assessment of significance. However, there are two processes that staff are most likely to be involved in; these are resource consent applications and regional, district and city plan development. In both instances these processes must be undertaken in a manner that is consistent with the purpose of the RMA and therefore recognises and provides for significance.

Other policy documents developed in accordance with the RMA and its purpose are also influential when assessing resource consent applications and reviewing proposed or draft plans. These documents are outlined in section 5 of this report.

Crown Pastoral Land Act

Under this Act, DOC's role is to assess conservation values on crown pastoral lease lands that are subject to discretionary consents, and to identify those which should be protected through the tenure review process. From a conservation perspective, the main purpose of tenure review is to protect the significant inherent values of reviewable land. DOC's advice is provided to Land Information New Zealand (LINZ) and the Commissioner of Crown Lands makes the final decision about what should be protected.

Activities such as burning vegetation or disturbing soil by cultivation, drainage or oversowing and topdressing require prior written consent from LINZ. DOC is consulted and provides advice about the protection of inherent values such as indigenous plants and animals, and natural ecosystems.

Wildlife Act

The primary value of the Act is its list of protected or partly protected species of fauna. It protects all native lizards, frogs, native birds (except for black-backed gull *Larus dominicanus*) and some introduced birds, including their nests and eggs. Some invertebrates (e.g. kauri snails *Paryphanta* spp.) and marine life are also protected, but not plants or freshwater fish. A major limitation of the Act is that it does not protect the habitat of these species. The Act also describes three types of protected areas and deals with management planning requirements.

Forests Act

Under this Act DOC is consulted about applications to harvest indigenous timber on private land, and provides information and advice to the Ministry for Primary Industries. This relates to the natural values of the land, the effects of harvesting and how the proposals may need to be modified to achieve sustainable forest management.

[1] (See [2012] NZEnvC162): Friends of Shearers Swamp Inc. (et al.) v. West Coast Regional Council.

5. Statutory policies and plans

5.1 National policy statements (NPSs)

NPSs are prepared in accordance with the RMA. Currently there are four operative national policy statements, with the New Zealand Coastal Policy Statement (NZCPS) being mandatory under the RMA. When considering an application for resource consent, consent authorities must have regard to any relevant provisions of an operative NPS. Similarly, when preparing plans or policy statements under the RMA, consent authorities must give effect to an operative NPS.

5.2 The New Zealand Coastal Policy Statement (NZCPS)

The NZCPS (DOC 2010) applies to the coastal environment, which includes the Coastal Marine Area (CMA) and terrestrial land adjacent to the coast. The coastal environment is not defined by specific limits, as its width varies at different localities (e.g. where plains or hills adjoin the coast). As a general guide, the coastal environment extends inland from the line of Mean High Water Springs and includes land influenced by coastal processes such as the movement of sediment, wind and water.

The purpose of the NZCPS is to state policies to achieve the purpose of the RMA in relation to the coastal environment. There are several provisions that make specific reference to indigenous biodiversity. These are:

Objective 1:

- *To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land, by:*
- *maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature;*
- *protecting representative or significant natural ecosystems and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna; and*
- *maintaining coastal water quality, and enhancing it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.*

Policy 11 – Indigenous biological diversity:

To protect indigenous biological diversity in the coastal environment:

a. *avoid adverse effects of activities on:*
    i. *indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System lists;*
    ii. *taxa that are listed by the International Union for Conservation of Nature and Natural Resources as threatened;*
    iii. *indigenous ecosystems and vegetation types that are threatened in the coastal environment, or are naturally rare;*
    iv. *habitats of indigenous species where the species are at the limit of their natural range, or are naturally rare;*
    v. *areas containing nationally significant examples of indigenous community types; and*
    vi. *areas set aside for full or partial protection of indigenous biological diversity under other legislation; and*

b. *avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on:*

   i. *areas of predominantly indigenous vegetation in the coastal environment;*

   ii. *habitats in the coastal environment that are important during the vulnerable life stages of indigenous species;*

   iii. *indigenous ecosystems and habitats that are only found in the coastal environment and are particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands, dunelands, intertidal zones, rocky reef systems, eelgrass and saltmarsh;*

   iv. *habitats of indigenous species in the coastal environment that are important for recreational, commercial, traditional or cultural purposes;*

   v. *habitats, including areas and routes, important to migratory species; and*

   vi. *ecological corridors, and areas important for linking or maintaining biological values identified under this policy.*

(DOC 2010)

Policy 11 thus provides the context in the coastal environment for managing adverse effects on indigenous biodiversity. This policy sets a high threshold for activities that have adverse effects on significant values, i.e. they are to be **avoided**. It does **NOT** provide for adverse effects on indigenous biodiversity values that are identified under 11a to be remedied or mitigated. The second part of the policy (11b) also recognises and provides for the maintenance of indigenous biodiversity values, including significant indigenous biodiversity not specifically related to rarity. The exception is 11b iv, which identifies significance for other than ecological reasons and that is not a consideration for these guidelines. It is important that both aspects of Policy 11 are read in conjunction.

5.3 National Policy Statement for Freshwater Management

The National Policy Statement for Freshwater Management was updated in 2014 (New Zealand Government 2014) and provides national direction for decisions under the RMA about water quality and water quantity, integrated management of land, freshwater and the coastal environment. Among other things, it contains objectives for safeguarding ecosystems and indigenous species, and protecting the significant values of outstanding water bodies and wetlands. For the purposes of these guidelines, the NPS does not assist with identifying significant terrestrial indigenous biodiversity, including wetlands.

5.4 RMA statements and plans

As stated previously, the purpose of the RMA is sustainable management, and an important element of this is the maintenance of indigenous biodiversity, not just recognising and providing for significant indigenous vegetation and significant habitats of indigenous fauna. Regional policy statements (RPSs), regional plans and district plans are fundamental tools used by regional councils and territorial authorities to meet their responsibilities under the RMA, which include the development of policies and rules for maintaining indigenous biodiversity.

RPSs are over-arching documents that other regional plans cannot be inconsistent with, and district plans cannot be inconsistent with regional plans. It is important to be aware of the multiplicity of plans and policies affecting indigenous biodiversity, so that appropriate advocacy approaches are used in plan submissions and in resource consent hearings. It should be noted that public conservation land is not normally subject to district plan provisions (s4 RMA exemption, providing the activity is consistent with a Conservation Management Strategy (CMS)

or Conservation Management Plan (CMP) and does not have adverse effects beyond the land concerned). Public conservation land is, however, subject to regional plan provisions, and private concessions on public conservation land are subject to district and regional plan provisions. Irrespective of this, DOC staff should be aware of district plan requirements and the importance of managing indigenous biodiversity on public conservation land in a manner that is consistent with what they advocate for in district plans for the management of private land.

Resource management statements and plans must include provisions that manage adverse effects on indigenous vegetation and habitats of indigenous fauna (ss30 & 31 RMA). Significant indigenous vegetation and habitats of indigenous fauna are recognised as matters of national importance, so it is essential to have objectives, policies and rules as methods to manage potential adverse effects on those values. Significant areas can be identified by several means, but undertaking a survey is particularly important and is a key consideration when determining boundaries or assessing a consent application. Ideally, there should be general rules to manage indigenous biodiversity values and specific rules to manage significant areas that have been mapped or identified. It is also important to include comprehensive ecological significance criteria within plans, as not all 'significant areas' are likely to be known or included in a schedule.

It needs to be recognised that when DOC staff are submitting on RMA plans or consent applications, an existing set of ecological assessment criteria will usually be present in RPSs and district plans, though they can be highly variable. When preparing a submission on a plan change, DOC should either support the criteria in the plan change if they are appropriate or propose alternative criteria that reflect these guidelines. In the case of consent applications, there is a requirement to use criteria from the operative plans. Understanding the meanings of assessment criteria (see section 9.1 of these guidelines) will assist in interpreting plan criteria used in consent applications, along with relevant statutory polices and non-statutory policies or plans.

District councils have responsibility for land use and regional councils have responsibility for policy, freshwater and coastal matters. In some parts of the country these functions are combined under Unitary Authorities. Under s30 RMA, regional councils have the function of controlling land use for the purpose of maintaining and enhancing ecosystems in water bodies and coastal water, and to establish objectives, policies and methods for maintaining biological diversity. Under s31 RMA, territorial authorities are responsible for controlling the effects of the use, development, or protection of land, including for the purpose of maintaining indigenous biological diversity.

A related responsibility is for councils to encourage landowners to maintain indigenous biodiversity, using a range of approaches such as providing management advice, financial incentives or information about formal protection options. Related to this is the need to monitor indigenous biodiversity trends within their areas. These approaches complement the development and implementation of RMA plan rules and should be supported by DOC. Without this encouragement, many small and isolated indigenous biodiversity remnants are at risk of further deterioration through ongoing neglect.

6. Non-statutory policies and other relevant matters

Non-statutory policies and other documents do not carry the same weight as statutory policies and plans. However, they should be used as they often provide valuable guidance for identifying and protecting indigenous biodiversity. In this respect, when a consent authority is considering an application for a resource consent, it has to have regard to any 'other matter' it considers relevant and reasonably necessary to determine the application. Other matters could include:

- The Proposed National Policy Statement on Indigenous Biodiversity
- Conservation management strategies
- The New Zealand Biodiversity Strategy (see section 3.2)
- Regional biodiversity strategies
- Protecting our places: the national priorities for protecting rare and threatened native biodiversity on private land

6.1 Proposed National Policy Statement (NPS) on Indigenous Biodiversity

There is no operational National Policy Statement (NPS) on indigenous biodiversity. A proposed NPS was notified in 2011 (MfE 2011) and public submissions were received. The proposed NPS was intended to provide clearer direction to local authorities on their responsibilities for managing indigenous biodiversity under the RMA. It outlined policies and decision-making frameworks for the identification and management of indigenous biodiversity found outside public conservation land. It also provided a definition of s6(c) RMA, which is similar to those provided by Walker et al. 2008a, b (see section 3.3 of these guidelines).

In 2015 the Government signalled its intention to develop a new NPS. As yet, the proposed NPS has not been withdrawn in accordance with s51A RMA. A revised NPS will provide further direction and guidance on maintaining indigenous biodiversity under the RMA.

6.2 Conservation management strategies

The purpose of conservation management strategies (CMSs) is to implement DOC's general policies (including the Conservation General Policy 2005), and to establish objectives for integrated management of natural and historic resources. A CMS operates at two levels: (1) the region[2]; and (2) specific places. For each layer, the values are defined and are accompanied by a series of objectives, policies and milestones. Currently, CMSs do not assist in identifying significant indigenous biodiversity.

6.3 Regional biodiversity strategies

Where they exist, these documents are non-statutory but are intended to reflect national priorities and additional information about local knowledge, priorities and commitments. Depending on how well they are written and the detail they contain, they can be helpful for better-understanding local contexts and priorities.

[2] CMSs apply to the former DOC conservancy boundaries; when reviewed after 10 years, they will apply to the current boundaries at that time.

6.4 Protecting our places: national priorities for protecting rare and threatened native biodiversity on private land

This government policy is intended to provide a better framework for decision-making about biodiversity on private land[3]. It is expected to be of particular use to local government, which has the primary responsibility for protecting indigenous biodiversity on private land under the RMA. Information about the policy notes that s6(c) of the RMA represents just one dimension of managing indigenous biodiversity, and that local authorities must consider the consequences of all effects on indigenous biodiversity. It is an important document and its key provisions have been incorporated in the Proposed NPS on indigenous biodiversity.

The four national priorities are summarised below:

National priority 1

To protect indigenous vegetation associated with land environments (defined by Land Environments of New Zealand at Level IV), that have 20% or less remaining in indigenous cover.

National priority 2

To protect indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.

National priority 3

To protect indigenous vegetation associated with 'originally rare' terrestrial ecosystem types not already covered by priorities 1 and 2.

National priority 4

To protect habitats of acutely and chronically threatened indigenous species.

As this policy was released in 2007, the terminology used to describe threatened species needs to be changed to reflect the latest threat classification system (DOC 2012). The Proposed NPS on indigenous biodiversity and the NZCPS both refer to threatened and at risk species. On this basis, it is therefore interpreted that national priority 4 now applies to threatened and at risk species.

[3] A more detailed version is also available (Information about the statement of national priorities for protecting rare and threatened biodiversity on private land, MfE 2007b).

7. Background to the assessment of ecological values in New Zealand

Historically, the protection of natural areas favoured scenic beauty, conspicuous vertebrates, rare species, forests in mountain lands and off-shore islands (Kelly & Park 1986; O'Connor et al. 1990). As a consequence, most protected natural areas were located in the mountains or in other unproductive or sparsely populated areas. Additionally, site evaluations were often based on a single criterion such as rarity, scenic value, spectacular landforms (O'Connor et al. 1990), or soil and water conservation.

Because of this, New Zealand's protected natural area system did not represent the full range of indigenous biodiversity and valuable ecosystems continued to be lost, especially wetlands, lowland and montane non-forest ecosystems. To rectify this imbalance, the New Zealand Protected Natural Areas Programme (PNAP) was developed, its statutory basis being the general purpose of the Reserves Act 1977 (S3.1 (b)).

The PNAP was designed to ensure an objective and scientific method was used to identify ecological values and protection priorities in New Zealand. The Ecological Region (ER) and District (ED) framework was developed as part of the PNAP and it remains the key biogeographic framework for significance assessments today. The Programme followed international best practice by using multiple criteria to assess ecological values, so that natural areas could be objectively compared, resulting in a more consistent identification of areas for protection. Detailed information about the PNAP and its methods can be obtained from Myers et al. (1987). O'Connor et al. (1990) observed that using a clearly defined set of criteria should help to avoid overlooking some features of natural diversity while over-emphasising others. They also highlighted the importance of using multiple criteria, as this approach was more likely to ensure that the full range of natural diversity was covered.

PNAP surveys originally focused on identifying the best representative examples of the natural diversity that characterised each ED. However, the focus on selecting examples meant that many sites were excluded that would be considered significant today. Site selection often came at the expense of secondary ecosystems, despite their importance as part of a wider mosaic of indigenous ecosystems. In recent years, the assessment criteria have been refined and applied more broadly to rectify this bias, and to address the requirement to maintain indigenous biodiversity.

This updated approach must be recognised when interpreting PNAP reports, as significance assessments should identify many more sites than the Recommended Areas for Protection (RAPs) identified in most PNAP reports. Particular caution is needed with the earlier reports, as their RAPs typically represent only a restricted range of natural diversity.

8. Framework for assessing ecological values

Before undertaking an ecological assessment, it is useful to do some background research about the area to be assessed. This is done to clarify what ED (or EDs) it occurs in, to view satellite imagery and aerial photos, to find relevant information that may occur in existing reports and to identify people with knowledge about the area. Guidance about information sources is provided in sections 8 and 10.

When doing ecological assessments for significance, an essential requirement is to assess ecological values at the appropriate scale(s). First and foremost, the values should be assessed at the local scale, as it best recognises ecological variation across the country. Thus the ED framework is the critical scale for making s6(c) RMA assessments, though regional and national scales are also important and assessments at any of these scales can trigger significance. As an example, a hillslope kānuka *Kunzea ericoides* stand in Nelson and a kānuka *Kunzea* sp. stand on an alluvial surface in Auckland may both be significant, but because the latter is within a threatened land environment it has a higher relative importance at a national or regional scale. Regional assessments are required in the context of RPSs and Regional Plans, but they also provide a useful context when ecological values are subject to a development proposal/resource consent.

8.1 Ecological Districts

Ecological Regions (ERs) and Districts (EDs) provide the structural framework for undertaking ecological surveys in New Zealand, with the country being divided into 85 ERs and 268 EDs (McEwen 1987). Each ED has a distinctive pattern of climate, geology, landforms and biological features, and adjacent districts with closely related characteristics form an ER. Maps showing New Zealand's EDs are available to DOC staff on the DOC Intranet through the DOCgis platform http://intmaps/richmapviewer/?Viewer=DOCgis under the tabs for Operational Layers>Boundaries.

They are also available to the wider public on the DOC Internet site, provided they have the software to load the maps onto. The link for this is http://maps.doc.govt.nz/richmapviewer/index.html?Viewer=DOCMaps. Boundaries can then be selected through the tabs for Operational Layers>Environmental Boundaries.

8.2 Land Environments of New Zealand

Over the last decade, Land Environments of New Zealand (LENZ) has provided a more quantitative structural framework to help determine the past extent and nature of New Zealand's ecosystems. They are based on national geomorphic and climatic information which predict areas of similar ecological character throughout New Zealand (Leathwick et al. 2003). LENZ can also be used to provide a prediction of the likely pre-human pattern of terrestrial ecosystems (patterns and gradients) and indigenous biodiversity (MfE 2007b). Four levels of detail are available, i.e. 20 (National-scale), 100, 200 or 500 (Regional to District-scale) environments (levels I, II, III and IV).

8.2.1 Threatened LENZ

LENZ can also be used to identify where threatened and poorly protected indigenous ecosystems are most likely to occur (Walker et al. 2007). This is arrived at by assessing the extent of remaining indigenous cover in each land environment (using the Land Cover Data Base, LCDB) and how much is legally protected. Threatened land environments are those that retain less than 20% cover of indigenous vegetation (<10% = acutely threatened, 10–20% = chronically threatened). Poorly protected land environments are those that retain >30% indigenous vegetation but are less than 20% protected (<10% = critically under protected, 10–20% = under protected). Using this approach, LENZ can thus help to identify significant ecological values and protection priorities.

To identify threatened land environments, open DOCgis and zoom to the area of interest, then select **Environmental Classification → LENZ → Level IV**. Different colours denote different Level IV environments. Check what they are by clicking on the Point Identify button. Once the pattern and identity of environments has been established, look up the threat status for each by going to: http://www.landcareresearch.co.nz/_data/assets/pdf_file/0007/21688/TECUserGuideV1_1.pdf

Note that this table provides a range of data over and above the threat category, so it is particularly useful.

The LENZ classification can provide a national context for assessing significance by identifying the level of threat and loss, but it does not take its place. It is important when using LENZ and the LCDB to recognise that both have limitations. Walker et al. (2007) provide some key reasons why LENZ and the LCDB2[4] should be used with caution and these are outlined as follows:

- LENZ is a classification of present environments based on abiotic features of climate, soils and landform. It is **NOT** a classification of ecosystems or vegetation. LENZ is part of a wider toolkit that complements field survey and other information, and problems may arise if it is used inappropriately (as it sometimes is).
- Limitations in the LENZ and LCDB2 datasets relate to issues of scale and accuracy of the underlying data, but also because LCDB2 types are too broad to resolve what is important at the local level, i.e. a finer level of analysis.
- Many distinctive indigenous ecosystems that are much reduced and modified are thus not recognised by the broad-scale national databases underlying the classification. For example, unprotected lowland forest fragments which form ecological networks or are contiguous with larger protected forests in the Waitakere Ranges may be classified within less-reduced and better-protected environments. Naturally rare ecosystems are similarly under-recognised because many are small and scattered.

Another important issue to recognise is that the same land environment can occur in a number of localities across New Zealand, sometimes in both main islands. For this reason they do not reflect local ecological character to the extent that EDs do.

8.3 Guidance on the national priorities for threatened indigenous biodiversity

The actual wording of the priorities was provided earlier (section 6.4), but this section contains additional commentary about their application. It is important to recognise that the reference to indigenous vegetation does not exclude fauna habitat, as indigenous vegetation is synonymous with indigenous cover and habitat. These terms are used interchangeably in detailed information about the priorities (MfE 2007b). The priorities are essential matters that need to be applied when determining ecological significance, but they are not the only ones relating to rarity.

National priority 1

The great majority of acutely threatened (<10% indigenous cover) or chronically threatened (10–20% indigenous cover) land environments are located in lowland and coastal areas, although not exclusively. Indigenous vegetation and fauna habitat that is present is likely to be significantly modified or degraded, and sometimes severely so. This does not detract from their importance, as they may constitute all that remains of indigenous cover in some areas and that is the very reason why it is a national priority to protect them. Any undeveloped soils associated with these land environments should also be regarded as important.

[4] Note: LCDB2 has since been updated to LCDB3 (and, more recently, LCDB 4), but some of the mapping problems remain (Davis et al. 2011).

National priority 2

Sand dunes and wetlands are well known for being severely reduced as a result of human activity, whether directly (e.g. wetland drainage), or indirectly (e.g. through the spread of marram grass *Ammophila arenaria* on sand dunes). They are specifically recognised under this priority because some will not be identified under priority 1 due to database and mapping limitations. Wetlands and sand dunes are thought to have been reduced to 9.4% and 11.6% respectively of their original extent (MfE 2007b).

National priority 3

Naturally uncommon ecosystem types are listed in MfE (2007b) and in the Proposed NPS on indigenous biodiversity (MfE 2011). However, they are simplified lists (43 and 35 respectively), and the full list of 72 from Williams et al. (2007) should be used, together with the detailed information provided in that paper. Holdaway et al. (2012) provide an assessment of the IUCN threat status of these naturally uncommon ecosystems and this can be used to provide further information when the rarity and special features criterion is being applied. (Note that 'originally rare', 'naturally uncommon' and 'historically rare' mean the same thing in the context of this national priority).

[See Appendix 5 for a list of naturally uncommon ecosystems and their threat status].

National priority 4

DOC staff should be familiar with the most up-to-date threatened species classifications, and the conservation status of all threatened and at risk species should be identified from these. Any of these species present within a site or habitat automatically denotes significance, except for situations involving vagrant fauna.

The New Zealand Threat Classification System (NZTCS; Townsend et al. 2008)) lists (2012–14) and an explanation of the NZTCS can be found at http://www.doc.govt.nz/about-us/science-publications/conservation-publications/nz-threat-classification-system/

For DOC staff, the 2008–11 status lists are available at http://intranet/our-work/biodiversity-and-natural-heritage/nz-threat-classification-system/taxa-status-lists-2008-onwards/. Each taxonomic group is reviewed, updated and published on a 3-yearly cycle and these become available on DOC's website as they are rolled out.

Note that 'Threatened' and 'At Risk' are capitalised when referring to the status of individual species assessed under the NZTCS, but are lower case when referring to the general situation, LENZ or the status of other areas or habitats.

8.4 Ecosystem and vegetation classification

Several councils around New Zealand are attempting to use rigid ecosystem classifications for determining significance, typically linking them to the criteria of representativeness or rarity. Examples include the Proposed One Plan (Horizons Regional Council 2014; discussed in Appendix 4) and the Proposed Auckland Unitary Plan, which uses the classification of Singers & Rogers (2014). The classifications combine biological and environmental factors to identify a range of mostly pre-human vegetation types.

There are major problems with this approach, as vegetation types that don't correspond to the prescribed classifications are largely ignored. This is a serious concern because most vegetation types outside of protected areas are secondary or seral in nature, and their protection is needed to maintain the full range of indigenous biodiversity. This is particularly urgent in highly modified EDs and land environments, as remnants of secondary indigenous biodiversity are often all that remain. As noted in Appendix 4, the use of these rigid classifications is no substitute for systematic ecological surveys at an ED level, and applying significance criteria to identify the full range of ecologically significant sites.

8.5 Freshwater Ecosystems of New Zealand Geodatabase

The FENZ geodatabase provides a national depiction of biodiversity values and pressures on New Zealand's rivers, lakes and wetlands. It consists of spatial data layers and information about environmental and biological patterns, with separate datasets for rivers and streams, lakes and wetlands (Leathwick et al. 2010). It provides information about the distribution and condition of wetlands, and the background context for informed decision-making about freshwater ecosystems generally. The database includes examples which show how the information can be used to assess the value of different sites for the long-term protection of natural values and biodiversity.

A link is available on the DOC intranet Freshwater page, see: http://intranet/our-work/biodiversity-and-natural-heritage/freshwater/. The FENZ user guide can be accessed by clicking the same FENZ link on that page.

A freshwater biogeographic framework (Leathwick et al. 2007) was produced in the early phase of the development of FENZ. The framework was designed to reflect regional patterns of freshwater biodiversity and resulted in seven national freshwater provinces and 29 units, with catchments being broadly used to derive the units (within which FENZ rankings are undertaken). It is noted, however, that the widely used ED framework adopted by these guidelines provides a much finer ecological scale that is more appropriate for assessing ecological significance, including for wetlands.

The following information about the New Zealand Freshwater Fish Database (NZFFD) comes from the NIWA website. The NZFFD contains over 30 000 records of freshwater fish observations in New Zealand. Data include the location of sample sites, the fish species present, their abundance and size, sampling methods and physical descriptions for each site. The database also includes a Fish Atlas (with fact sheets and distribution maps) and a species identification guide. The information is accessible from the NIWA website, i.e. http://www.niwa.co.nz/our-services/online-services/freshwater-fish-database

If freshwater information is accessed and used as part of a significance assessment (e.g. for wetlands and riparian margins) contact should be made with DOC Freshwater/Wetland Technical Advisors. They will be more familiar with the freshwater databases and framework and should be able to provide assistance, if required.

9. Assessment criteria and their application

Before undertaking a site assessment, people should be clear about what constitutes a potential significant site. The following points are based on a discussion of this issue in the Canterbury RPS guidelines (Wildland Consultants 2013).

- A site should include the significant features, connecting habitat and key ecological processes that help to maintain the significant features. This includes the vegetation/habitat units that contain the significant features, and buffering habitat that connects those units and forms a more compact and cohesive site.
- Mosaics of indigenous vegetation are often included within a site, as an assemblage of smaller areas can contribute to the cumulative value of a site, e.g. a network of small wetlands and intervening semi-natural vegetation.
- Seral vegetation is frequently included in significant sites, as much of New Zealand's vegetation is secondary and it forms a stage in the development of mature vegetation. Seral vegetation may itself have significant value as habitat for indigenous flora and fauna, or as a buffer or linkage between other areas of indigenous vegetation (spatially or temporally).
- Significant sites can be entirely seral vegetation where they are the only examples of indigenous vegetation remaining in an ED.
- Areas of exotic vegetation are often included within a significant site where they occur within a mosaic of indigenous vegetation. Exotic vegetation can also provide habitat for indigenous fauna (e.g. riparian willow woodlands used by bats in South Canterbury, coastal macrocarpa trees used for shag roosting, gorse providing a nursery for the regeneration of indigenous scrub and forest).
- In some cases, the boundaries of a significant site are predetermined (e.g. by a property boundary or a consent application). In this situation it is still essential to consider the wider ecological context, a requirement that is often overlooked.

9.1 Assessment criteria

The PNAP used seven criteria to assess ecological values, based on those that were widely used internationally to evaluate nature conservation values (O'Connor et al, 1990). The criteria were **representativeness, diversity and pattern, rarity and special features, naturalness, size and shape, buffering/surrounding landscape and boundaries, and long-term ecological viability**.

While other assessment criteria are sometimes used, they are typically variants of the above criteria. Whaley et al. (1995) proposed the use of 9 criteria, retaining those of the PNAP but adding **fragility and threat**, and **management input** (though both were originally included in the PNAP as 'management criteria'). Norton & Roper-Lindsay (1999, 2004) proposed using a reduced number of combined criteria, and they also used incorrect definitions and set high thresholds for attaining significance (Walker et al. 2008a). Their approach was further discredited by a 2010 West Coast regional wetlands Environment Court decision ([2012] NZEnvC162), which rejected their interpretation of representativeness for evaluating the extent of ecosystem loss, i.e. a rarity assessment, and their use of sustainability as a significance criterion. It also reinforced the view that protecting indigenous biodiversity involves identifying more than the 'best examples'.

Based on this history, six assessment criteria are considered appropriate for ensuring that the reasons for site identification are explicit and clear. Three management criteria are also included after the assessment critieria. The criteria (except the management ones) should be applied in the context of a biogeographical framework, i.e. EDs, with regional and national settings also being applicable for some criteria. A reduced set of criteria has been rejected, as combining criteria is likely to alter the meanings of the underlying criteria and to cloud the reasons for site identification. The exception is 'ecological context', as its underlying criteria are especially

closely related. In these guidelines, the underlying criteria are explicitly described so that it is clear what the broader criterion covers. The following descriptions are derived from O'Connor et al. (1990), with updated interpretations reflecting current knowledge about the state of indigenous biodiversity and statutory requirements.

Representativeness

The extent to which indigenous biodiversity is typical of the natural diversity of the relevant ED.

The assessment of representativeness has traditionally involved comparing current natural indigenous diversity with that of the past (a specified datum, usually 1840), and focuses on the typical or commonplace, or what is characteristic of an area. With earlier definitions, a high representative value was attributed to those ecosystems that were present in the original landscape, i.e. 1840. However, with s6(c) RMA now being linked to maintaining indigenous biodiversity, the 1840 benchmark has become redundant, as most of New Zealand's terrestrial ecosystems and communities are secondary or successional in nature, especially those in lowlands and, increasingly, in montane areas. By implication, this situation also applies to EDs and land environments. This means that the focus of representativeness is on identifying what is typical of each ED now. Original ecosystems remain highly valued, but the reality is that they often occur only as remnants in coastal, lowland and montane environments.

Because of this reality, the importance of secondary or successional plant communities must be fully recognised, as the assessment is not restricted to primary vegetation and should no longer be based on an 1840 datum. Secondary or successional plant communities were widespread prior to 1840 due to burning by New Zealand's first (Polynesian) settlers and, to a lesser extent, because of natural disturbances such as wildfire, wind damage, flooding, slips and landslides. However, secondary communities became more extensive post 1840 due to widespread burning, logging and the clearance of indigenous vegetation after Europeans arrived. Secondary communities take on increased significance and importance in areas that are heavily modified (e.g. the Canterbury Plains). In such situations, secondary communities may be virtually all that remains and their protection is a high priority as a contribution to maintaining indigenous biodiversity.

Overall, the application of this criterion should largely result in the representation of the full range of genetic and ecological diversity across all environmental gradients (such as climate, altitude and soil sequences). A representative area is also more likely to cater for the needs of sedentary, smaller and inconspicuous biota that are not normally seen. However, it is complemented by other criteria, as some ecological elements are not well catered for by representativeness alone (e.g. mobile animals, specialised or rare species).

It is important not to confuse representativeness with how well an ecosystem or habitat type is protected or represented in the protected natural area system. The latter is irrelevant to assessing the significance of a site (e.g. many areas of beech forest are protected in the South Island, but this does not infer that unprotected sites are not significant). The interpretation that a site is not significant if the ecosystem type is well-protected is incorrect, as it confuses significance with importance (in the priority sense).

Diversity and pattern

The extent to which the expected range of diversity and pattern is present for the relevant ED.

This criterion is sometimes referred to as natural diversity. It refers to all kinds of diversity, including physical, habitat, biological, genetic and ecological processes.

Biological diversity can be further subdivided into species and community diversity, although the two are usually related. Species diversity is a measure of species richness (number of species) and abundance. Community diversity usually reflects the degree of environmental variation present within a site, such as aspect and altitude variation. In general, larger areas contain more diversity per se, but this is not always so. Some areas naturally have low diversity, but support the full range of species expected for a particular habitat type or community (e.g. dunelands, dense

tall tussock and raupō *Typha orientalis* wetlands). By way of example, an Auckland landowner was prosecuted for draining a raupō wetland, emphasising the significance of wetlands, including those that are typically of low diversity.[5]

Species and community composition change along environmental gradients and this is reflected in ecological patterns. Altitudinal sequences are a common example, where indigenous vegetation and habitat values change with increasing altitude (e.g. from an estuary, through lowland forest to other forest types and scrub on the slopes behind to, finally, tussockland and herbfield on the mountains above). Full sequences are highly valued, although partial sequences are also important and characteristic of modified EDs. Ecotones are particularly important zones for species and community diversity, being transitions between adjacent ecological patterns or communities. They provide habitats for species from adjacent communities and tend to be very productive, supporting high species diversity.

Rarity and special features

Rarity is the natural or induced scarcity of biological, physical and ecological features within an area; special features identify unusual or distinctive features of an area.

This criterion incorporates rarity in the uncommon sense, and threatened in its classification sense (e.g. species classified under the NZTCS as as Nationally Threatened or At Risk; ecosystems classified as naturally rare (Williams et al. 2007)), or ecosystems or species that have become uncommon. The criterion is applied to biological, physical and ecological features. It identifies non-typical features, and is a safety net for those not identified through the representativeness criterion. Rarity can be natural or human-induced.

It is important to apply this criterion within a local context (i.e. EDs and ERs), as some biota or ecological features can be uncommon locally, even though they may be common elsewhere in the country.

The national priorities for threatened indigenous biodiversity would be applied within this criterion. While this specifically covers threatened and at risk species, data deficient species should also be recognised, as they are broadly of similar importance to locally uncommon species. (Note that the national priorities do not override the need to apply this criterion—they simply provide specific information about rarity which needs to be recognised when the criterion is being applied).

Special features include endemism, relict distributions, type localities, distribution limits, atypical bedrock, unique or specialised species and features of scientific interest. 'Distinctiveness' is an alternative term for 'special features'.

Naturalness

The relative absence of human disturbance or modification within an ED.

Naturalness refers to a lack of human disturbance or modification. Natural ecosystems are valued more, as modified ones tend to lose their integrity and, especially, their vulnerable species. In reality, naturalness is a gradation, as there are few, if any, totally natural areas remaining in New Zealand. Many original ecosystems have been modified by human activities, introduced animals or introduced plants. It is essential to recognise that while many ecosystems are induced or secondary, they can still be highly natural and valuable for supporting indigenous biodiversity. Likewise, highly modified areas can be important for their contribution to natural diversity, as they may represent the only indigenous biodiversity remaining in local areas. Such areas are also the nuclei for ecological recovery, succession and restoration. Naturalness must be assessed within the context of each ED, as it varies greatly between EDs.

Some ecologists and territorial authority plans have discarded this criterion or subsumed it within other criteria. Norton and Roper-Lindsay (2004) considered naturalness to be redundant because most of New Zealand's ecosystems are modified to some extent. In some cases, naturalness is said to be addressed within sustainability or long-term viability, where a degraded

[5] AK CRN 10440220918 [2002]

site may be given a low rating due to reduced ecological functioning etc. It is sometimes considered as part of representativeness, where an original ecosystem in good condition is rated highly and a degraded secondary ecosystem is rated relatively poorly.

In these examples, proper account has not been taken of the ED framework. In an ED that is largely unmodified, the expectation is that most communities and habitats will rate highly under naturalness, and those that are atypically modified would be rated lower. This is helpful where similar community types or habitats are being directly compared, and their relative importance is later assessed from a management or protection perspective. In the case of an ED on lowland plains that are highly modified, a lower threshold of naturalness has to be applied so that the context of modification is properly recognised. In this situation, naturalness is still relevant, as its application will assist in determining which remnants are least modified, moderately modified or highly modified. It is also useful when assessing the effects of development proposals. For example, ecosystem naturalness will be reduced when industrial infrastructure (roads, wind turbines etc.) is built in areas where it was previously absent or minor, or where a native plant community is degraded as a result of over-sowing and topdressing (OSTD).

If this criterion is subsumed within other criteria, specific details of its application are unlikely to be apparent (e.g. the cover of exotic plants, the presence of particular weeds, the impact of exotic mammals and altered hydrology). For these reasons, it is important to retain naturalness as a separate criterion so that explicit information is provided that will be useful to the significance assessment and for wider management use. This last point is an important component of significance assessments (i.e. the gathering of information that can assist with subsequent site management or the establishment of priorities).

Size and shape, buffering/surrounding landscape and boundaries (ecological context)

The extent to which the size and configuration of an area and its degree of buffering from a surrounding landscape affects its ability to maintain its indigenous biodiversity.

While these two criteria were originally listed separately (e.g. in Myers et al. 1987), they are often applied together, as they are very closely related. For this reason, many plans combine the criteria within the criterion 'ecological context'.

In general, larger areas and those of compact shape are more highly valued because of their greater life-supporting or carrying capacity. Larger areas tend to be characterised by greater natural diversity, and compact areas are less influenced by edge effects. Small areas do, however, contribute to total genetic diversity and may have an increased collective value (e.g. scattered small wetlands used by waterbirds). This is particularly important in highly modified landscapes where small remnants may be all that remains. Current knowledge is inadequate to be definitive about the needs of all biota and communities in terms of site size and shape. Despite this, it is known that some fauna are able to survive in small habitats (e.g. some lizards and less-mobile invertebrates), emphasising the need to take a broad approach. A similar approach is needed for (some) threatened plants.

Corridors and linkages have important ecological roles between isolated remnants or distant ecosystems. They provide for migration, dispersal and the exchange of genetic material between sites. Small habitats between larger habitats fulfil similar functions, including their role as stepping-stones for the movement of fauna and their contribution to maintaining meta-populations across the landscape.

Buffers are zones around core areas of ecological value that help to reduce external influences and maintain their values. Activities and threats from surrounding landscapes can have major impacts on the long-term viability of sites (e.g. wind effects on forest edges, weed invasion, grazing and nutrient pollution). Buffers are often natural or semi-natural areas, though they can be highly modified areas (e.g. an ungrazed riparian pasture or exotic pine plantation).

The ecological processes affecting indigenous ecosystems inevitably extend beyond their obvious physical boundaries (e.g. hydrology, pollination and dispersal). This is why management factors must be considered beyond the physical boundaries of ecosystems.

Long-term ecological viability

The ability of an area of indigenous biodiversity to retain its ecological health and values over time with minimal management input.

This is a management criterion and is **NOT** to be used for assessing significance.

An assessment of long-term viability requires an overview of ecological values and ecosystem functioning. Ideally, areas of indigenous biodiversity should be able to inherently retain their ecological health and natural values over time. They need to be able to evolve in a natural way, and their ability to adapt to changing circumstances is central to the realisation of evolutionary potential. Park (2000) makes a distinction between integrity and health. The former relates to ecosystems in their natural state that are self-maintaining and resilient. Health has a more narrow meaning and applies to those altered ecosystems which, despite containing naturalised biota etc., are still stable and resilient.

The best way of achieving long-term viability is through the maintenance of complete ecosystems. This will be more difficult in highly modified areas because of increased ecosystem fragmentation and the effects of adjacent land uses. In those situations, sites will typically need greater management input. Restoration potential is an important consideration, and an integral part of this concept.

Fragility and threat

A site's inherent vulnerability to environmental change by virtue of the nature of its ecological components and its position in the landscape.

These are management criteria which are **NOT** to be used for assessing significance.

Fragility refers to a site's inherent vulnerability to environmental change, which is determined by its particular biological components and its position in the landscape. Examples include highly fragmented remnants, wetlands and dunelands, as well as alpine ecosystems because of their severe climate.

Threats usually refer to those human or artificial factors that adversely affect the health of a natural area. In highly modified landscapes where ecosystems are no longer in equilibrium, specific indigenous plants or animals may function as threats.

Management input

The management effort needed to maintain the health of a particular natural area.

This is a management criterion and is **NOT** be used for assessing significance.

Management input is a measure of how much effort is required to maintain the health of a particular natural area. This might include regular weed and pest control, monitoring, fencing, restoration and preparing a management plan.

9.2 Application of criteria in case studies

Table 1 provides details of applying criteria, along with case study examples.

Significance thresholds

- The ratings given under each criterion reflect the cumulative extent to which their requirements have been met.
- For a site or area to be significant, it **must receive a medium rating** for **one** criterion or more. This applies irrespective of whether ratings of H, M, L, or a five-tiered system of H, M/H, M, L/M, and L are used.
- The ratings are **NOT** to be given numerical values that produce a summed score, as significance assessments are not an exercise in ranking.

Management criteria

- The ratings for the management criterion 'long-term viability' are assessed in the same manner as signficance criteria, i.e. a site with excellent long-term prospects would be rated H.
- 'Fragility and threat', and 'management input' are rated in the opposite manner. Thus if a site is very modified and requires much management input to maintain its values, it would be rated high. Similarly, if an urban site was subject to a variety of threats, it would be rated high under fragility and threat.

Additional information on particular case studies is provided in Appendix 6.

Table 1. Details of applying criteria, along with case study examples.

ASSESSMENT CRITERIA	GUIDELINES	EXAMPLES
Representativeness		
The extent to which indigenous biodiversity is typical of the natural diversity of the relevant ED.	• The emphasis is on the commonplace, as that accounts for most indigenous biodiversity. • Full consideration must be given to secondary and successional communities, as well as to mature communities that were originally present. • Degraded ecosystems or habitats are an important consideration, especially in the more modified EDs.	• ***High rating***: Matagouri *Discaria toumatou*, seral mat plants and other native herbs and mosses on active floodplains typical of upper braided rivers in the eastern South Island. • ***High rating***: Old-growth forests typical of largely natural mountainous ERs and EDs throughout NZ, such as those of South Westland, NW Nelson and the Raukumara Range. • ***High rating***: Old-growth and secondary podocarp broadleaved forest remnants of lowland ERs and EDs in Northland, Auckland and Waikato. • ***High rating***: Lowland kahikatea *Dacrycarpus dacrydioides* swamp forest remnants on alluvium in Waikato. • ***High rating***: Coastal broadleaved forest in northern NZ, including Northland, Auckland, Coromandel Peninsula. • ***High rating***: Coastal karaka *Corynocarpus laevigatus*-kohekohe *Dysoxylum spectabile* forest on sand plain such as in Foxton ED. • ***High rating***: A bird fauna comprising the majority of species characteristic of forests and shrublands, and representing the expected foraging guilds. • ***High rating***: A characteristic bird fauna of coastal and riverine wetland birds, such as those present (28 species) in the Karamea ED of northern Buller. • ***High rating***: Short tussock grasslands and shrublands (not over-sown and topdressed (OSTD)) that are typical of montane to subalpine alluvial valley floors in inland South island such as Central Otago and Mackenzie ERs. • ***High rating***: Remnants of second growth forests or shrublands in highly modified EDs, such as those of the Wairarapa, Southland, Wairau Plains (Marlborough) and the Canterbury Plains. • ***M/H rating***: Raupō *Typha orientalis*-flax *Phormium* spp.-rush palustrine swamps in farmed landscapes of Northland and Auckland. • ***M/H rating***: Sedgeland/rushland palustrine swamps in Northland and Auckland. • ***M/H rating***: Seral hardwood forest and scrub typical of modified low-altitude hills throughout NZ, such as the Pareora, Eastern Wairarapa and Wairoa ERs. • ***M/H rating***: Old-growth matagouri or grey shrubland on terraces of upper braided rivers in the eastern South Island where naturalised exotic grasses are common (e.g. Heron ER). • ***M/H rating***: Red tussock *Chionochloa rubra* and bog rush fens on terraces typical of inland eastern South Island (e.g. Heron ER). • ***Medium rating***: Ephemeral wetlands in highly modified low-altitude regions that are dominated by exotic herbs and rushes but still support indigenous sedges, rushes and herbs (e.g. Canterbury Plains ER). • ***Medium rating***: Moderate-diversity native shrublands in gullies of foothills ERs that have been peripherally OSTD.

Continued on next page

Table 1 continued

ASSESSMENT CRITERIA	GUIDELINES	EXAMPLES
		• ***Medium rating***: About half the expected bird fauna present in modified hill country forest remnants, such as eastern South Island foothills (i.e. common species but not those with patchy distributions such as tomtit *Petroica macrocephala*, tūī *Prosthemadera novaeseelandiae* and morepork *Ninox novaeseelandiae*). • ***L/M rating***: Silver tussock *Poa cita* grassland on OSTD hill country, such as in North Canterbury ERs. • ***L/M rating***: Patches of matagouri and mingimingi *Coprosma propinqua* in gullies of hilly ERs that have been burned and OSTD. • ***L/M rating***: Kettlehole turfs of South Island intermontane basins that are dominated by exotic grasses and sedges due to on-going cattle grazing and pugging. • ***Low rating***: Patches of induced low-statured shrub monocultures (e.g. matagouri, mānuka *Leptospermum scoparium*, kānuka *Kunzea* sp.) in exotic grassland on foothills EDs, such as those adjoining the Canterbury Plains. • ***Low rating***: Occasional roadside silver tussocks and bracken *Pteridium esculentum* in modified low-altitude hill country (e.g. the Kaikoura hills). • ***Low rating***: Patches of cutty grass *Carex geminata* in developed paddocks of low-altitude NZ, such as the coastal hills and terraces of eastern Wairarapa. • ***Low rating***: Only the commonest bird species in forest and scrub remnants throughout NZ (e.g. silvereye *Zosterops lateralis*, grey warbler *Gerygone igata*, bellbird *Anthornis melanura*, fantail *Rhipidura fuliginosa*). • ***Low rating***: Exotic *Juncus*-dominated lowland swamps in Northland, Auckland, Waikato and Wellington.
Diversity and pattern		
The extent to which the expected range of diversity and pattern is present for the relevant ED.	• Diversity includes physical, habitat, biological and genetic components, and ecological processes. • It is important to recognise that that some communities and ecosystems have naturally low diversity (e.g. dunelands, dense tall tussock and raupō wetlands). • Species and community composition change along environmental gradients, resulting in ecological patterns such as sequences and ecotones. • Ecotones are transitional areas between adjacent patterns which support higher species diversity than is otherwise suggested by their size; some ecotones can be caused by land use activities resulting in vegetation mosaics.	• ***High rating:*** Changing complexes of old and young substrates, channels and wetlands supporting seral vegetation and fauna habitats of braided river floodplains. • ***High rating***: Dense red tussock on poorly drained surfaces with expected low inter-tussock species diversity (e.g. Hawdon and Spenser ERs). • ***High rating***: Complex mosaics of primary and secondary forests and shrublands across environmental gradients (e.g. altitude, rainfall). • ***High rating***: Coastal lagoons and estuaries with high microhabitat diversity providing the full range of requirements for wading birds (e.g. fresh, saline, shallow and deep water, exposed sand/mud flats and saltmarsh). • ***High rating***: Intact sequences from estuarine saltmarsh to freshwater swamp forest and to terrestrial podocarp forest. Remnants remain in the southern and northern South Island, Northland and Auckland (e.g. Bushy Point (Invercargill), Whanganui Inlet (NW Nelson), Kaukapakapa estuary (Kaipara) and Soldiers Bay (Waitemata Harbour). • ***Medium rating***: Small coastal dongas[6] on the Canterbury Plains with a modest range of indigenous dryland plants, but lacking most original woody species. Turf plants occur on exposed stony patches, and skinks are present. • ***Medium rating***: Small kettlehole turfs with limited habitat diversity, dominated by an uncharacteristically simple flora.

Continued on next page

[6] Dongas are steep-sided gullies created by soil erosion. Coastal dongas formed as a result of water moving underground through different layers of gravels and sediments, then percolating out through coastal cliffs, causing back-cut erosion. Older dongas were probably active through glacial and post-glacial periods, and larger ones were characterised by surface streams that were often sourced from springs. Dongas continue to be formed by high rainfall events initiating their development on coastal cliffs or benches (Trevor Webb, pers. comm. 10 Sept 2013). See example in Appendix 6.

Table 1 continued

ASSESSMENT CRITERIA	GUIDELINES	EXAMPLES
		• ***Low rating***: Low-statured induced shrub monocultures (e.g. matagouri, mānuka, kānuka) with few other native plants, little habitat diversity and no indigenous vegetation sequences, e.g. dry eastern NZ hill country. • ***Low rating***: A single roadside silver tussock among rank exotic grassland on the Canterbury plains.
Rarity and special features		
Rarity is the natural or induced scarcity of biological, physical and ecological features within an area. Special features identify unusual or distinctive features of an area.	• Both elements are assessed at the local (ED), regional and national scales. • National priorities include Threatened and At Risk species, naturally rare ecosystems, threatened land environments (Level IV) and indigenous biodiversity associated with wetlands and sand dunes. National priorities do **NOT** override the fundamental importance of applying rarity at the ED level. • Other rarity considerations include locally and regionally uncommon species, habitats, ecosystems and physical features. • Special features include endemism, type localities, distribution limits, relict distributions, specialised species, or features of scientific interest.	• ***High rating***: Small coastal dongas in acutely threatened land environments, with naturally uncommon turf communities, at risk and locally uncommon plants present. • ***High rating***: The Denniston Plateau has a unique assemblage of lizard fauna, with Threatened (West Coast green gecko *Naultinus tuberculatus*) and At Risk (speckled skink *Oligosoma infrapunctatum*, forest gecko *Mokopirirakau granulates*, Nelson green gecko *Naultinus stellatus*) species present. It is the only place in New Zealand where two green gecko species co-exist, and both at their distribution limit. • ***High rating***: Modified river terraces that provide refugia for lizards, despite the dominance of exotic vegetation (e.g. the At Risk Canterbury gecko *Woodworthia brunneus* and common skink *Oligosoma nigriplantare*). • ***High rating***: Riparian willow (*Salix* spp.) woodlands in South Canterbury providing habitat for acutely threatened (Nationally Critical) long-tailed bats *Chalinolobus tuberculatus*. • ***High rating:*** Intensively grazed lowland limestone ecosystems in NW Nelson providing habitat for two species of cave-restricted beetles *Kettlotrechus marchanti* and *Pholeodytes palmai* (both At Risk, Naturally Uncommon). Cave entrances are also naturally rare ecosystems. • ***High rating***: Broadleaved forest on volcanic substrate in Northland and Auckland. • ***High rating***: Kauri *Agathis australis* – hard beech *Fuscospora truncata* associations on spurs in lowland forest in Auckland and Northland. • ***High rating***: kōwhai *Sophora* spp. forest on coastal gravel ridges, Firth of Thames. • ***Medium rating***: Low rear beach sand undulations with an extensive cover of marram grass, supporting At Risk katipō *Latrodectus katipo* spiders. • ***Medium rating***: mature second growth kānuka, or mixed grey scrub, on at risk LENZ. • ***Medium rating***: Sites where many water birds flock together to moult. These sites are important as they provide shelter, protection from predators, and food supplies that are difficult to obtain at many other sites. • ***Medium rating***: Small refugia habitats that support locally uncommon species, such as the fern *Asplenium trichomanes* on Banks Peninsula bluffs. • ***Medium rating***: Species close to or at their distribution limit. • ***Low rating***: Induced young matagouri, mānuka or kānuka on hillslopes in land environments with >30% indigenous cover, with no special features and no threatened, at risk, data deficient or locally uncommon species present. • ***Low rating***: Where threatened or at risk fauna only occur as vagrants, e.g. one white heron *Ardea modesta* in a farm paddock near Cape Foulwind on the West Coast.

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Table 1 continued

ASSESSMENT CRITERIA	GUIDELINES	EXAMPLES
Naturalness		
The relative absence of human disturbance or modification within an ED.	• It is crucial that naturalness is applied within a particular ED, as it varies greatly between EDs. • In reality, nearly everywhere is modified to some degree, including original ecosystems (e.g. through the presence of introduced animals). • Secondary or induced communities can be highly natural and important for supporting indigenous biodiversity. • Highly modified areas should not be dismissed, as they may represent the only indigenous biodiversity remaining in local areas.	• ***High rating***: Indigenous plant communities with intact core areas, healthy ecological functioning and few exotic species (e.g. substantial areas of subalpine scrub, old growth forest, closed canopy second growth forest and scrub mosaics, and dense red or copper tussock). • ***M/H rating***: Indigenous vegetation which is largely induced, but has few exotics and natural functioning. Modifications include fencing and limited tracking (e.g. the higher summits of Central Otago block mountain ranges). • ***Medium rating***: Depleted fluvioglacial or alluvial outwash surfaces of intermontane basins with indigenous vegetation that has not been OSTD, but where exotic species can be dominant due to disturbance (e.g. mouse-ear hawkweed *Pilosella officinarum*). • ***Low rating***: A single silver tussock among exotic plants on an undeveloped surface in highly modified areas with no other indigenous plants present (e.g. the Canterbury Plains).
Ecological context (size and shape, boundaries, buffering and surrounding landscape)		
The extent to which the size and configuration of an area and its degree of buffering from a surrounding landscape affects its ability to maintain its indigenous biodiversity.	• Larger and more compact areas usually have a greater natural diversity and life-supporting capacity and therefore tend to be more highly valued. • Small and isolated areas still contribute to total genetic diversity and may have a higher collective value (e.g. scattered shrublands on a river terrace). • Some biota is able to survive in small habitats (e.g. lizards, less-mobile invertebrates and some plants). • Small sites are important in modified landscapes, as they may retain the only indigenous biodiversity locally. • Corridors and linkages provide for migration, dispersal and genetic exchange between sites. • Small habitats between larger habitats can function as stepping stones for the movement of some fauna. • Buffers are zones around core areas of ecological value that reduce external influences (e.g. wind effects on forest edges, weed invasion and nutrient pollution). • Buffers are often semi-natural areas, though they can be highly modified (e.g. ungrazed riparian pasture or exotic pine plantation).	• ***High rating***: Extensive old matagouri on large terraces that are well buffered by adjacent floodplains and mountains. Most adjacent land is public conservation land, but some is grazed by sheep. • ***High rating***: High connectivity of bird habitats across gradients required for seasonal and lifetime requirements (e.g. the Mokihinui River catchment has a wide range of high- to low-altitude forests and shrublands which provide seasonal food supplies at different times of the year). • ***Medium rating***: Part of a wider seasonal network of bird foraging and wintering sites (e.g. the Hokitika River mouth supports wetland and coastal birds that breed in Nelson and other parts of the West Coast). • ***Medium rating***: Small wetlands along the Canterbury coast providing linked habitats for waterbirds and migratory birds. Some are surrounded by farmland, but others are buffered by terraces, cliffs and beaches. • ***Medium rating***: Successional kānuka-mānuka-tree fern forest and shrubland providing buffering to old-growth forest habitats, and/or ecological linkages and corridors with other habitats (e.g. North Shore of Auckland, Tamaki ED). • ***Medium rating***: Secondary podocarp-broadleaved forest fragments in lowland hill country, providing stepping stones between larger habitats (e.g. in Rodney ED, north Auckland). • ***L/M rating***: Small coastal dongas that are vulnerable to adjacent farming practices such as grazing and the use of irrigation water, but are partly buffered by gravel beaches. • ***Low rating***: Small indigenous shrub remnants on a river terrace, where adjoining terraces have been cleared and developed for vineyards. They are highly vulnerable to edge effects and have minimal linkages to distant remnants.

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Table 1 continued

ASSESSMENT CRITERIA	GUIDELINES	EXAMPLES
Long-term viability		
The ability of an area of indigenous biodiversity to retain its ecological health and values over time with minimal management input. *(This is a management criterion and is **NOT** used for assessing significance.)*	• It is important for areas to be able to maintain their indigenous biodiversity over time and evolve in a natural way. • Long-term viability is best achieved though the maintenance of complete ecosystems. • In more modified sites, buffering is particularly important for limiting effects from surrounding areas.	• ***M/H rating***: Depleted fescue tussock *Festuca novae-zelandiae* grasslands on fluvioglacial and alluvial outwash surfaces in intermontane basins and inland valleys that are not OSTD, but are grazed by sheep and rabbits. If they are not developed for agriculture and stock, and rabbits and wilding trees are properly controlled, their long-term viability seems assured, as natural ecological processes will largely continue and contribute to ecological recovery. • ***Low***: Small remnants surrounded by irrigated dairy farms have very poor survival prospects in the absence of substantial buffer zones.
Fragility and threat		
A site's inherent vulnerability to environmental change by virtue of the nature of its ecological components and its position in the landscape. *(This is a management criterion and is **NOT** used for assessing significance.)*	• Fragile areas typically include highly fragmented remnants, wetlands, dunelands, dryland vegetation and alpine ecosystems (severe climate). • Threats are usually those human or artificial factors that adversely affect the health of natural areas.	• ***High rating***: Small unfenced wetlands in production landscapes are particularly vulnerable to stock trampling, nutrient pollution and weed invasion. Many wetland plants (especially smaller, delicate ones) are easily damaged by trampling, and wetland hydrology can also be altered by trampling. • ***Medium rating***: Mosaic remnants of regenerating forest and scrub in sheep-grazed pasture on Banks Peninsula are vulnerable to wild animals and shade-tolerant weeds. • ***L/M rating***: Matagouri on floodplain terraces is subject to floods, but this is a natural process. Exotic weeds such as broom *Cytisus scoparius* are major threats in nearby catchments, so care will be needed to ensure they don't establish here.
Management input		
The management effort needed to maintain the health of a particular natural area. *(This is a management criterion and is **NOT** used for assessing significance.)*	• Examples include weed control, pest control, fencing, restoration and monitoring.	• ***High rating***: Small lowland podocarp-broadleaved forest remnants in Auckland and Waikato lack understories and are affected by grazing, weeds and past land clearance. Management requires fencing, weed control, pest control and developing buffers. • ***M/H rating***: For coastal dongas, a change from dryland to intensive farming and irrigation must be avoided. Weed control is needed and the area should be fenced off from grazing. The latter requires monitoring to clarify whether this causes increased weed problems. • ***Low rating***: Low rating: An alpine tarn on PCL surrounded by a boulderfield requires no management to maintain its values, i.e. no wild animal effects or adjoining landuse effects.

9.3 Gaps in knowledge

It is accepted that there will often be knowledge gaps for areas that are being assessed or about particular ecosystems or habitats, and sometimes there will not be any previous survey information or literature available. In those cases it is important to consult with technical advisors or other specialists to minimise the chances of ecological values being overlooked. Even then, it may not always be possible to supplement one's own knowledge, and these situations emphasise the importance of taking as broad an approach as possible to assessing the ecological values.

At the same time, it is important to acknowledge what the information gaps are, and their implications. A precautionary approach is appropriate, rather than dismissing an area for which only limited knowledge may be available. Even the least-impressive-looking sites can still be significant and reveal special values when they are formally assessed. Where knowledge about an area is simply too limited, there is merit in promoting future assessment work, even if it slows down statutory processes.

9.4 The importance of taking a broad approach when assessing significance

It is self-evident from the criteria that a broad approach is required when undertaking significance assessments. In the past, there was a tendency to focus on the rare or unusual and this had the unfortunate effect of overlooking common values, the key focus of representativeness. In this regard, it is essential to recognise the value of common ecosystems and habitats as important repositories for a broad range of indigenous biodiversity. Combining this with the legislative requirement to maintain indigenous biodiversity makes it very clear why taking a broad approach is essential.

It is recognised that most individuals undertaking significance assessments do not have expertise across the full range of ecological disciplines, but this can be compensated for by consulting other people with specialist knowledge (e.g. a plant ecologist assessing the significance of an area should recognise the importance of consulting other specialists about fauna (birds, lizards, invertebrates) and geomorphological values if he or she does not have such knowledge. Similarly, if wetlands are present but assessors have limited knowledge of wetlands, specialist assistance should be sought to clarify their value). Reading literature relevant to the area in question can also be helpful. While background reports may not actually assess an area's significance, they may contain considerable detail about the ecological character of an area and what species may be present.

This broad approach is central to achieving effective significance assessments that take proper account of the biological and physical characteristics of an area, and the relationships between these.

10. Other ecological databases and information sources

When undertaking ecological assessments for significance, the following information sources can provide useful information about indigenous biodiversity. They should be used to supplement field assessments, though care is needed with respect to the age and reliability of some data:

SSWIs (Sites of special wildlife interest)

Surveys were undertaken from 1977 to 1985, so some data will be out of date (e.g. some sites may no longer be present or their boundaries will be inaccurate). The emphasis in these surveys was on recording birds, in contrast to other fauna such as lizards and invertebrates, and this also needs to be borne in mind.

WERIs (Wetlands of ecological and representative importance)

Data were compiled from 1985 to 1987 by the New Zealand Biological Resources Centre (DSIR) before being handed over to DOC to look after (S. Myers, pers. comm.). It was based on SSWI sites and information from other agencies. Some data will be out of date, as some sites may no longer be present or their boundaries may now be inaccurate.

PNAP reports

Although areas recommended for protection are the main output from the surveys, other important site information is described on field cards and typically recorded on databases (held by a range of agencies such as councils, DOC, consultancies and Landcare Research). The level of detail varies between surveys, but it is typically very useful and accurate. Information from earlier reports may be less accurate and some identified sites may no longer be present (especially older ones). It is important to recognise that a substantial number of EDs have not been surveyed, particularly in the South Island. Where EDs have been surveyed, it also needs to be recognised that some parts may not have been because of access refusals or because of the reconnaissance nature of the surveys.

The following link (http://www.biodiversity.govt.nz/pdfs/funded_projects_2.pdf) will take you to a report that lists published and unpublished PNAP reports up to and including 2003 (Wildland Consultants 2004). It also provides examples of a number of other ecological survey reports (mostly unpublished) prepared by Forest and Bird, DOC, territorial authorities, forestry companies, Universities, the former Lands and Survey Department and the New Zealand Wildlife Service. The report also points out that many other territorial authorities have undertaken or are in the process of undertaking ecological inventories. For more information or for individual PNAP survey reports refer to the DOC website (www.doc.govt.nz) or contact the local DOC District Office.

SONS/SNAs (Sites of natural significance/Significant natural areas)

These databases identify significant ecological sites or areas identified from a range of information sources and other databases and are usually held by some local authorities and DOC (including Bioweb), depending on the region. They are only as accurate and useful as their underlying data sources and the same caution is required when using their data as it is with the underlying data sources.

Landcare Research databases

These include the national vegetation survey (NVS) and contain data collated from many vegetation surveys carried out over more than 50 years (e.g. from survey plots established by the New Zealand Forest Service, Botany Division (DSIR), DOC, regional councils, universities

and the PNAP). Other databases include New Zealand lizards and soils (though coverage is concentrated in lower-altitude areas). Herbaria are also available and can be accessed online.

Universities

Useful ecological data is often accessible through relevant university departments and staff. If you don't personally know staff who can assist, you should approach the relevant department with your request and you should be put in touch with the appropriate people.

Libraries

University and public libraries often contain valuable papers and reports, including theses, which can provide useful information and supplement significance assessments. Much material is available in electronic form or on-line, but this is not always the case.

Local authorities

District and regional councils often have ecological databases or information about wetlands and indigenous biodiversity from surveys within their administrative areas. These could include SNA surveys, wetland inventories or river surveys (which may include information about riparian vegetation). Approaches to councils should allow contact to be made with relevant individuals who are likely to know what information is available.

Land cover database (LCDB)

The LCDB maps land cover in New Zealand using satellite imagery, and have a minimum mapping unit of 1 ha. The second version (LCDB2) underestimates the recent loss of native grasslands and is also of limited use for identifying wetlands (Walker et al. 2007). An assessment of wetlands in the Wellington region confirmed that LCDB2 had major limitations for identifying wetlands, particularly those smaller than a few hectares (Davis et al. 2011). This assessment also demonstrated that the dryland classification of LCDB2 was inconsistent. These limitations highlight that caution is needed when using the database on its own, or when using information sources that rely on the LCDB (including LCDB3 and the most recent LCDB4 (which was released in June 2014), as these also contain significant classification errors).

The LCDB may be of some use when looking at broad vegetation patterns and changes at regional and national scales, but it is likely to be of little use for site-by-site evaluations.

Reptiles

All native lizards are absolutely protected under the Wildlife Act 1953. When researching information about lizards, council schedules, planning maps and registers should not be relied upon, because councils generally do not have this information. This information is also often kept confidential from the public due to risks that it could be used by poachers. Assistance should always be sought from an experienced herpetologist who will be able to access the DOC herpetofauna database (the most comprehensive national repository for lizard records). A negative result should not be interpreted as meaning that lizards are absent, as many areas have not been surveyed, or surveys may have failed to detect them. Other information sources include Landcare Research's New Zealand lizards database, national and regional field guides, Lizard Action Plans (produced by DOC), and ecological reports containing lizard information (e.g. PNAP site forms and tenure review reports). Depending on what your review reveals, it may be necessary to undertake a lizard survey to determine species' presence and distribution within a particular area. The information that has been gathered should remain confidential to ensure populations are protected from poachers.

Invertebrates

Invertebrates are often overlooked by significance assessments. It is important to consider what fauna may be present at sites being assessed; for invertebrates, this will usually require specialist

advice or input. Such advice should assist in identifying likely habitats and survey requirements, and what references and other information sources may be available.

Other on-line databases or information sources

New Zealand Birds Online is a searchable encyclopedia of New Zealand birds. It contains detailed information about all 467 species of New Zealand birds, including all living, extinct, fossil, vagrant and introduced bird species. The database is searchable by name, conservation status, and geographical distribution. Sound files of bird calls can be listened to and more than 8700 photographs can be viewed (see http://nzbirdsonline.org.nz/).

The New Zealand Ecological Society website has a large selection of useful links related to ecology and indigenous biodiversity. These enable access to other information sources such as other societies, university departments, museums, research agencies and specific data about indigenous flora and fauna.

The Quality Planning website provides very comprehensive information about indigenous biodiversity, ecological assessment, significance assessment, RMA responsibilities for indigenous biodiversity, RMA plans, resource consents and definitions (see http://www.qualityplanning.org.nz/).

National threatened and at risk species classifications

The most up-to-date classification lists for plants and animals are available through the DOC website. These should always be accessed to check the latest conservation status for various species (see section 8.3, National Priority 4).

Regional Biodiversity Strategies

Regional biodiversity strategies can provide a useful background context, but they do not provide the detail necessary for significance assessments. They tend to focus on importance or priorities, which largely reflect national priorities (e.g. threatened land environments, wetlands and habitats of threatened species).

Conservation Management Strategies

CMSs primarily focus on the management of public conservation land, and set overall priorities for each Conservancy. An exception is advocacy in relation to local authority plans, consent processes and conservation generally. They provide little assistance for identifying significant values because of their focus on broad priority setting and because the ecosystems in question are already formally protected as public conservation land.

Land Protection Strategies

These are intended to assist DOC regions in allocating resources to reflect protection priorities. The priorities are based on estimates of the proportion remaining of pre-human ecosystems and their current levels of formal protection. Their focus is, again, on importance and helping to set priorities, not on assessing significance. They can, however, assist in setting the historical context for assessing significance by helping to clarify the extent and type of original ecosystems or habitats.

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Appendix 1

Ecological assessment checklist

This checklist applies to any ecological assessment. While many will relate to consent applications, they may also be for other purposes, e.g. concessions on DOC land, protection proposals or assessing ecological values for prioritising management.

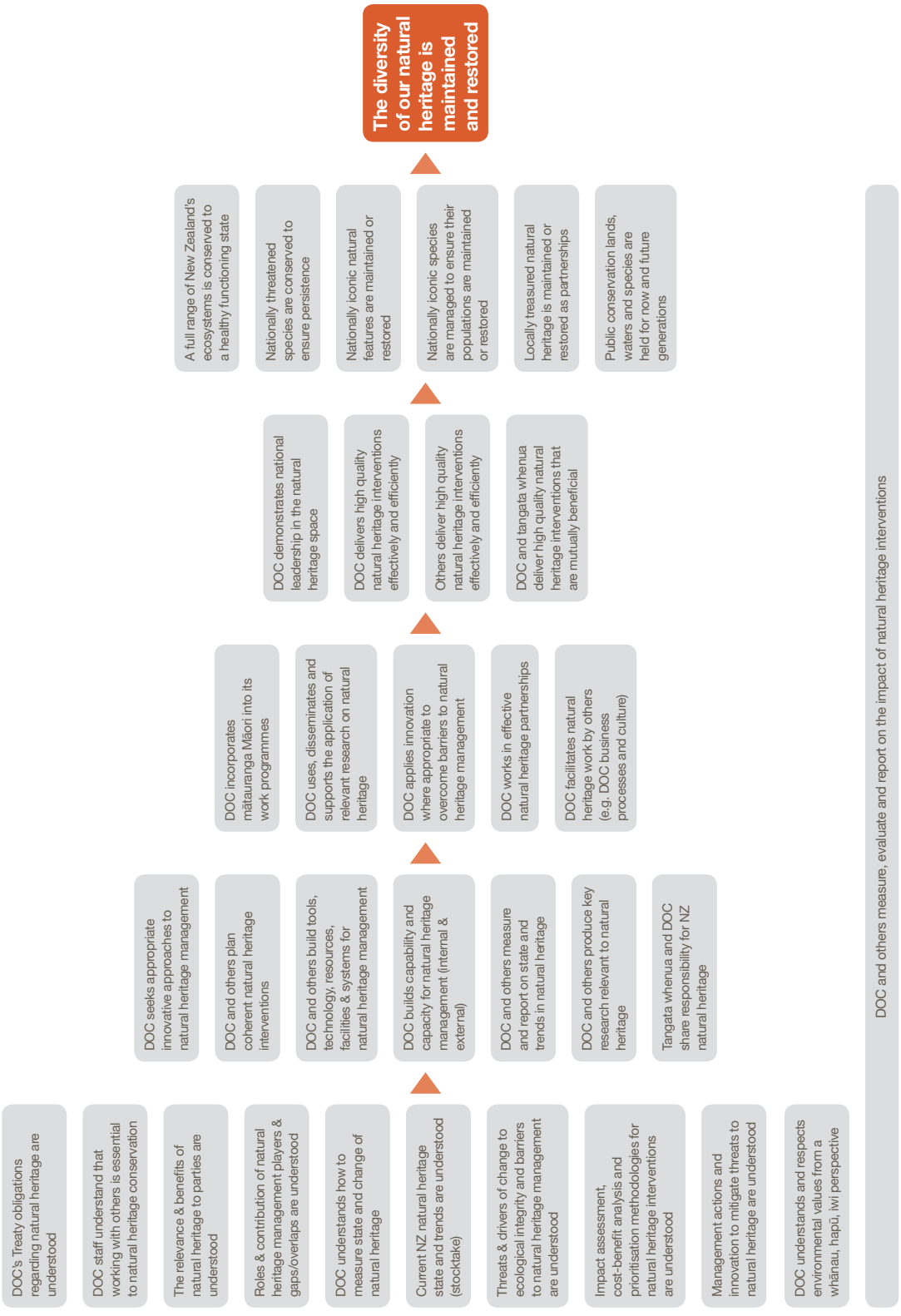
Purpose of assessment (e.g. RMA consent, concession, land swap, plan submission etc.)	
Brief project description (list all related DME files etc.)	
1. Has a full ecological assessment been undertaken that is consistent with DOC's guidelines (including statutory policy matters and plans)?	**Yes/No** (If No, where DOC has undertaken the assessment, DOC staff members should rework their assessment. Where an application relates to an activity on DOC land, e.g. a concession, the applicant should rework their assessment using the guidelines.)
2. Have assessment criteria been applied within the appropriate biogeographical context?	**Yes/No** (If No, application should be reworked to ensure this context is properly applied; this also applies to applications on DOC land and must be followed by an applicant.)
3. Has a DOC field inspection been completed?	**Yes/No** (If No, provide reason.) (If reason is inadequate, undertake field survey, as this is normally required.)
4. Are significant ecological values present?	**Yes/No** (If Yes, consider seeking advice from DOC S&T.)
5. Does activity result in loss or damage to ecological values[1]?	**Yes/No** (If Yes, consider seeking advice from DOC S&T and Planning.)
6. Has technical advice/review been obtained to support this assessment?	**Yes/No** (If No, seek further advice and review.) If Yes, have concerns been raised—Yes/No. If Yes, have concerns been satisfactorily addressed—Yes/No (provide reference to advice.)
Staff members consulted	
Decision and rationale[2] (by delegated decision maker)	

[1] An assessment of effects is not part of the significance guidelines, but will often be part of a wider process.

[2] This checklist is only for ecological values; in a wider process, decisions will also take account of other values.

Appendix 2

DOC's Natural heritage outcomes model



Appendix 3

Statutory definitions and interpretation

Conservation Act 1987

Conservation—the preservation and protection of natural … resources for the purpose of maintaining their intrinsic values, providing for their appreciation and recreational enjoyment by the public, and safeguarding the options for future generations.

Preservation (in relation to a resource)—the maintenance, so far as is practicable, of its intrinsic values.

Protection (in relation to a resource)—its maintenance, so far as is practicable, in its current state, but includes its restoration to some former state, its augmentation, enhancement or expansion.

Freshwater—includes the waters of rivers, streams and wetlands, whether naturally occurring or artificially made.

Natural resources—the same interpretation as in the Crown Pastoral Lands Act (see below), except that 'systems of interacting living organisms and their environment' replaces 'ecosystems' (has the same meaning).

Crown Pastoral Lands Act 1998

Significant inherent values—those inherent values that are of such importance, nature, quality or rarity that the land deserves protection under the Reserves Act or the Conservation Act.

Inherent values—a value arising from an … ecological … or scientific attribute or characteristic of a natural resource in or on the land.

Natural resources—plants and animals of all kinds, air, water, soil on which they live or may live, landscape or landform, geological features and ecosystems.

Resource Management Act 1991

Environment—includes:

(a) ecosystems and their constituent parts, including people and communities
(b) all natural and physical resources
(c) amenity values
(d) the social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) or which are affected by those matters

Intrinsic values—those aspects of ecosystems and their constituent parts which have value in their own right, including:

(a) their biological and genetic diversity; and
(b) the essential characteristics that determine an ecosystem's integrity, form, functioning and resilience

Land—includes land covered by water and the airspace above land

Natural and physical resources—includes land, water, air, soil, minerals, and energy, all forms of plants and animals (whether native to New Zealand or introduced), and all structures

River—means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse

Water body—means fresh water or geothermal water in a river, lake, stream, pond, wetland or aquifer, or any part thereof, that is not located within the coastal marine area

Wetland—includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions

Appendix 4

Case law examples

The following examples illustrate some important issues and interpretations about ecological significance. They identify limitations, along with findings that assist the process of assessing significance. The One Plan and the West Coast wetlands examples are included as they are recent cases on significance. However, both contain interpretations which merit clarification of their limitations as well as their positive findings. Key points taken directly from the case law findings are provided first. Comments outlining concerns about the particular interpretations are provided in italics, by the authors of these guidelines.

[2012] NZEnvC182: (Proposed One Plan, Manawatu-Whanganui Regional Council)

- The plan uses a desk top approach which relies on remote sensing (including LENZ / LCDB2) and predictive modelling to define and identify the habitat types, based on what were thought to be pre-human habitat (vegetation) types.
- Naturally rare and threatened habitat types (< 20% indigenous cover remaining) were confirmed as being significant, subject to size thresholds for the specific habitat types (i.e. Schedule E).
- At risk habitat types are not automatically significant and are subject to a second-tier assessment using the criteria of representativeness, rarity and distinctiveness, and ecological context. If one or more of the criteria are met, they **MAY** qualify as being significant. If they do, they are subject to the Schedule E size thresholds (which are typically higher than for rare and threatened habitat types).
- As a result of the Environment Court decision the 32 rare, threatened and at risk habitat types were refined to produce 39 habitat types (defined at the regional scale).
- All significant sites are subject to exclusions related to the extent of exotic vegetation, their association with drains and artificial wetlands etc.
- Ecological condition (broadly equivalent to naturalness) was not accepted as a significance criterion in the plan. However, under representativeness, requirements for composition and structure are included as indicators of habitat condition. Condition is also implicit in the size thresholds.

Concerns

- *The plan does not sufficiently recognise the problems of classification, accuracy, and scale when using remote sensing and spatial data.*
- *Systematic ecological survey and assessment will more effectively identify ecosystems at an ED level, habitats for indigenous flora and fauna (including threatened species), and provide greater accuracy, certainty, and information about condition.*
- *The full range of criteria is not used (e.g. the plan does not include diversity and pattern, naturalness and some aspects of context). Combining elements of different criteria (e.g. large size within representativeness) has resulted in a lack of clarity and misinterpretations of criteria meanings.*
- *The focus on threatened and uncommon habitat types does not adequately address habitats for fauna and flora*[7]*. This also risks excluding habitat types that do not meet the habitat definitions, because predictive tools are least effective for identifying seral, successional and regenerating vegetation.*

[7] The exceptions are habitats for powelliphanta snails, and criterion (iii)D of 'ecological context' in Policy 12.6, which relates to important breeding areas, seasonal food sources, or an important component of a migration path.

- *Under the plan, representativeness has become a rarity assessment, as it does not address the commonplace. A limited number of habitat types have been specified, prioritising those with less than 20% indigenous cover remaining. The resulting significant sites will not represent the remaining indigenous biodiversity of the region.*
- *The inclusion of habitat condition as a consideration of representativeness will not properly recognise the importance of sites in highly modified EDs and land environments.*
- *Rarity and distinctiveness is applied in a way that does not recognise locally and regionally uncommon species, habitats and ecosystems, or atypical physical features. It does not properly address at risk species or habitat types, and at risk habitats can be excluded if they are modified or small. Habitats for threatened species (a national priority) are not automatically identified as rare or threatened. In addition, the plan does not appear to address exotic vegetation that provides habitat for threatened indigenous species (or indigenous species generally).*

[2012] NZEnvC162: (West Coast Regional wetlands)

- The Court did not accept that 'significant' means special or exceptional.
- The Norton / Roper-Lindsay approach to significance was not accepted, as they set a high threshold for representativeness and they included aspects of rarity within the representativeness criterion.
- Confirmed that the extent of wetland types currently protected is irrelevant to whether another wetland is significant or not.
- Sites on public conservation land should not be excluded from consideration, as this would not provide a true picture of significant sites.
- Confirmed that natural character is not a matter for significance, thus reinforcing the view that s6(c) RMA is based on ecological values

Concerns

- *The full range of criteria was not used (e.g. it did not include diversity and pattern, naturalness and some aspects of context). Combining the criteria also resulted in a lack of clarity and misinterpretations of criteria meanings.*
- *Representativeness is assessed in a biogeographical context—either the ED or Freshwater biogeographic unit. Note, however, that the ED is a more appropriate scale for assessing terrestrial significance and wetlands (see section 8.3 of these guidelines).*
- *Under representativeness, requiring wetland attributes to be typical of what they were before 1840 sets an inappropriately high threshold. It implicitly incorporates naturalness (condition) and thus may exclude more-modified wetlands.*
- *Under representativeness, a size threshold of >40 ha for pakihi has to be met to attain significance. However, size thresholds should not apply to significance and the threshold used does not take proper account of significant values within smaller pakihi sites, including naturally occurring pakihi. The exclusion of smaller pakihi is also inconsistent with the RMA definition of a wetland.*
- *Under rarity, a higher threshold has been set for at risk species than for regionally uncommon species, but this is not consistent with national priorities. Similarly, pakihi are excluded as a category of historically rare wetlands.*
- *The normal meaning of 'distinctiveness' has been confused and thresholds have been set too high (e.g. a requirement for intact sequences, as distinct from partial sequences). It is also inappropriate to apply the distribution limits of forest trees to adjacent wetlands.*
- *The criterion of context does not include the extent to which wetlands are buffered.*

A128/2004 [2004] NZEnvC327: (Royal Forest and Bird Protection Society v. Central Otago District Council)

- The Environment Court endorsed the use of multiple assessment criteria as being a helpful means of guidance for determining significance. The criteria were based on the case of the Minister of Conservation v. Western Bay of Plenty District Council (A71/2001).
- It was accepted that sustainability should not be used as a significance criterion, as it relates to management considerations.

Concerns

- *While the criteria referred to are similar to those used in these guidelines, they include management criteria that should not be used for determining significance (i.e. fragility and threat, longterm viability and management input).*

[2011] NZEnvC129

- This Environment Court decision on urban tree protection in Auckland recognised the contribution urban trees make to the life-supporting capacity of ecosystems, and to air, water and soil 'by absorbing CO_2, by removing nitrogen and pollutants, and by slowing down run-off of stormwater' (s5(2)(b) RMA).
- The decision recognised that trees and urban vegetation can contribute to s6(a), (b) and (c) and 7(d) RMA, and that 'trees, especially native trees, contribute to many ecosystems' integrity, form, functioning and resilience' (Part 1 s2 RMA—definition of environment includes 'Ecosystems and their constituent parts… ').

Concerns

- *It is noted that changes to the RMA resulting from the Resource Management Amendment Act 2013 revoke the blanket tree protection addressed by this Environment Court decision and require scheduling of individual trees and groups of trees in a district plan. Guidance is provided by MfE in 'Tree Protection in Urban Environments' (INFO 704. MfE 2013)*

Appendix 5

Naturally uncommon ecosystems

The following table of ecosystem types was published by Williams et al. 2007 and is reprinted with permission from the *New Zealand Journal of Ecology*. For the threat status of these ecosystem types, refer to Table 3 in Holdaway et al. (2012).

Physical environments and vegetation structure of New Zealand's historically rare ecosystems

The common name and definition describe the environment of the ecosystem type. Vegetation structure lists the main vegetation units across all occurrences of that ecosystem and uses categories adapted from Atkinson (1985)—forest, treeland, scrub, shrubland, tussockland, fernland, grassland, sedgeland, rushland, reedland, restiadland, cushionfield, herbfield, mossfield, lichenfield, and open land (includes rockland, boulderfield, stonefield/gravelfield, sandfield, loamfield/peatfield). * indicates that rarity at a national scale may be questionable. Information that is not part of the formal description but is important to further characterise the ecosystem type is given in parentheses.

Table A5.1. Ecosystem types from Williams et al. 2007.

TENTATIVE COMMON NAME	DEFINITION (I.E. DIAGNOSTIC CLASSIFIERS) AND NOTES	VEGETATION STRUCTURE	EXAMPLE LOCALITY
Coastal			
*Active sand dunes	Raw/sand/dune/coastal	Grassland, sedgeland, open land	Himatangi, Manawatu
Dune deflation hollows	Raw/sand/depression/excessive drainage/coastal	Open land	Kaitorete Spit, Canterbury
Shell barrier beaches	Raw/shells/plain/coastal	Grassland, herbfield	Miranda Chenier Plain, Firth of Thames
Coastal turfs	Raw/atmospheric salinity/coastal, extreme exposure	Open land, herbfield	Westhaven Inlet, NW Nelson
Stony beach ridges	Raw–recent/gravel–cobbles/ beach ridge/coastal	Scrub, shrubland, open land	Rarangi, Marlborough
Shingle beaches	Raw–recent/gravel–cobbles / beach/coastal	Open land	Rarangi, Marlborough
*Stable sand dunes	Recent/sand/dune/coastal	Shrubland, grassland, tussockland, herbfield, open land	Himatangi, Manawatu
Coastal rock stacks	Raw/acidic rock/tor/coastal	Open land, herbfield, lichenfield, shrubland	Cape Kidnappers, Hawke's Bay
Coastal cliffs on quartzose rocks	Raw/quartzose rock/cliffs/coastal	Open land, lichenfield, herbfield, scrub, shrubland tussockland	17 Mile Bluff, Westland
Coastal cliffs on acidic rocks	Raw/acidic rock/cliffs/coastal	Open land, lichenfield, herbfield, scrub, shrubland tussockland	Cape Turnagain, Wairarapa
Basic coastal cliffs	Raw/basic rock/cliffs/coastal	Open land, lichenfield, herbfield, scrub, shrubland tussockland	Coastal areas of Banks Peninsula,
Calcareous coastal cliffs	Raw/limestone rock/cliffs/coastal	Open land, lichenfield, herbfield, scrub, shrubland tussockland	Punakaiki, North Westland
Ultrabasic sea cliffs	Raw/ultrabasic rock/cliffs/coastal	Scrub, herbfield, lichenfield, open land	Western cliffs, D'Urville Island; Surville cliffs, Northland
Inland and alpine systems			
Volcanic dunes	Raw/acidic rock (volcanics)/sand/ dune	Open land	Rangipo Desert, central North Island
*Screes of acidic rocks	Raw/acidic rock/gravel–cobbles/ talus/(excessive drainage–near permanently saturated; inland–alpine)	Open land	Porters Pass, Canterbury

Continued on next page

Table A5.1 continued

TENTATIVE COMMON NAME	DEFINITION (I.E. DIAGNOSTIC CLASSIFIERS) AND NOTES	VEGETATION STRUCTURE	EXAMPLE LOCALITY
Calcareous screes	Raw/calcareous rock/gravel–cobbles /talus/(excessive drainage–near permanently saturated; inland–alpine)	Open land	Mt Arthur, Nelson
Ultrabasic screes	Raw/ultrabasic rock/gravel–cobbles/talus/(excessive drainage–near permanently saturated)	Open land, lichenfield, shrubland	Olivine Range, Southland
Young tephra (<500 years) plains and hillslopes	Raw/acidic rock(volcanic) /sand–gravel/plains and hillslope	Open land	Mt Tarawera, Rotorua
Recent lava flows (<1000 years)	Raw/acidic rock (volcanic)/ boulders–bedrock (numerous landforms)	Scrub, shrubland, treeland, forest, herbfield, mossfield, open land	Rangitoto Island, Auckland
Old tephra (>500 years) plains (= frost flats)	Acidic rock (volcanic)/depression/ seasonally fluctuating water table/ inland, >200 frost days year	Shrubland, scrub, tussockland	Kaingaroa, central North Island
Frost hollows	Terrace/>200 frost days per year	Shrubland, scrub	Buller River, Nelson
Boulderfields of acidic rocks (non-volcanic)	Raw/acidic rock/boulders/talus	open land, lichenfield, shrubland	Iron Hill, western Nelson
Volcanic boulderfields	Recent/acidic(volcanic)/boulders/ talus/excessive drainage	Forest, scrub	Mt Eden, Auckland
Volcanic debris flows or lahars	Recent/acidic rock(volcanic)/ silt–cobbles	Forest, scrub, mossfield	Maero debris flow, Mt Taranaki
*Moraines	Raw–recent/cobbles–boulders/ moraine/(various parent materials)	Open land, shrubland, herbfield, tussockland	Murchison Valley, Canterbury
Boulderfields of calcareous rocks	Raw/calcareous rock/boulders/ talus	Open land, lichenfield, shrubland	Mt Arthur, western Nelson
Ultrabasic boulderfields	Raw/ultrabasic rock/boulders/ talus	Open land, lichenfield, shrubland	Red Hills, Southland
Cliffs, scarps and tors of quartzose rocks	Raw/quartzose rock/bedrock/cliff, scarp and tor/inland–alpine	Open land, herbfield, tussockland, shrubland	Lyell Range, Westland
*Cliffs, scarps and tors of acidic rocks	Raw/acidic rock/bedrock/cliff, scarp and tor/inland–alpine	Open land, herbfield, tussockland, shrubland	Mt Rolleston, Canterbury
Basic cliffs, scarps and tors	Raw/basic rock/cliff, scarp and tor/inland–alpine	Open land, herbfield, tussockland, shrubland	Mt Herbert, Banks Peninsula, Canterbury
Calcareous cliffs, scarps and tors	Raw/calcareous rock/cliff, scarp and tor/inland–alpine	Open land, herbfield, tussockland, shrubland	Mt Owen, Nelson
Ultrabasic cliffs, scarps and tors	Raw/ultrabasic rock/cliff, scarp and tor/coastal–alpine	Open land, herbfield, tussockland, shrubland	Olivine Range, Southland
Ultrabasic hills	Ultrabasic rock/hillslope, hillcrest/ (raw–mature)	Open land, herbfield scrub, shrubland, tussockland, forest (very limited extent)	Red Hills, Marlborough
Inland sand dunes	Raw–recent/sand/dune/inland	Open land, scrub, tussockland, herbfield	Clutha Valley, Otago
Inland outwash gravels	Raw–recent/sand–boulders/plain/ inland	Open land, herbfield, treeland	Pisa Flats, Clutha Valley
Braided riverbeds	Raw–recent/sand–boulders/plain/ periodically flooded ([2]p. 56)	Open land, herbfield	Waimakariri River
Granitic sand plains	Raw/granite/sand–gravel/hillslope, hillcrest (mostly alpine)	Open land	Lookout Range, Nelson
Granitic gravel fields	Raw/granite/gravel/hillslope, hillcrest	Open land	Mt Titiroa, Manapouri
Sandstone erosion pavements	Raw/quartzose/bedrock/hillslope, hillcrest	Open land	Mt Augustus, West Coast
Limestone erosion pavements	Raw/calcareous/bedrock/ hillslope, hillcrest/(alpine)	Open land	Matiri Tops, western Nelson
Inland saline (salt pans)	Ground water salinity/semi arid/ depression ([2]pp. 20, 22)	Herbfield, grassland	Maniototo Valley, Central Otago

Continued on next page

Table A5.1 continued

TENTATIVE COMMON NAME	DEFINITION (I.E. DIAGNOSTIC CLASSIFIERS) AND NOTES	VEGETATION STRUCTURE	EXAMPLE LOCALITY
Strongly leached terraces and plains ('Wilderness' vegetation)	Over-mature/sand–gravel/terrace–plain/inland	Open land, herbfield, shrubland	The Wilderness, Southland
Cloud forests	High cloud cover (<1500 sunshine hours and >200 rain days p.a.)/ inland	Forest	Mt Manuoha, Urewera National Park; Waima Forest, western Northland
Geothermal systems			
Heated ground (dry)	Geothermal—excessive heat	Open land, mossfield, shrubland, scrub	Whakarewarewa, Rotorua
Hydrothermally altered ground (now cool)	Geothermal—acid soils, toxic elements	Open land, shrubland, scrub	Whakarewarewa, Rotorua
Acid rain systems	Geothermal—acid rain	Open land, scrub, treeland, forest	White Island, Bay of Plenty
Fumeroles	Geothermal—superheated steam/ acid rain/depression	Open land, shrubland	Waimangu, Rotorua
Geothermal streamsides	Geothermal—excessive heat/near permanently saturated (but water table not high)	Open land to scrub	Waimangu, Rotorua
Induced by native vertebrates			
*Seabird guano deposits	Seabirds—guano deposits/ coastal/(numerous landforms)	Open land, herbfield	Muriwai gannet colony, Auckland; South Bay, Kaikoura
*Seabird burrowed soils	Seabirds—burrowing/coastal	Open land to forest	Petrel colonies, Paparoas; Catlins Coast, SE Otago
Marine mammal haulouts	Seabirds and marine mammals—trampling and grazing/coastal	Open land to forest	Seal colonies, Westport
Subterranean or semi-subterranean			
Sinkholes	Raw/limestone, marble, dolomite/ doline	Open land, shrubland, tussockland, flaxland	Thousand Acre Plateau, western Nelson
Cave entrances	raw/calcareous/cave entrance	open land, herbfield	Mangapu cave
Caves, and cracks in karst	Calcareous/subterranean/coastal–alpine	None	Waitomo caves, Waikato
*Subterranean river gravels	Raw/alluvium and till/gravel/ subterranean/	None	Waimea Plains
Subterranean basalt fields	Raw/basic rock (basalt)/ subterranean	None	Beneath Auckland city
Wetlands			
Lake margins	Inland/regularly high water table/ silt and clay–gravel/beach ([2]p. 18)	Open land, herbfield, rushland	Lake Te Anau, Fiordland
Cushion bogs	Permanently high water table/ peat/plain ([2]p. 27)	Cushionfield	Mararoa Valley, Southland
Ephemeral wetlands[1]	Seasonally high water table/ depression ([2]p. 33)	Herbfield, open land	Rangitaiki, Taupo
Gumlands (excludes those induced by anthropogenic fire)	Over-mature soils/seasonally high water table/(peat or non-peat) ([2]p. 34)	Shrubland, fernland, sedgeland, forest	Ahipara Plateau; Spirits Bay, Northland
Pakihi	Over-mature soils/regularly–permanently high water table/ (peat or non-peat) ([2]p. 34)	Shrubland, fernland, sedgeland, forest	German Terrace, Westland
Damp sand plains	Raw–recent/coastal/sand/plains/ permanently high water table ([2]p. 44)	Open land, herbfield	Kaipara Heads, Northland
Dune slacks	Raw–recent/coastal/sand/ depression/permanently or seasonally high water table ([2]p. 44)	Herbfield, open land	Himatangi, Manawatu
Domed bogs (*Sporadanthus*)	Permanently high water table/ peat/dome ([2]pp. 48, 70)	Restiadland, rushland, sedgeland, shrubland	Kopuatai Bog, Hauraki Plains
String mires	Permanently high water table/ peat/depression on hillslope/open water ([2]p. 48)	mossfield, sedgeland	Garvie Mountains, Southland

Continued on next page

Table A5.1 continued

TENTATIVE COMMON NAME	DEFINITION (I.E. DIAGNOSTIC CLASSIFIERS) AND NOTES	VEGETATION STRUCTURE	EXAMPLE LOCALITY
*Blanket mires	Permanently high water table/ peat/hillcrest, hillslopes, depressions (low relief) ([2]p. 50)	Rushland, mossfield, fernland, shrubland, scrub, forest	Southern Stewart Island
Tarns	Open water/depression/alpine (usually) ([2]p. 53)	Tussockland, sedgeland, cushionfield	Glenmore moraines, Mackenzie Basin
*Estuaries	Coastal/estuary ([2]p. 54)	Open land, sedgeland, rushland, reedland, herbfield, shrubland, scrub	Ohiwa Harbour, Bay of Plenty; Whangapoua estuary, Great Barrier Island
*Lagoons	Coastal/lagoon ([2]pp. 54–55)	Open land, sedgeland, rushland, reedland, herbfield, shrubland, scrub	Lake Ellesmere, Canterbury
Seepages and flushes	Permanently high water table/ hillslope and fan/enhanced nutrients ([2]pp. 57–58)	Sedgeland, cushionfield, mossfield, scrub	Garvie Mountains, Southland
Snow banks	Alpine/late snow-lie/seasonally high water table ([2]p. 62)	Tussockland, herbfield	Top of Kelly Range, Brunner Range

[1] May be usefully split into 'acidic' vs 'basic' to account for the very rare turfs surrounding karst lakes (e.g. Lake Koraha, Taumata Totara Forest)

[2] Johnson, P.; Gerbeaux, P. 2004: Wetland types in New Zealand. Department of Conservation, Wellington, New Zealand.

Appendix 6

Additional information on case studies

One significance criterion has to attain a medium rating for a site to be 'significant'.

Note that asterisks indicate exotic plants in the following examples.

1. Ephemeral wetland on the Canterbury Plains

Location and general description

This wetland is located directly inland from the coast, approximately 175 m behind the beach. The turf occurs in a circular depression about 10 m across. It is one of several turfs in depressions and channels associated with former river meanders (the river is now 700 m away). The turf occurs in a wider matrix of farmland, which includes larger open-water lagoons associated with former river channels. The turf is in the Low Plains ED.

The turf is dominated by native herbs, with the dominant plant being *Lobelia perpusilla*. Other prominent plants include marsh foxtail *Alopecurus geniculatus**, *Lilaeopsis novae-zelandiae*, *Centipeda cunninghamii,* spike sedge *Eleocharis acuta, Leptinella dioica* and *Oxalis exilis*. Les common plants are *Selliera radicans*, white clover *Trifolium repens**, arrow grass *Triglochin palustris* and *Juncus edgariae*. A similar but weedier turf occurs adjacent to this depression (i.e. the 'NW' corner of the photograph).

Application of guideline criteria

Representativeness

- Similar ephemeral wetlands were more widespread in the past, but many will have been lost to coastal erosion and land development. Several were visited and this one is typical of what would have been previously present.
- Ecological functioning has been altered by farming practices, including an increase in nutrient levels through animal waste and, possibly, fertiliser. Plant dispersal is likely to be more restricted now because of the loss of similar habitats in the vicinity.
- [M/H rating].

Diversity and pattern

- Relatively high diversity of indigenous plants, though not as high as in original habitats due to the presence of exotic plants and altered ecological functioning.
- Specific faunal values unknown, though the area will be used by invertebrates and birds.
- The range of habitat diversity generally will have been reduced in the vicinity.
- [Medium rating].

Rarity and special features

- Wetlands are a national priority for protection as they have become uncommon.
- No land environments are identified here, as the turf is supposedly within a defined river system. However, the land environments on similar land surfaces adjoining lagoons nearby are acutely threatened.
- The turf occurs in the coastal environment, and coastal turfs are identified as a naturally rare ecosystem (ephemeral wetlands generally are also naturally rare).
- Turf habitats which support a combination of freshwater and salt-tolerant species are uncommon in the ED.
- *Lobelia perpusilla* is locally rare and not recorded from other wetlands in the ED by recent surveys.
- [High rating].

Naturalness

- Turfs of this type have are limited in the ED, and those that remain are usually much modified. This turf is unusual in that it is still dominated by indigenous plants rather than exotic plants. Surrounding vegetation is strongly dominated by exotic plants.
- Nutrient levels are likely to be higher due to stock waste within the wetland and from adjoining farmland. Some trampling by sheep is likely at times.
- The presence of brackish water reflects natural hydrological processes associated with groundwater that would also have occurred in the past.
- [M/H rating].

Size and shape, buffering/surrounding landscape and boundaries

- While the turf depression is small, there are other small depressions and channels supporting similar vegetation nearby. Collectively, they provide important turf habitats and are likely to be used by indigenous invertebrates and birds. Linkage functions are likely to be important.
- The site is very vulnerable to edge effects, but it is unclear whether stopping grazing could result in increased weed problems.
- The site is not naturally buffered, but buffers are clearly needed around this habitat and other nearby turfs and wetlands; i.e. they need to be managed collectively.
- [L/M rating].

Long-term ecological viability

- This turf should be managed in conjunction with other nearby wetlands, taking into account the management of adjoining farmland.
- Maintaining natural hydrological functioning is likely to be a key factor in maintaining this and other turfs in the vicinity, along with managing exotic plants.
- [Medium rating].

Fragility and threat, and management input

- The turf is vulnerable to trampling and pugging, but the recent sheep grazing regime does not appear to be causing obvious physical damage. This contrasts with other turfs nearby that have been damaged by sheep or destroyed by cattle (pugging, nutrient pollution and weed invasion).
- This does not mean that sheep grazing is not having adverse effects such as increasing nutrient levels or spreading weeds. On the other hand, stopping grazing may result in the spread of exotic plants.
- Marsh foxtail is known to be invasive in wetland turfs and should be removed.
- The turf (and a surrounding buffer) should be fenced-off from the adjacent farmland and subsequently compared with a similar grazed turf nearby.
- Grazing and other effects should be assessed by monitoring to determine what vegetation changes result when grazing is withdrawn. If weed problems increase, some controlled grazing or intermittent grazing may be needed. The effects of removing marsh foxtail should also be monitored.
- Substantial and on-going management input will be required in this highly modified environment.
- [High rating].

2. Coastal donga in mid Canterbury

Location and general description

This small donga is located on the mid-Canterbury coast. Most of it is within farmland and is dominated by exotic grasses with patches of gorse *Ulex europaeus*. It is one of a number occurring on this coastline, but most have been developed. The donga is in the Low Plains ED.

A few porcupine shrubs *Melicytus alpinus*, matagouri *Discaria toumatou* and scrub pohuehue *Muehlenbeckia complexa* occur here. Additional indigenous plants include *Cotula coronopifolia, Crassula moschata, Oxalis exilis, Calystegia soldanella, Raoulia australis, Colobanthus brevisepalus, Geranium sessiliflorum, Einadia triandra,* silver tussock *Poa cita,* lichens and mosses.

Application of guideline criteria

Representativeness

- This donga is characteristic of the many dongas occurring between the Rakaia and Waitaki Rivers, although only a relatively small number continue to support indigenous vegetation.
- The porcupine shrub, matagouri and scrub pohuehue are all that remains of the indigenous woody vegetation that was typical of these dryland ecosystems.
- The turfs present on donga spurs above the beach are characteristic of exposed cliff tops and spurs along this coast.
- Ecological functioning will have been altered by farming practices, including an increase in nutrient levels through animal waste and, possibly, fertiliser. Plant dispersal is likely to be more restricted now because of the loss of indigenous vegetation generally and the modification of other dongas and associated dryland habitats in the vicinity.
- [Medium rating, which is less than other dongas with more woody species].

Diversity and pattern

- Supports a substantial diversity of indigenous plants characteristic of dryland habitats on this coast, though not as many woody species as in some dongas and undoubtedly many fewer than originally.

- Has some diversity of habitat with exposed stony patches at the mouth supporting a specialised turf community (*Colobanthus brevisepalus*, mosses, lichens, *Raoulia australis* etc.), while inland portions support remnants of woody plants and associated herbs.
- Faunal values are unknown, though skinks were seen in a number of dongas elsewhere and are likely to be present here.
- [Medium rating].

Rarity and special features

- Occurs within an acutely threatened land environment.
- The coastal turfs at the mouth are a naturally uncommon ecosystem.
- Coastal dongas have a restricted distribution within New Zealand.
- The processes of donga formation are of special geomorphological interest.
- *Colobanthus brevisepalus* is an At Risk species (Naturally Uncommon).
- [High rating].

Naturalness

- While many dongas retain their physical presence, only a relatively small number retain remnant indigenous habitats. This example retains a substantial diversity of indigenous species, though with less-extensive habitat than others.
- Exotic grasses, other herbs and patches of gorse are common, and much of the area is grazed as part of a dryland farming operation.
- [Medium rating].

Size and shape, buffering/surrounding landscape and boundaries

- This is a small donga and is therefore vulnerable to farming activities, including water from an irrigation race.
- The small coastal strip receives a degree of protection from stock by a fence which runs across the donga. The long shingle beach provides some buffering due to its relatively limited access.
- There are two other small dongas nearby, but their values are unknown.
- [L/M rating].

Long-term ecological viability

- The donga needs to be managed in conjunction with the surrounding farmland and the two nearby dongas (if they retain any remnant habitats). The spread of gorse in particular needs to be addressed, along with stock management. Any channelling of water through the donga also needs to be prevented.
- In the long term, the donga is likely to gradually succumb to coastal erosion.
- [L/M rating, unless extreme rainfall events facilitate inland back-cutting].

Fragility and threat, and management input

- The indigenous dryland vegetation is least vulnerable to extensive dryland farming and grazing. In contrast, any direct irrigation or by-wash from irrigation on its surface will destroy its values rapidly.
- It is also vulnerable to other activities and landuse changes such as cultivation, forestry and development associated with dairy farming.
- The spread of gorse and, perhaps, broom *Cytisus scoparius* (if present in the vicinity) poses a threat.
- Dryland farming needs to be retained, excessive water avoided and weeds controlled. The area should probably be fenced-off from grazing, but monitoring will be required to check whether this causes an increase in weeds and exotic plants generally.
- [M/H rating].

3. Matagouri on an upper Rakaia River terrace, inland Canterbury

Location and general description

This matagouri *Discaria toumatou* shrub grassland is located on a river terrace in the upper Rakaia River catchment. The terrace is an older stable terrace above the active floodplain. The site is in the Mathias ED.

Vegetation cover was estimated for those species exceeding 1% ground cover (Myers et al. 1987). The cover classes used were 1 (present), 2 (1–5% cover), 3 (5–25% cover), 4 (25–50% cover), 5 (50–75% cover) and 6 (75–100% cover). The ground surface is dominated by a mix of exotic grasses and indigenous herbs, while taller matagouri occurs in the 30 cm – 2 m tier (a cover of 3) and the 2–5 m tier (a cover of 1). The dominant ground tier plants are Chewing's fescue *Festuca rubra* subsp. *commutata**, browntop *Agrostis capillaris**, creeping pohuehue *Muehlenbeckia axillaris*, woolly moss *Racomitrium lanuginosum* and sweet vernal *Anthoxanthum odoratum**. Other indigenous species include matagouri, silver tussock *Poa cita*, patotara *Leucopogon fraseri*, harebell *Wahlenbergia albomarginata* subsp. *albomarginata*, *Acaena caesiiglauca*, everlasting daisy *Anaphalioides bellidioides*, red woodrush *Luzula rufa* and *Pimelea oreophila*. Overall matagouri cover varies from 20% to 50%, depending on the locality.

Application of guideline criteria

Representativeness

- Matagouri is the characteristic woody plant of the terraces adjacent to the floodplain, where it is also present, albeit of much lower stature. The tallest matagouri bushes are up to 4 m tall. A number of native herbs characteristic of terraces are also present. These plants are typical of the original terrace communities of the upper Rakaia River.
- Exotic grasses are widespread on river terraces here and elsewhere adjoining the Rakaia Riverbed, though not higher up in the headwaters.
- Fauna values were not recorded here, but in similar habitats nearby skinks are present along with birds such as the New Zealand pipit *Anthus novaeseelandiae*, grey warbler *Gerygone igata* and silvereye *Zosterops lateralis*. An invertebrate fauna characteristic of this habitat type is also expected here.

- Ecological functioning is largely continuing as it did in the past, with flooding of lower terraces by the Rakaia River or by smaller streams from the adjacent mountain slopes. Plant dispersal and succession will have been altered to some degree by the extent of exotic grasses in the ground tier. The area has not been oversown and topdressed.
- [M/H rating].

Diversity and pattern

- There is a modest diversity of indigenous plants, reduced by the prominence of exotic grasses.
- Habitat diversity and pattern is, however, similar to what would have been present originally (e.g. small meandering streams, localised bog rush in depressions and stony patches and ridges with additional indigenous plants such as *Raoulia australis*, mat coprosma, mosses and lichens).
- Original stream flow patterns occur across the surface of the terrace.
- [M/H rating].

Rarity and special features

- Occurs within an at risk land environment (20–30% indigenous cover), but at risk does not meet the national threshold. However, because substantial losses are occurring in these environments, a precautionary approach necessitates a medium rating. This approach is also consistent with the national threatened species classification, i.e. at risk species receive medium rating (as illustrated in the table and the case studies).
- No threatened or at risk species were recorded here, but *Aciphylla subflabellata*, New Zealand pipit and common skink *Oligosoma polychroma* (clade 4) are all classified as At Risk species that have been recorded from similar habitats nearby and may be present. No locally uncommon species are known here.
- [Medium rating].

Naturalness

- Similar terrace habitats are less extensive in the headwaters and exotic grasses are much less common there. However, other similar habitats on both sides of the river are known to have a lower diversity of indigenous plants and a higher cover of exotic grasses, especially Chewing's fescue *Festuca rubra* subsp. *commutata*.
- The area has not been oversown or topdressed; sheep tracks and some animal waste are present.
- [M/H rating].

Size and shape, buffering/surrounding landscape and boundaries

- The habitat is part of a large terrace complex which is more than 10 km long and 1–2 km wide.
- It is well-buffered by the Rakaia River floodplain and steep mountains behind.
- [High rating].

Long-term ecological viability

- While the vegetation receives extensive sheep grazing, effects are relatively minor. Natural ecological processes such as flooding continue as they have done in the past.
- [High rating].

Fragility and threat, and management input

- Little management input is required. Natural floods may alter the area intermittently but this is accepted as an integral characteristic of the habitat. Introduced broom is present in the wider area and a watching brief will be needed to ensure it does not become established here.
- In the medium term it is likely that the area will be formally protected.
- [Low rating].

4. Depleted short tussock grassland, Mackenzie Basin, south Canterbury

Location and general description

This depleted short tussock grassland is located on a fluvioglacial outwash surface in the vicinity of the middle reaches of the Tekapo River. The site is in Pukaki ED.

There is much exposed soil at the site, and the dominant plants are mouse-ear hawkweed* *Pilosella officinarum*, fescue tussock *Festuca novae-zelandiae*, sheep's sorrel *Rumex acetosella**, scabweed *Raoulia australis* and *Raoulia parkii*. Other prominent plants include matagouri *Discaria toumatou*, blue tussock *Poa colensoi*, hawksbeard *Crepis capillaris**, blue wheatgrass *Elymus solandri*, creeping pohuehue *Muehlenbeckia axillaris*, patotara *Leucopogon fraseri*, harebell *Wahlenbergia albomarginata*, *Poa lindsayi*, dandelion *Taraxacum officinale**, *Raoulia subsericea*, *Carex breviculmis*, *Agrostis muscosa*, *Carex muelleri*, silvery hair grass *Aira caryophyllea**, *Poa maniototo*, *Geranium brevicaule*, *Veronica verna**, sweet vernal* *Anthoxanthum odoratum*, bristle tussock *Rytidosperma setifolium*, *Raoulia monroi*, lichens and mosses.

Application of guideline criteria

Representativeness

- The site is typical of fluvioglacial outwash surfaces in the central basin. Despite the prominence of bare ground, there is a diversity of native herbs and localised patches of matagouri.
- Exotic herbs are widespread, with mouse-ear hawkweed and sheep's sorrel being particularly common.
- Indigenous fauna was not specifically assessed, although moths were common and the endemic grasshopper *Sigaus minutus* was present. A characteristic invertebrate fauna is likely to be present, and while they were not seen on this occasion, skinks are likely to be present. Banded dotterels *Charadrius bicinctus* and New Zealand pipits *Anthus novaeseelandiae* may also be present, as they were seen in similar habitats nearby.
- Ecological functioning is likely to be occurring as it did in the past. While the area has not been cultivated or oversown or topdressed, it has been subject to disturbance by burning,

sheep grazing and rabbits. This will have altered the flora, reducing the woody component and the more palatable plants. Ecological processes such as pollination, succession and dispersal are expected to continue.

- [M/H rating].

Diversity and pattern

- There is a substantial diversity of indigenous plants, with more species present than those listed. The characteristic dendritic pattern of outwash channels is clearly evident and older terrace surfaces occur within the wider area.
- [M/H rating].

Rarity and special features

- The site occurs within an at risk land environment (20–30% indigenous cover), but the at risk rank does not meet the national threshold. Despite this, fluvioglacial outwash surfaces such as occur at this site are continuing to be developed and irrigated and they may shift into the chronically threatened category in the future. Because substantial losses are occurring in these environments, a precautionary approach necessitates a medium rating for this aspect of the rarity criterion. This approach is also consistent with the national threatened species classification, i.e. at risk species receive medium rating (as illustrated in the table and the case studies).
- *Raoulia monroi* is classified as At Risk (Declining).
- *Sigaus minutus* is classified as At Risk (Declining).
- [High rating].

Naturalness

- Mouse-ear hawkweed and sheep's sorrel are dominant plants at the site, indicating substantial disturbance from stock, rabbits and frost heave. Despite these impacts, the flora is still dominated by indigenous plants.
- The site has not been cultivated, or oversown or topdressed.
- [Medium rating].

Size and shape, buffering/surrounding landscape and boundaries

- The habitat is part of a large series of outwash terraces which extend for several kilometres on either side of the Tekapo River. Although it is located well away from developed moraines to the north and west, wilding pines are present on or beyond these surfaces and they are therefore a long-term threat.
- [M/H rating].

Long-term ecological viability

- The vegetation is extensively grazed by sheep and intensively grazed by rabbits. Providing rabbits are controlled to reasonable numbers and the area is not developed for agriculture, its long-term viability is assured. This is demonstrated by the Tekapo Scientific Reserve, which has the same soil type and is not grazed. Natural ecological processes will continue as they have done in the past.
- [High rating].

Fragility and threat, and management input

- The soils here are fragile and vulnerable to wind erosion in particular, so retirement from grazing would enhance vegetation cover over time. If this was achieved, the main threats would be from rabbit grazing and wilding pines which could establish on these surfaces.
- If the land was retired from grazing, it would ideally be incorporated in a drylands park. The main management effort required would be on-going rabbit control and wilding pine control, as wilding pines are present on nearby surfaces.
- [Medium rating].

5. Pakihi wetland, Arnold valley, West Coast

Location and general description

This 32-ha wetland is located on a low glacial outwash terrace in the Arnold River Valley on the West Coast of the South Island. Much of the valley floor and adjacent terraces have been cleared of their original indigenous vegetation, and what remains is mostly a mosaic of farmland and secondary indigenous vegetation. The wetland is in the Hochstetter ED.

The dominant plant community is characterised by tangle fern *Gleichenia dicarpa*, *Baumea* spp. and sphagnum moss *Sphagnum cristatum*, with other prominent species including *Carex carsei*, swamp kiokio *Blechnum minus*, *Gahnia rigida*, *Coprosma tayloriae*, *C. rigida*, *C. tenuicaulis*, mānuka *Leptospermum scoparium* and bracken *Pteridium esculentum*. Also present are saplings of New Zealand cedar *Libocedrus bidwillii*, celery pine *Phyllocladus alpinus*, mānuka, *Podocarpus acutifolius* and weeping mapou *Myrsine divaricata*. Exotic plants include gorse *Ulex europaeus*, catsear *Hypochaeris radicata**, *Juncus canadensis**, soft rush *Juncus effusus**, khasia berry *Cotoneaster simonsii**, blackberry *Rubus fruticosa** and Spanish heath *Erica lusitanica**. Total indigenous cover is approximately 98%, while gorse comprises about 1% and is concentrated on the eastern side. Four small forest remnants within the site are composed of rimu *Dacrydium cupressinum*, kahikatea *Dacrycarpus dacrydioides*, miro *Prumnopitys ferruginea*, silver pine *Manoao colensoi* and cedar, and they show evidence of past logging and burning.

Application of guideline criteria

Representativeness

- Pakihi ecosystems are a prominent feature of low-fertility, glacial outwash ecosystems in the ED, having been largely induced by the clearance or burning of swamp and less-fertile bog forests.
- This pakihi site is characteristic of other pakihi in the ED, many of which were viewed from roadsides. Most of those that could be seen were more modified, as indicated by widespread gorse, tracking, drainage and the presence of rough pasture. Several retained scattered shrubs and secondary kahikatea and were of similar character to the Arnold Valley site.

- A diverse array of indigenous shrubs and trees is present, representing elements of the original forest that occurred here. Shrubs and young trees are scattered throughout the wetland, and there are four small forest remnants.
- The indigenous fauna is largely unknown, although SI fernbirds *Bowdleria punctata punctata* are abundant and western weka *Gallirallus australis australis* are present. A characteristic invertebrate fauna is likely.
- Natural ecological functioning is likely, as the area has not been drained and natural water movement is occurring within the wetland and down the terrace riser to the east. Plant regeneration is extensive for many of the indigenous plants present, especially for kahikatea in the forest remnants.
- [M/H rating].

Diversity and pattern

- The wetland supports a considerable diversity of indigenous plants characteristic of west coast pakihi, including many woody species.
- The vegetation is a mosaic of fernland, shrubland, scrub and wetland forest types, with many ecotones between the vegetation types, and localised ponds and channels. There is a particularly notable ecotone between the pakihi and the beech-podocarp forest on the adjacent terrace riser.
- Faunal values are largely unknown apart from SI fernbird and western weka. However, it is likely that other indigenous birds will be present, along with lizards, a range of invertebrates and, perhaps, indigenous fish. Bats are thought to be present in the general area and may occur here.
- [M/H rating].

Rarity and special features

- It occurs in an at risk land environment (20–30% indigenous cover remaining), although this does not meet the national threshold for threatened land environments. However, because substantial losses are occurring in these environments, a precautionary approach necessitates a medium rating for this aspect of the rarity criterion. This approach is also consistent with the national threatened species classification, i.e. at risk species receive medium rating (as illustrated in the table and the case studies).
- Wetlands are a national protection priority, and pakihi are a naturally rare ecosystem type, i.e. national priorities 2 and 3 are satisfied.
- SI fernbird and western weka are both classified as At Risk (Declining). Brown mudfish *Neochanna apoda* (also At Risk, Declining) may be present but the area has not been surveyed.
- Pakihi wetlands are a distinctive feature of the ED and, more generally, of the West Coast and Northwest Nelson Regions. Their formation and the distinction between induced pakihi and naturally occurring pakihi is of scientific interest.
- Kokiri is the type locality for the endemic caddisfly *Kokiria miharo*, AG McFarlane 1964 (*Records of the Canterbury Museum 8(1)*: 55–79), which only occurs in North Westland and Northwest Nelson (Winterbourn et al. 2006). This appears to be the southern limit for the species, according to Massey University's New Zealand trichoptera database.
- [High rating].

Naturalness

- Despite being induced, this pakihi ecosystem is still largely natural in terms of its plant species composition and ecological functioning.
- Although a number of exotic plants are present, up to 98% of the total vegetation cover is indigenous. The original forest has been selectively logged and burned, although remnants of it still remain.

- Natural ecological functioning is likely to be occurring (e.g. regeneration and hydrological functioning).
- [M/H rating]

Size and shape, buffering/surrounding landscape and boundaries

- At 32 ha, the pakihi is of moderate size and compact shape. It does not adjoin cleared farmland as many other pakihi do in the ED.
- It is well buffered from nearby farmland by a terrace riser and indigenous forest to the east. It largely adjoins exotic forests to the west and north, and if these were harvested to the edge of the wetland, adverse effects would be likely (e.g. sedimentation and weed invasion). Potential effects on the hydrology are unclear, although the broad drainage pattern is from south to north.
- There is also a vehicle track and a row of eucalyptus trees along the western margin.
- There is a direct linkage with the beech-podocarp forest on the terrace riser and partly with indigenous forest to the northwest.
- [Medium rating].

Long-term ecological viability

- The pakihi should remain viable, as its hydrological functioning appears largely intact and many of its indigenous plants are regenerating. The control of exotic weeds such as gorse and Spanish heath would be beneficial, as they have the potential to spread at the site. In the absence of further disturbance or drying out of the wetland, gorse is likely to be restricted to drier localities and Spanish heath should be similarly limited by water-logged soils.
- In the long term, much of the vegetation is likely to revert back to forest.
- [M/H rating].

Fragility and threat, and management input

- If the proposed Arnold hydroelectric power scheme proceeds, at least 10 ha of the wetland would be destroyed by a canal. This would have hydrological impacts on the wider wetland and contribute to further weed invasion from the disturbed area.
- Harvesting of adjacent pine plantations is also likely to increase weed spread and result in sedimentation, depending on hydrological relationships.
- The wetland may be vulnerable to future drainage and subsequent development, as it is below the 40 ha threshold identified in the West Coast Regional Wetlands EC case (see attachment 3).
- Existing key weeds need to be controlled (e.g. Spanish heath).
- If the above developments do not occur, the management input required to maintain wetland values would be modest.
- [M/H rating].

6. Riparian invertebrate habitat, Yeo Stream, Marlborough

Location and general description

Yeo Stream is within the Molesworth Recreation Reserve, Marlborough. Its riparian margins retain remnant indigenous woody vegetation that provides important habitat for invertebrates. It lies in the Dillon ED.

Discontinuous ribbons of indigenous trees and shrubs occur for much of the length of Yeo Stream, separated by extensive areas without woody vegetation. The woody remnants typically include mountain ribbonwood *Hoheria lyalli* and grey shrubs. Higher-altitude communities are more intact and include rocklands, screes, snow tussock grasslands and shrub-grasslands.

Note that in this example, the criteria have been applied to invertebrate values only to illustrate how they are applied in that context.

Application of guideline criteria

Representativeness

- The moth and caddis assemblages associated with these remnants are characteristic of a combination of forest, alpine and open country ecosystems within the context of the Dillon ED.
- [M/H rating].

Diversity and pattern

- The range of moth and caddis fauna associated with these remnants is still diverse given the extent of woody habitat loss in the ED. The caddis fauna in particular is extremely diverse, within the context of eastern South Island drylands, and includes species normally associated with stable, forested catchments.
- [Medium rating].

Rarity and special features

- The vegetation provides habitat for one of only two populations of Kaikoura giant weta *Deinacrida parva* (At Risk, Relict), known with certainty to be present within the ED.
- [Medium rating].

Naturalness

- Although these are modified remnants, the diverse moth and caddis fauna and the presence of a Kaikoura giant weta population in the headwaters suggest a much less disturbed landscape within the context of extensive habitat loss in the ED. The Yeo Valley is used for winter grazing by cattle, although much of the riparian woody vegetation is on steeper slopes beyond the reach of stock.
- [M/H rating].

Size and shape, buffering/surrounding landscape and boundaries

- The remnants are small and fragmented and often surrounded by short tussock grassland which has been oversown.
- [L/M rating].

Long-term ecological viability

- The long-term viability is uncertain as habitats are small and fragmented, yet moth and caddis have managed to persist until now. However, the natural processes which would normally allow the expansion of habitat are limited by grazing pressure. The area is used for winter grazing by cattle, although much of the riparian woody vegetation is on steeper slopes beyond the reach of stock.
- Fire is another long-term threat to the site in this dry environment.
- [L/M rating].

Fragility and threat

- Recruitment of key tree and shrub species is restricted by grazing and browsing pressure, largely from rabbits, hares, goats and cattle, even though moth and caddis communities are able to persist at the smaller scale.
- [Medium rating].

Management input

- Control of plant and animal pests is needed and fencing is also probably needed to exclude cattle from the valley. This would facilitate habitat expansion and enhancement, and improve the overall value of the site.
- [M/H rating].

7. Alluvial kānuka forest, Albany, North Auckland

Location and general description

This area of kānuka (*Kunzea* sp.) forest comprises a narrow corridor of regenerating alluvial forest alongside a tributary of Lucas Creek, one of the main creeks flowing into the north side of the Upper Waitemata Harbour. It is in the Tamaki ED on the northern urban fringe of Auckland. It is semi-contiguous with indigenous coastal riparian habitat to the south and north associated with Lucas Creek and its tributaries.

The forest is composed of mature kānuka with kahikatea *Dacrycarpus dacrydioides*, celery pine/tānekaha *Phyllocladus trichomanoides*, tōtara *Podocarpus totara* and kōwhai *Sophora* sp. in the canopy, while the understory includes ponga *Cyathea dealbata*, mamaku *C. medullaris*, māhoe *Melicytus ramiflorus*, nīkau *Rhopalostylis sapida*, lancewood *Pseudopanax crassifolius*, mapou *Myrsine australis* and hangehange *Geniostoma rupestre* var. *ligustrifolium*. Shortfin eel *Anguilla australis*, longfin eel *A. dieffenbachii*, banded kōkopu *Galaxias fasciatus* Gray, giant kōkopu *Galaxias argenteus*, red-finned bully *Gobiomorphus huttoni*, common bully *Gobiomorphus cotidianus* and smelt *Retropinna* sp. are present in the stream catchment, while the bird fauna includes kererū *Hemiphaga novaeseelandiae*, tūī *Prosthemadera novaeseelandiae* and grey warbler *Gerygone igata*.

Application of guideline criteria

Representativeness

- The remnant is typical of successional kānuka-podocarp forest in the northern part of the Tamaki ED. Such habitats were widespread on the Auckland isthmus and North Shore in early European times, as described by Esler (1991[8]) and Kirk (1871[9]). Indigenous vegetation elsewhere in the ED has been significantly reduced through urban growth and development.

[8] Esler, A.E. 1991: Changes in the native plant cover of urban Auckland, New Zealand. *New Zealand Journal of Botany 29(2)*: 177–196.

[9] Kirk, T. 1871: On the botany of the isthmus of Auckland and the Takapuna District. *Transactions of the new Zealand Institute 3*: 148–161.

- The site is one of two areas of kānuka-podocarp forest remaining on alluvial flats in the ED[10].
- It is characteristic of the remaining indigenous riparian forest of Auckland ER.
- [M/H rating]

Diversity and pattern

- The diversity of indigenous plant and bird species present is typical of regenerating forest communities in this part of the ED, and there is a high diversity of indigenous fish species in the Lucas Creek catchment.
- It is part of a continuous corridor of riparian forest involving Oteha Stream and Lucas Creek. There is a narrow ecotone from dominant kōwhai on the stream edge which grades into kānuka-podocarp forest.
- [Medium rating].

Rarity and special features

- The site is in an acutely threatened land environment (<10% remaining indigenous vegetation).
- Riparian forest has been significantly reduced in extent within the ED and ER.
- It is one of only two remaining examples of kānuka-podocarp forest on alluvial flats within the ED.
- *Leptinella tenella* (At Risk, Declining) has been recorded here in the past.
- Longfin eel (At Risk, Declining), giant kōkopu (At Risk, Declining) and red-finned bully (At Risk, Declining) are present in the stream catchment
- [High rating].

Naturalness

- The forest is typical of vegetation in the region which is regenerating from past clearance. It contains relatively low levels of weeds, but it has been impacted by recent clearance associated with the construction of a school on the eastern boundary.
- [Medium rating].

Size and shape, buffering/surrounding landscape and boundaries

- The site is part of large (295 ha) complex of indigenous coastal riparian habitat stretching from Albany Heights to Gills Reserve and encompassing the riparian margins of Oteha Stream and Lucas Creek.
- Although it is part of a wider habitat network, the site is narrow and vulnerable to edge effects.
- [Medium rating].

Long-term ecological viability

- The site is part of a continuous corridor of riparian coastal forest in the Lucas Creek catchment, and provides important corridor habitat for native birds. However, it is narrow and impacted by edge effects and the recent construction of a school on its eastern boundary will increase the spread of weed species. Increasing development pressure in this part of the catchment will also increase stormwater runoff and adversely affect water quality and habitat for fish species in the creek.
- [Medium rating].

Fragility and threat, and management input

- This site will be impacted by edge effects and by human use. It has been covenanted as part of the school development on its eastern boundary, with restoration, weed and pest control being part of the consent conditions.
- [M/H rating].

10 North Shore City Council and Auckland Regional Council 2005: North Shore Ecological Survey. A survey of ecological significance in Tamaki and Rodney Ecological Districts.

8. Sedge wetland, Kumeu, North Auckland

Location and general description

This is one of a series of small wetlands located in farmland in the headwaters of the Waikoukou Stream catchment, Kumeu, North Auckland. The catchment discharges into the upper Waitemata Harbour and is within Rodney ED.

The wetlands range in size from 0.3 ha to 1.4 ha., and are dominated by indigenous sedges such as *Isolepis prolifer*, *Eleocharis acuta*, *E. gracilis*, *Machaerina teretifolia* and *Carex lessoniana*, with cabbage tree *Cordyline australis*, swamp kiokio *Blechnum novae-zelandiae*, scattered kahikatea *Dacrycarpus dacrydioides* and mānuka *Leptospermum scoparium*. Exotic rushes occur on the margins, and small patches of kahikatea swamp forest are present in places.

Banded kōkopu *Galaxias fasciatus*, inanga *Galaxias maculatus*, longfin eel *Anguilla dieffenbachii* (At Risk, Declining), shortfin eel *Anguilla australis*, Cran's bully *Gobiomorphus basalis*, common bully *Gobiomorphus cotidianus*, red-finned bully *Gobiomorphus huttoni* (At Risk, Declining) and kōura *Paranephrops planifrons* (At Risk, Declining) have been recorded in an adjacent stream.

Application of guideline criteria

Representativeness

- The sedgeland wetlands are typical of wetlands associated with ephemeral streams in headwater catchments of the ED.
- Wetlands are significantly reduced in the ED, and these are representative of the small remaining fragments of indigenous wetlands.
- [M/H rating].

Diversity and pattern

- The diversity of wetland plant species is typical of what is expected for wetlands associated with ephemeral streams in the ED. Fragments of swamp forest with kahikatea trees occur in places. There are gradations from headwater wetlands to riparian forest on the eastern side of the main stream.
- [Medium rating].

Rarity and special features

- Wetlands are a national priority to protect and have been significantly reduced in extent in the ED.
- They occur within an at risk land environment (20–30% indigenous vegetation cover), though this is not a national priority. However because substantial losses are occurring in these environments, a precautionary approach necessitates a medium rating for this aspect of the rarity criterion. This approach is also consistent with the national threatened species classification, i.e. at risk species receive medium rating (as illustrated in the table and the case studies).
- No rare or threatened species have been recorded from the site; however, wetland birds including North Island fernbird *Bowdleria punctata vealeae* (At Risk, Declining) and spotless crake *Porzana tabuensis* (At Risk, Relict) are present in the wider catchment. Longfin eel (At Risk, Declining), red-finned bully (At Risk, Declining) and kōura (At Risk, Declining) have also been recorded from an adjacent stream. The headwater stream supporting the wetland is connected to the stream where these birds and fish are present.
- [High rating].

Naturalness

- The wetlands are dominated by indigenous wetland species and their hydrology is functionally intact. Exotic pasture grasses and rushes (*Juncus* spp.) dominate the wetland margins and are scattered through the wetlands. Continued grazing of the wetlands will favour dominance by exotic species.
- Small fragments of kahikatea swamp forest are present, and these would have once been dominant in the gullies.
- The wetlands are unfenced and though the catchment is not grazed heavily, the wetlands will be affected by stock grazing and nutrient runoff from farmland. They are likely to be fenced in the future as part of a farm development proposal.
- [Medium rating].

Size and shape, buffering/surrounding landscape and boundaries

- This is a complex of small wetlands in the catchment headwaters surrounded by farmland. The wetlands are not buffered from the impact of agricultural runoff and stock grazing. The wetlands are linked downstream with the main stream which is buffered on the eastern side by regenerating indigenous forest.
- There is potential for improving ecological connections by fencing the wetlands and restoring riparian areas.
- [Medium rating].

Long-term ecological viability

- Impacted by farming and stock grazing. Exotic pasture grasses and rushes will become more dominant if the catchment remains unfenced.
- [Medium rating].

Fragility and threat, and management input

- The wetland complex is proposed for covenanting as part of the District Plan wetland protection incentives, with fencing and riparian buffer planting of the wetlands and catchment being a priority. There is a low level of weed species present. Pasture grasses and exotic rushes will not need control as fencing is likely to encourage growth and expansion of indigenous wetland plants.
- [Medium rating].

9. Raupō wetland, South Manukau, Auckland

Location and general description

This small wetland occurs in a perennial stream gully on the south side of Manukau Harbour. It is surrounded by farmland which is increasingly being subdivided and developed as lifestyle blocks. The wetland is dominated by raupō *Typha orientalis* with mānuka *Leptospermum scoparium*, cabbage tree *Cordyline australis*, swamp kiokio *Blechnum minus*, kahikatea *Dacrycarpus dacrydioides*, flax *Phormium tenax*, *Isolepis* spp., *Machaerina* spp. and swamp millet *Isachne globosa*, while exotic rushes occur on the margins. The wetland is in Manukau ED.

It provides habitat for North Island fernbird *Bowdleria punctata vealeae* (At Risk, Declining), spotless crake *Porzana tabuensis* (At Risk, Relict), and pūkeko *Porphyrio porphyrio*. Shortfin eel *Anguilla australis* and other indigenous freshwater fish species occur in the stream.

Application of guideline criteria

Representativeness

- The wetland is characteristic of the remaining indigenous vegetation in this part of the ecological district.
- This wetland is one of only four remaining examples in this part of the ED. Collectively, these wetlands are the only areas of indigenous vegetation on the undulating coastal flats on the south side of the Manukau Harbour.
- The wetland provides typical habitat for several species of indigenous wetland birds and fish.
- [High rating].

Diversity and pattern

- There is a relatively low diversity of indigenous species present, but this is characteristic and expected of wetlands dominated by raupō.
- Such wetlands provide habitat for a diversity of indigenous wetland birds and fish.
- [M/H rating].

Rarity and special features

- Wetlands are a national priority for protection and they have also been heavily reduced in extent in this ED.
- The wetland is one of four small wetlands remaining on the undulating coastal flats on the south side of the Manukau Harbour, and there is also less than 2% of indigenous vegetation remaining in Manukau ED.
- The wetland occurs in an acutely threatened land environment (<10% remaining indigenous vegetation).
- These raupō wetlands provide habitat for spotless crake (At Risk, Relict) and North Island fernbird (At Risk, Declining).
- [High rating].

Naturalness

- The natural hydrology of the wetland and its associated stream system has been modified by a downstream dam, and the wetland is bisected by a road and culvert.
- The surrounding landscape is farmland with small coastal settlements, and the wetland has been impacted by stock grazing and other farming practices.
- Despite these modifications the wetland is dominated by indigenous species, and contributes significantly to the natural character and ecological processes in an ED essentially devoid of indigenous vegetation.
- [Medium rating].

Size and shape, buffering/surrounding landscape and boundaries

- The wetland is small (0.5 ha), but its margins have been fenced from stock and are buffered by rank pasture. There is no planted indigenous riparian buffer.
- Collectively, this and the three other small wetlands nearby provide important habitat in an ED with little remaining indigenous vegetation, and provide potential for restoration. The existing habitats also provide stepping stones in a farmed landscape.
- [Medium rating].

Long-term ecological viability

- The wetland has been impacted by farming and stock grazing, though it is now fenced. There is pressure for subdivision and lifestyle blocks, and if urban development proceeds it is likely to increase weed impacts, predation by cats and stormwater runoff into streams.
- The rating below applies in the absence of subdivision. If subdivision did occur, effective predator control, weed control and buffering of the wetland would be needed to maintain the rating.
- [Medium rating].

Fragility and threat, and management input

- The wetland is scheduled in the District Plan, which has incentives for protecting indigenous wetlands, i.e. development rights in exchange for protecting, restoring and covenanting significant wetlands.
- The control of weeds such as willows and the control of animal pests like mustelids will be needed to ensure its long-term maintenance and protection. Increased urbanisation will result in increased weeds and predator impacts, and stormwater runoff.
- [Medium/High rating].

10. West coast flaxland, south Auckland

Location and general description

This flaxland and shrubland occurs on the west coast of Awhitu Peninsula, which is in Awhitu ED of Auckland ER. The peninsula extends north from the Waikato Heads to Manukau Heads and comprises consolidated sand dunes built up over the last few million years. The land has been extensively farmed, resulting in erosion caused by vegetation loss and the impacts of animal pests such as rabbits and deer.

Flaxland (*Phormium* spp.) occurs on the windswept coastal cliffs and dunes, with toetoe *Cortaderia* spp., cabbage trees *Cordyline australis*, pohuehue *Muehlenbeckia australis*, tauhinu *Ozothamnus leptophyllus*, knobby club rush *Ficinia nodosa* and pīngao *Desmoschoenus spiralis* in suitable sandy habitats. Broadleaved species such as māhoe *Melicytus ramiflorus*, houpara *Pseudopanax lessonii*, hangehange *Geniostoma ligustrifolium*, mingimingi *Coprosma propinqua* and kawakawa *Macropiper excelsum* occur in more sheltered areas.

Coastal seabirds are likely to be present as the north end of Awhitu Peninsula is part of the North Auckland seabird flyway for Cook's petrels *Pterodroma cookii*. Tūī *Prosthemadera novaeseelandiae*, fantails *Rhipidura fuliginosa* and grey warblers *Gerygone igata* occur in more sheltered shrublands, while relict patches of bush contain a high diversity of small land snails.

Application of guideline criteria

Representativeness

- The flaxland and shrubland is typical of the remaining indigenous vegetation of the steep coastal dune hills and cliffs.
- The pīngao is relict in nature, having been more extensive in the past.
- The coastal seabirds, bush birds and land snails are also characteristic of the habitats of this part of the Awhitu Peninsula.
- [High rating]

Diversity and pattern

- The site contains a modest diversity of flora and fauna typical of this coastline.
- The area is part of a wider a complex of coastal ecosystems including shrubland, forest and dune lakes. However, remaining indigenous vegetation is very fragmented and occurs only on the steeper slopes and dunes along the coastline.
- [L/M rating]

Rarity and special features

- The area occurs in a land environment with 20–30% remaining indigenous vegetation, so it is not a national priority.
- However, only 8.3% of the ED remains in indigenous vegetation.
- Pīngao (At Risk, Declining) is present.
- Cook's petrel (At Risk, Declining) is highly likely to use the area.
- [High rating]

Naturalness

- The area is similar to the ecosystems remaining elsewhere on this landform.
- It has a relatively low level of exotic weed species, but the coastal ecosystems are impacted by accelerated erosion and farming. Marram grass *Ammophila arenaria* has been planted on the coastline to prevent erosion and protect adjacent farmland.
- Rabbits, deer and possums also affect the remaining indigenous ecosystems.
- [Medium rating]

Size and shape, buffering/surrounding landscape and boundaries

- This is a relatively large area of flaxland and shrubland (18 ha) which provides protection and buffering for the steep coastal cliffs.
- The remaining coastal indigenous vegetation on the peninsula is fragmented and ecological linkages are sparse; farmland also occurs immediately inland of here.
- [Medium rating]

Fragility and threat, and management input

- The site is identified as a Significant Ecological Area in the Auckland Unitary Plan
- The remnant ecosystems are threatened by invading pasture grasses from adjacent farms, accelerated sand erosion and animal pest species such as rabbits and deer.
- The Awhitu Landcare Group undertakes possum control on the peninsula.
- [Medium rating]

11. Forest mosaic on modified hills, Banks Peninsula, Canterbury

Location and general description

This 5 ha remnant on Banks Peninsula is in the montane zone and has a core of old-growth forest with adjoining regenerating forest and scrub that comprises most of the site. It occupies a broad spur and steep shady slopes below Mt Fitzgerald, merging into predominately exotic grassland below which is grazed by cattle and sheep. The site occurs in Herbert ED of Banks ED (Wilson 1992).

The core area of mature forest is dominated by thin-bark totara *Podocarpus cunninghamii* up to 15 m high and typically <1 m dbh. Other canopy species present include New Zealand broadleaf *Griselinia litoralis*, narrow-leaved lacebark *Hoheria angustifolia*, kōhūhū *Pittosporum tenuifolium* and putaputawētā *Carpodetus serratus*. The lower tiers include weeping mapou *Myrsine divaricata*, mingimingi *Coprosma propinqua, Coprosma rigida, C. rhamnoides, C. rotundifolia, C. taylorii, C. virescens, C. crassifolia*, crown fern *Blechnum discolor*, prickly shield fern *Polystichum vestitum, Blechnum fluviatile, Poa mathewsii, Uncinia* spp., *Hydrocotyle moschata, Ranunculus reflexus* and *Lagenifera pumila*. The understory composition has been depleted by grazing animals, but recovery would occur in the absence of stock and possums.

The regenerating forest and scrub on adjoining shady slopes is a mosaic of broadleaf, kawakawa *Piper excelsum*, tree fuchsia *Fuchsia excorticata, Coprosma* spp. and ferns. Several large specimens of the At Risk (Declining) *Coprosma wallii* occur here and one specimen of mountain cedar *Libocedrus bidwillii* is also present.

Application of guideline criteria

Representativeness

- Although the site is affected by grazing animals, the podocarp forest is highly representative of the original vegetation of the ED. The composition and structure of the second growth forest and scrub is also representative of the full range of natural diversity that occurred in the ED, especially with the extensive loss that has occurred since the arrival of Europeans.

- Fauna values include the expected range of forest birds such as bellbird *Anthornis melanura*, New Zealand pipit *Anthus novaeseelandiae*, grey warbler *Gerygone igata*, fantail *Rhipidura fuliginosa*, brown creeper *Mohoua novaeseelandiae*, silvereye *Zosterops lateralis* and, occasionally, kererū *Hemiphaga novaeseelandiae*. An invertebrate and reptile fauna characteristic of this habitat type is expected here.
- Ecological functioning is largely healthy with regeneration occurring despite the effects of stock grazing and generic wild animal pests.
- [High rating].

Diversity and pattern

- The high diversity of indigenous plants reflects the variable ages of the vegetation mosaic and the environmental diversity present, i.e. aspect, slope and substrate.
- Environmental gradients are reflected by subtle changes in species composition that occur in the forest from the wetter east to the drier west.
- Habitat diversity is similar to what would have been present originally and is typical for similar remnants in the ED.
- [M/H rating].

Rarity and special features

- The site is in the Central Hill Country (F3.3a) land environment (Leathwick et al. 2003) and is classified as at risk (Walker et al. 2007), but at risk does not meet the national threshold. However, because substantial losses are occurring in these environments, a precautionary approach necessitates a medium rating for this aspect of the rarity criterion. This approach is also consistent with the national threatened species classification, i.e. at risk species receive medium rating (as illustrated in the table and the case studies).
- A volcanic bluff is present that supports a characteristic flora, and is classified as a naturally rare ecosystem.
- No nationally threatened species are recorded as present, but the site includes several good specimens of *Coprosma wallii* (At Risk, Declining), and at least one specimen of locally rare mountain cedar. The habitat is occasionally used by significant fauna, such as kererū.
- [High rating].

Naturalness

- The general structure of the forest community is largely natural with few exotic species under the closed canopy, and natural regeneration is also occurring. However the subcanopy structure and composition, and the composition of the regenerating forest and scrub have been altered by prolonged grazing and browsing by wild animals and stock, although this pattern is typical for similar remnants elsewhere in the ER.
- [Medium rating].

Size and shape, buffering/surrounding landscape and boundaries

- The site is relatively small but is of compact shape. It is partly buffered by the bluff, which offers some protection from fire and limited protection from stock. It remains vulnerable to wild animals.
- [Medium rating].

Long-term ecological viability

- Grazing has altered the vegetation composition, but it has not prevented natural regeneration from proceeding.
- The site is resilient to the establishment of most weed species

- Natural ecological processes continue as they have done in the past.
- [High rating].

Fragility and threat, and management input

- Little management input is required, although the site would benefit from fencing and occasional animal pest control (possums, goats and deer). Shade-tolerant weeds will require monitoring to ensure they do not become established here.
- Medium rating.

12. Kānuka forest on inland mountain slopes, St James, north Canterbury

Location and general description

The site comprises second growth kānuka (*Kunzea robusta*) that extends for >40 ha across steep montane hillslopes, and is contiguous with mountain beech *Fuscospora cliffortioides* remnants in gullies. It merges into modified tussock grasslands containing many exotic pasture species on sunny slopes and spurs that are grazed by cattle and sheep. The site occurs in Miromiro ED of the Molesworth ER. Mountain beech forest was the predominant cover here before human modification.

The forest canopy is dominated by kānuka up to 8 m high, though it is lower (4 m) around the site margins. Other species occasionally present in the canopy include broadleaf *Griselinia littoralis*, mountain beech, putaputaweta *Carpodetus serratus* and kōwhai *Sophora* sp. Subcanopy species include broadleaf, prickly mingimingi *Leptecophylla juniperina*, *Coprosma rhamnoides*, prickly shield fern *Polystichum vestitum*, *Blechnum fluviatile* and *Uncinia* spp.

Application of guideline criteria

Representativeness

- This relatively large and continuous area of mature kānuka is a good example of the naturally occurring second growth forests that occur in the ED. Although of low diversity, the composition and structure is typical for these ecosystems.
- Fauna values include the expected range of forest birds such as bellbirds *Anthornis melanura*, New Zealand pipit *Anthus novaeseelandiae*, grey warbler *Gerygone igata*, fantail *Rhipidura fuliginosa*, brown creeper *Mohoua novaeseelandiae* and silvereye *Zosterops lateralis*. An invertebrate and reptile fauna characteristic of this habitat type is also expected here.
- Ecological functioning is largely healthy with regeneration occurring despite the effects of stock grazing and generic wild animal pests.
- [M/H rating].

Diversity and pattern

- The forest is naturally of low diversity but its composition reflects its variable age and the environmental diversity present, i.e. aspect, slope and substrate.
- Environmental gradients are reflected by subtle changes in species composition within the forest and by the age of different successional stages. The age of successional changes is also partly a result of human modification; in particular, past burning.
- Habitat diversity is similar to what would have been present originally, and is typical of other similar remnants in the ED. Pattern has changed from the original beech forest, though kānuka would have been present on the margins and in naturally disturbed areas.
- [M/H rating].

Rarity and special features

- The site is in the Central Hill Country (F3.3a) land environment (Leathwick et al. 2003). This at risk land environment (20–30% indigenous cover) does not meet the national threshold. However, because substantial losses are occurring in these environments, a precautionary approach necessitates a medium rating for this aspect of the rarity criterion. This approach is also consistent with the national threatened species classification, i.e. at risk species receive medium rating (as illustrated in the table and the case studies).
- No nationally threatened or at risk species were present when assessed, though the habitat is probably used by threatened and other significant fauna such as New Zealand pipit (At Risk, Declining), kererū *Hemiphaga novaeseelandiae* and lizards.
- [Medium rating].

Naturalness

- The forest structure is largely intact with few exotic species under the closed canopy, and natural regeneration is occurring.
- There have been minor changes to the understory composition due to grazing animals, but recovery would occur in the absence of stock and possums.
- This situation is typical of similar remnants in the ER.
- [M/H rating].

Size and shape, buffering/surrounding landscape and boundaries

- The site is of moderate size and is compact and contained between prominent spurs.
- There is an intact forest cover within a local catchment and it is contiguous with remnant mountain beech forest in a gully.
- Exotic grassland below and modified tussock grasslands on adjacent spurs reduce the buffering and connectivity of the site.
- [Medium rating].

Long-term ecological viability

- Grazing has altered the vegetation composition to a minor extent, and natural regeneration back into mountain forest beech is proceeding.
- The site is resilient to the establishment of most weed species.
- Natural ecological processes continue as they have done in the past.
- [High rating].

Fragility and threat, and management input

- Little management input is required although the site would benefit from fencing and occasional animal pest control (possums, goats and deer). Shade-tolerant weeds will require monitoring to ensure they do not become established here.
- The main threats are primarily from agriculture development, fire and herbicide.
- [L/M rating].

13. Grey shrubland on inland terrace risers, inland south Canterbury

Location and general description

The site comprises shrublands on montane toe slopes and terrace risers adjacent to a large inland river in the South Island. It adjoins modified tussock grasslands containing a mosaic of native and exotic species that are grazed by cattle and sheep. The site occurs in Arrowsmith ED of the Heron ER. Prior to human modification, the dominant vegetation cover was a mosaic of hardwood and conifer forests, and shrublands.

The mixed matagouri/coprosma shrublands have a fairly consistent cover, though matagouri is the dominant species and forms the densest cover. The oldest stands are at least several decades old and can exceed 4 m in height. Other shrubs include mingimingi *Coprosma propinqua, C. rugosa, C. taylorii, C. rigida,* mountain wineberry *Aristotelia fruticosa, Hebe traversii, Corokia cotoneaster,* tauhinu *Ozothamnus leptophyllus* and tutu *Coriaria arborea,* along with climbers such as bush lawyer *Rubus* sp., scrub pohuehue *Muehlenbeckia complexa* and native jasmine *Parsonsia capsularis.* Bracken *Pteridium esculentum* and prickly shield fern *Polystichum vestitum* can be common, while mountain ribbonwood *Hoheria lyalli* is occasionally present.

Application of guideline criteria

Representativeness

- This is a good example of the full range of naturally occurring shrublands in the ED. Their composition and structure is typical of these ecosystems.
- Fauna values include the expected range of forest birds such as bellbird *Anthornis melanura,* New Zealand pipit *Anthus novaeseelandiae,* grey warbler *Gerygone igata,* fantail *Rhipidura fuliginosa,* brown creeper *Mohoua novaeseelandiae* and silvereye *Zosterops lateralis.* An invertebrate and reptile fauna characteristic of this habitat type is expected here.
- Ecological functioning is largely healthy with regeneration occurring despite the effects of stock grazing and generic wild animal pests.
- [M/H rating].

Diversity and pattern

- The site contains the full range of species that would naturally be expected. Its composition reflects the variable ages of the shrubland and the environmental diversity present, i.e. aspect, slope and substrate.
- Habitat diversity is similar to what would have been present originally, and is typical of similar remnants in the ED.
- There are many ecotones resulting from the mosaic nature of the shrublands, their riparian relationship with the adjoining river and the presence of small gullies.
- [M/H rating].

Rarity and special features

- The site is in the Central Mountains (P1) land environment (Leathwick et al. 2003) which has no threat category.
- No nationally threatened species are recorded as present, though New Zealand pipit (At Risk, Declining) and at risk skinks are likely to be present.
- [Low rating].

Naturalness

- The structure of the shrublands is relatively natural, though they contain a moderate number of exotic species beneath the canopy. This is typical of similar remnants in the ED and ER.
- The site will have been burned in the past and it is grazed intermittently by sheep.
- [Medium rating].

Size and shape, buffering/surrounding landscape and boundaries

- The site is relatively small but reasonably intact with semi-contiguous shrublands. It is protected somewhat by the steepness of the terrace riser and the presence of some incised gullies.
- It is part of a partly intact sequence extending from the river to tall tussocklands, dracophyllum shrublands and alpine communities above.
- [M/H rating].

Long-term ecological viability

- Grazing has altered the vegetation composition to a minor extent only.
- The site is resilient to the establishment of most weed species.
- Natural ecological processes continue as they have done in the past.
- [High rating].

Fragility and threat, and management input

- Little management input is required, though the site would benefit from fencing and occasional animal pest control (possums, goats and deer). Shade-tolerant weeds will require monitoring to ensure they do not become established here.
- The main threats are from agriculture development, fire and herbicide.
- [L/M rating].