Guide for Users of the Threatened Environment Classification

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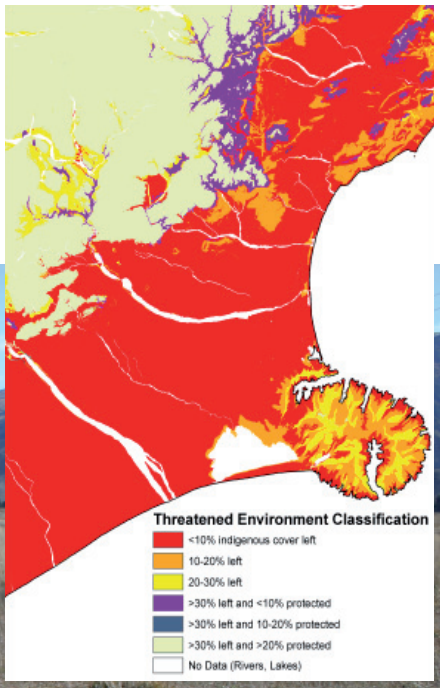

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Introduction

The Threatened Environment Classification has been developed by Landcare Research – Manaaki Whenua to help identify areas in which much reduced and poorly protected terrestrial indigenous ecosystems are most likely to occur. The Threatened Environment Classification can help in setting priorities for protection of indigenous biodiversity, planning biodiversity protection activities, and/or reporting achievements.

The Threatened Environment Classification is readily accessible to GIS users who have access to LENZ (the Land Environments of New Zealand). It can be downloaded from the Local Government Action-Biocommunity website (http://www.biocommunity.org.nz/). Instructions for uploading the Threatened Environment Classification, and this User Guide, can also be downloaded from this website. Non-GIS users can download maps of the Threatened Environment Classification for their region or district from this website.

Workshops funded by will be held around the country in August 2007 to familiarise users with the Threatened Environment Classification.

This User Guide is divided into three parts:

PART ONE provides the reader with a broad overview of the Threatened Environment Classification, its applications and its key limitations.
PART TWO presents more detailed background and technical material, as well as supplementary information and links that users may find helpful.

Acknowledgements

The Threatened Environment Classification was developed with help and input from many end-users including regional councils, the Department of Conservation, the Ministry for the Environment, and QEII National Trust.

The development of this User Guide and the transfer of the Threatened Environment Classification to Councils through a series of workshops was funded by a Foundation for Research, Science & Technology Envirolink Tools grant. The Envirolink scheme funds research organisations to provide Regional Councils with advice and support for research on identified environmental topics and projects.

The Oversight, User and Implementation Groups of the Threatened Environment Classification project acknowledge the considerable assistance of Action Biocommunity (a partnership between central and local government), and in particular we thank Sarah Wilson and Angie Gooch. We also warmly thank Wildland Consultants for their support.

PART ONE:
THE THREATENED ENVIRONMENT CLASSIFICATION

What is the Threatened Environment Classification?

The Threatened Environment Classification is a source of broad (i.e. national) scale background information on New Zealand's land (but not water) environments. Specifically, it shows how much native (indigenous) vegetation remains within land environments, how much is legally protected, and how past vegetation loss and legal protection are distributed across New Zealand's landscape. The Threatened Environment Classification combines this information into a simple and practical GIS tool that focuses attention on areas in which much indigenous vegetation has been cleared and small proportions are legally protected.

The Threatened Environment Classification uses indigenous vegetation (see Glossary p. 32) as a surrogate for *indigenous biodiversity*, which includes indigenous ecosystems, habitats, and communities; the indigenous species, subspecies and varieties that are supported by indigenous vegetation; and their genetic diversity. It uses legal protection as a surrogate for the relative vulnerability of indigenous biodiversity to pressures such as land clearance, extractive land uses, and the effects of fragmentation. The Threatened Environment Classification is therefore most appropriately applied to help identify places that are priorities for formal protection against clearance and/or incompatible land uses, and for ecological restoration to restore lost species, linkages and buffers.

It makes sense to invest in pest, weed and fire control to maintain and restore remnants of much reduced habitats that are poorly protected elsewhere. Fragmented remnants close to towns, cities and roads are particularly vulnerable to weeds and fire. However, to maintain the sensitive biodiversity and ecosystem functions now lost from more modified landscapes, it is also important to maintain native habitats in places that have been safest from human land-use pressures, and investment in pest and weed control may be urgently needed here too. Strategies and plans for these threats will require additional information and tools.

National-scale information on loss and protection is notoriously difficult to assess. The Threatened Environment Classification provides this information in a way that is consistent across New Zealand, because it treats all areas (or land environments, as they are called) on the same basis. It is objective, in that it is based on data rather than opinion. It is repeatable, because the national datasets that inform it are available, and the results can be reproduced. These advantages do not mean that the Classification replaces local knowledge and information or that it is a substitute for field inspection and survey. Rather, the Threatened Environment Classification is part of a biodiversity protection toolkit that can complement survey and other information.

Problems may arise if the Threatened Environment Classification is used inappropriately because its principles and limitations of the underlying data are poorly understood. This part of the User Guide provides some examples to illustrate how it can be used, and notes some ways it *shouldn't* be used. Part Two contains more detail on science principles, limitations of the underlying datasets, and implications for appropriate use.

Why was the Threatened Environment Classification developed?

The indigenous vegetation of New Zealand's coastal, lowland and montane environments has been substantially altered by human impacts. Areas of indigenous vegetation that remain in the coastal, lowland and montane zones today are typically highly modified and degraded from their original states, and are poorly represented in the national network of private and public protected areas. Despite this, they support a high proportion of New Zealand's most threatened species, habitats and ecosystems, most (if not all) of which only exist today in less than pristine condition.

To maintain the full range of biodiversity that remains in New Zealand today, and sustain it into the future, we need to protect these remaining areas of indigenous vegetation as a matter of urgent priority. This urgency is recognised in the New Zealand Biodiversity Strategy, in which the first priority action for biodiversity on land is to formally protect '…those habitats and ecosystems important for indigenous biodiversity that are not represented within the existing protected area network or that are at significant risk of irreversible loss or decline…'.

In the last decade, the highest rates of indigenous vegetation loss in New Zealand (and therefore loss of indigenous ecosystems, habitats and species) were recorded in environments that already had the least remaining indigenous vegetation. The majority of indigenous vegetation loss was in areas that were not formally protected. Because the places that were most likely to be cleared were also some of the last refuges for many of New Zealand's threatened species, habitats and ecosystems, the recent pattern of loss greatly exacerbates past biodiversity loss. The pattern of loss further reduced, fragmented and threatened the future persistence of what little remained of New Zealand's coastal, lowland and montane biodiversity.

Protection of remaining indigenous vegetation from the pressure of development, resource extraction, pests and weeds is important everywhere in New Zealand to halt biodiversity decline. However, formal protection is especially urgent in environments where indigenous vegetation has already been much reduced in the past, and/or where what remains is poorly protected, and in situations where remaining indigenous vegetation is vulnerable to future development. The landscapes where fragmentation is most advanced are also those that may urgently require restoration on-site and beyond (e.g. the restoration of ecological linkages and buffering) to maintain and restore their indigenous biodiversity.

The Threatened Environment Classification was developed to provide a context that can assist users to identify these places.

How does the Threatened Environment Classification work?

The Threatened Environment Classification is a combination of three national databases:

- land environments of New Zealand (LENZ),
- classes of the second land cover database (LCDB2), and
- the protected areas network (PAN-NZ)[1].

The Threatened Environment Classification is very simple; it divides all of New Zealand's land into just six threat categories.

Table 1 (below) shows how each of the 500 land environments (the 500 units identified at Level IV of LENZ) is assigned one of six threat categories on the basis of:

a) **past loss of indigenous vegetation** ('% indigenous vegetation left'), and
b) **current legal protection** ('% protected').

Table 1. The six threat categories

Category	Criteria	Name
1	<10% indigenous vegetation left	Acutely Threatened
2	10–20% indigenous vegetation left	Chronically Threatened
3	20–30% indigenous vegetation left	At Risk
4	>30% left and <10% protected	Critically Underprotected
5	>30% left and 10–20% protected	Underprotected
6	>30% left and >20% protected	Less Reduced and Better Protected

When this User Guide refers to all six of the categories in Table 1 together, it refers to them as 'threat categories' or 'environment threat categories'.

The first five categories are likely to contain some of New Zealand's most severely reduced and poorly protected indigenous biodiversity. The User Guide refers to these five categories jointly as 'threatened environments'.

The Threatened Environment Classification reduces complexity and adds utility to LENZ. Specifically, it adds information to LENZ that is important and relevant across *all* environments – 'from North Cape to the Bluff!' – for planning, implementation and reporting of biodiversity protection. When loaded into a GIS or viewed as a map, this information can be absorbed at a glance.

Figure 1 (next page) shows how the three different layers of information (land environments, land cover classes, and protected areas) are combined in the Threatened Environment Classification.

[1] The underlying data are described in more detail in Part Two, p. 26.

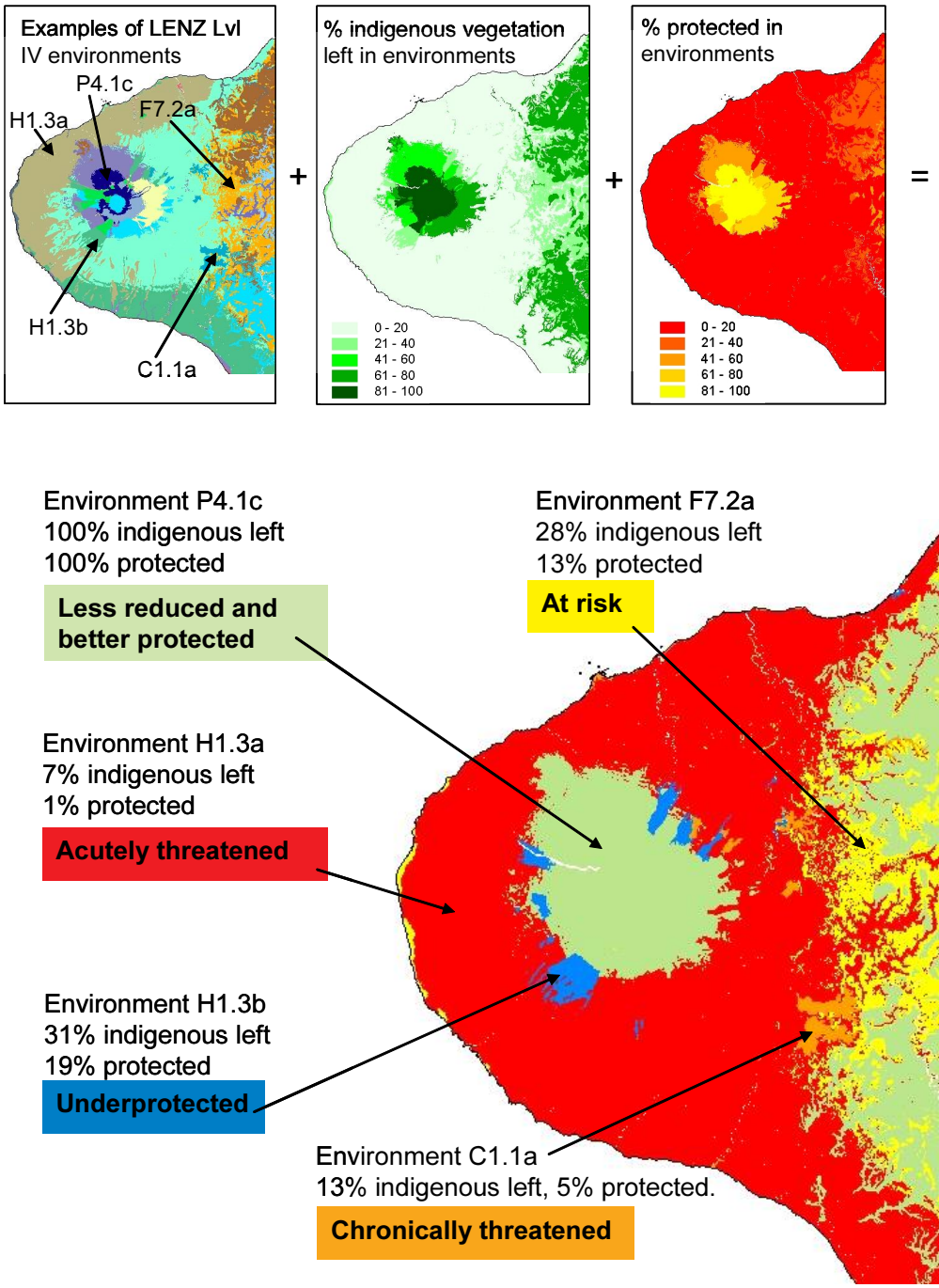

Figure 1. Threatened Environment Classification for Taranaki. This example shows the underlying data layers (insets) and the classification that results from their combination (main map). A few of the land environments around Taranaki are highlighted as examples.

What Figure 1 shows is not surprising: the Taranaki ring plain, which was extensively cleared for farming, has lost much of its indigenous vegetation. Little of the land area in the lowland and coastal environments of the ring plain has legal protection for natural heritage (e.g. just 1% of the Acutely Threatened land environment H1.3a). In contrast, environment P4.1c (Less Reduced and Better Protected) falls almost entirely within the legally protected Egmont National Park, and none of its indigenous vegetation has been cleared.

Figure 2 shows certain key facts about some Canterbury environments at a glance:

- The red colour indicates that flat, lowland environments (such as those on the eastern plains and coast of Canterbury) retain less than 10% of their land area under some form of indigenous vegetation.
- The yellow colour shows that environments on the valley floors of rivers draining east from the Southern Alps, and some very different environments on Banks Peninsula, both retain somewhere between 20% and 30% of their area under some form of indigenous vegetation.
- Environments of lower hillslopes of eastern mountain ranges (in purple) retain somewhat more than 30% of their land area under indigenous vegetation, but natural habitats are formally protected over less than 10% of their land area.
- The indigenous vegetation of cooler, wetter environments of the foothills and mountain slopes of the Southern Alps (in green) has been less reduced and better protected in the past.
- Rivers, lakes and marine ecosystems (i.e. non-terrestrial ecosystems) are not displayed or incorporated into the Threatened Environment Classification.

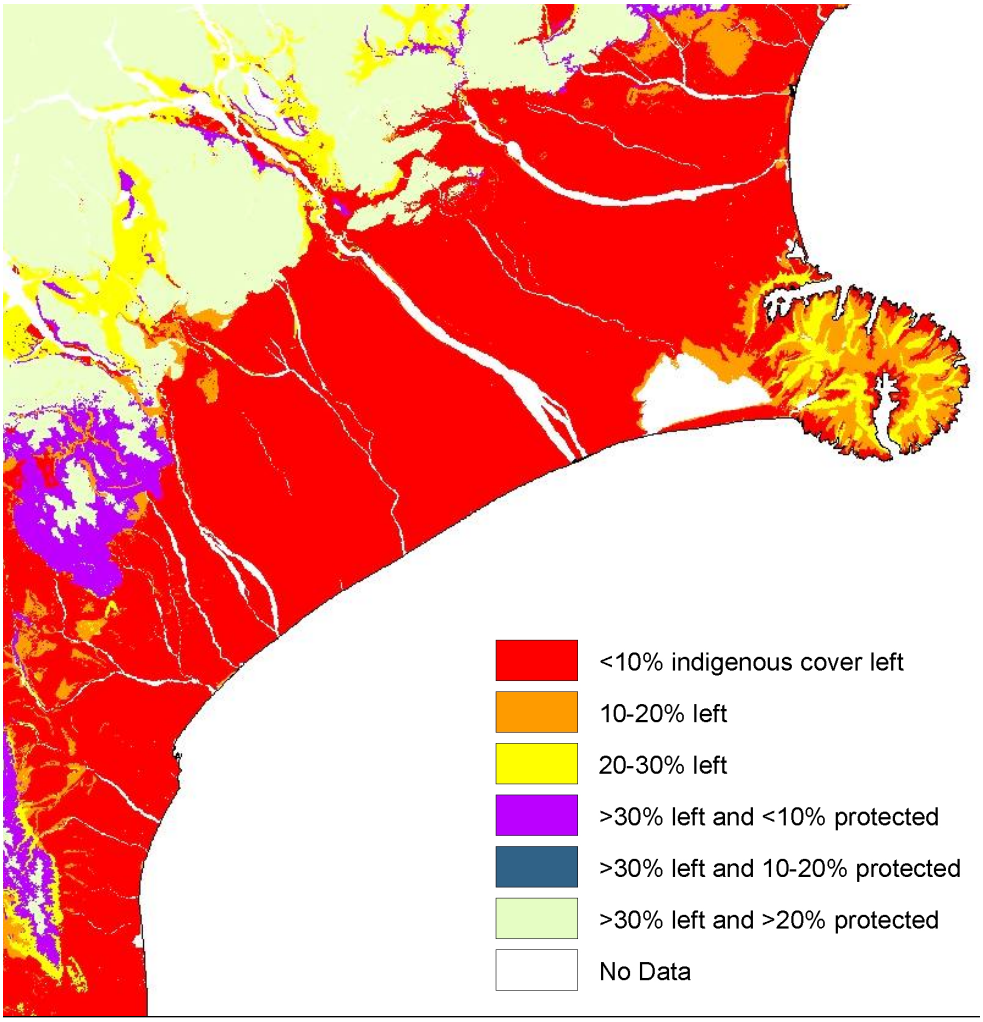

Figure 2. Threatened Environment Classification for part of Canterbury.

Overview of threat categories

This section summarises the characteristics of the six threat categories.

Categories 1, 2 & 3

Environments with much reduced indigenous biodiversity

The first three categories contain the environments where the loss of habitats for native species has been greatest in the past (i.e. those in which 0–10%, 10–20% and 20–30% indigenous cover remains nationally). The category names were chosen to match the national system for classifying species according to threat of extinction. Although usually highly modified and depleted, remaining indigenous vegetation in these environments provides critical habitat for threatened species. Categories 1 and 2 are the environments in National Priority 1 in the government's *National Priorities for Protecting Rare and Threatened Native Biodiversity on Private Land* (see Links p. 34).

Categories 4 & 5

Environments with poorly protected indigenous biodiversity

These two threat categories include environments that will have more than 30% of their land area remaining in indigenous cover, but have <10%, and 10–20% of their land area legally protected, respectively. Indigenous vegetation in these environments has been less reduced and fragmented in the past than in Categories 1–3, but little of what remains has formal protection. It is therefore poorly represented in either private or public conservation areas. The biodiversity associated with this remaining indigenous vegetation is at risk of loss because national data show that indigenous habitats that are not legally protected are more likely to be cleared, and it is assumed they are also less likely to receive biodiversity management inputs to deal with other threats such as pests and weeds.

Category 6

Environments where indigenous biodiversity is less reduced and better protected

Environments with >20% of their area protected and >30% indigenous cover have been assigned to the sixth category, 'Less Reduced and Better Protected'. Land in these environments is generally steeper and wetter, and less suitable for settlement and agricultural development, than land in Category 1–5 environments. Although indigenous vegetation cover is generally more intact, less fragmented, and better protected than other environments, it will still be vulnerable to threats such as pests, weeds, logging, and other extractive land uses. Indigenous species that are most susceptible to habitat loss and fragmentation will persist only in these environments, because they need large and intact tracts of habitat. Many threatened species, including most threatened birds and bats, now survive only here. To maintain this biodiversity it is important to prevent further loss and attrition of relatively large, intact areas. This category was formerly referred to as the 'No Threat' category. It has been renamed to avoid any chance the name could be misconstrued to infer or imply it is not important to protect indigenous biodiversity in these environments, and/or that this biodiversity is secure from threats.

Table 2. Threat categories: criteria, names and the state of indigenous biodiversity

Category	Criteria	Name	State of indigenous biodiversity
1	<10% indigenous vegetation left	Acutely Threatened	Very little indigenous biodiversity remains in these environments. There are only a few very rare relicts of former indigenous habitats and ecosystems left and what little does remain is typically highly modified, with poor connectivity and degraded ecological linkages. Species threatened by habitat loss are concentrated in these remnants. Further habitat loss may be expected to result in extinction or accelerated decline of remaining indigenous species and ecosystem types, and to severely compromise the viability of other habitat patches remaining nearby in similar environments.
2	10–20% indigenous vegetation left	Chronically Threatened	Indigenous biodiversity in these environments has been severely reduced and remaining habitats are sparsely distributed in the landscape. Risks to biodiversity from fragmentation have become severe, threatening the persistence of many species in these environments. Further habitat loss will disproportionately exacerbate risks to biodiversity.
3	20–30% indigenous vegetation left	At Risk	Indigenous biodiversity in these environments has been much reduced and habitats are seriously fragmented. Therefore, although loss is not as advanced as in Categories 1 and 2, the future persistence of species dependent on habitats in these environments is already compromised. Further habitat loss will exacerbate threats and decrease the security of biodiversity associated with these environments.
4	>30% left, <10% protected	Critically Underprotected	Indigenous habitats in these environments are less reduced and fragmented than in Categories 1 to 3, but have very little legal protection and are very rare in private and public conservation areas. This means indigenous habitats are very poorly protected from clearance. Many habitat types (e.g. tussock grasslands and shrublands) are imminently threatened by conversion to more intensive land uses. It is assumed that indigenous biodiversity outside private covenants and public conservation lands receives little conservation management input (e.g. fencing, pest and weed control), and many species may be in decline or at risk of extinction.
5	>30% left, 10–20% protected	Underprotected	As for Category 4 (above), but more indigenous habitat is protected from clearance, and a somewhat higher proportion may receive conservation management inputs.
6	>30% left, >20% protected	Less Reduced and Better Protected	Biodiversity is probably more secure from direct clearance of indigenous vegetation and its consequences than in any other category. However, biodiversity remains vulnerable to other threats such as pests, weeds and extractive land uses. Natural areas here will typically be larger, more intact and better connected, and will often support species, community types and ecotones that now remain only in relatively intact ecosystems. Many threatened species, including most threatened frogs, birds and bats, now survive only here.

Potential uses of the Threatened Environment Classification

The Threatened Environment Classification has many potential applications. Some of these are summarised in Table 3. A selection are supported by examples and narratives below.

Table 3. Applications of the Threatened Environment Classification

Application	Use	Conditions/limitations
State of the Environment reporting	Provides a framework for assessment of the status of indigenous biodiversity nationally, regionally or at the district level (see example on next page).	Will be of limited use for reporting at local and property scales due to limitations in the underlying national datasets.
Planning and policy	Provides a context for planning biodiversity protection and ecological restoration. For example, it can help to identify the places where ecosystems have been most significantly reduced in extent or lost or where ecological corridors need to be restored.	Field survey and tools beyond the Threatened Environment Classification are needed for policy and planning for the maintenance of biodiversity. Pest and weed control strategies and plans will also need additional tools and information.
Biodiversity strategies and action plans	Can direct local authorities to places where action is needed to provide regulatory protection and incentives for private landowners to maintain and restore remaining biodiversity in areas that have seen great loss and which support biodiversity that has little protection elsewhere. Can be used to set targets by threat category (e.g. in Acutely Threatened environments by 2009: 9 species recovery projects, 1500 ha under sustained possum & goat control, 350 ha of restoration planting).	Threatened environments probably contain the biodiversity most imminently threatened by present and future land uses and fragmentation effects. However, Less Reduced and Better Protected environments are the only places where much sensitive biodiversity and most healthy functioning ecosystems remain today. Strategies need to recognise that maintaining this biodiversity requires protection too (for example, investment in pest and weed control).
Operations and management	Provides strategic direction for biodiversity protection and ecological restoration programmes on land administered by agencies. Can guide priority setting for 'site-led' conservation projects (see example on next page).	As noted earlier, guidance on optimal investment in pest and weed control to maintain biodiversity will require field survey information and tools beyond the Threatened Environment Classification.
Regulatory	Regional and district plans can be guided by this information in identifying priority environments for protection. It can also help to guide planning rules and resource consents relating to vegetation clearance or modification.	No ecological rationale exists for excluding indigenous vegetation in any environment category (including Less Reduced and Better Protected) from regulatory protection. As noted earlier and in Part Two, these areas also require protection to maintain biodiversity. National land cover data are limited to broad cover classes and coarse scales and are out of date. Therefore field survey is needed to determine where indigenous vegetation remains at property and local scales.
Monitoring and reporting	Provides a framework for reporting of biodiversity protection activities (see example on p. 15).	Reporting on progress should include not only the gains made and losses avoided (e.g. hectares protected or receiving conservation management), but also the losses sustained (e.g. hectares cleared or modified).

Table 3. cont…

Application	Use	Conditions/limitations
Incentives and assistance	Provide direction for incentives and targeted assistance programmes or protection of biodiversity on private land, when the incentives are proactive (i.e. approach initiated by funder). Provides a tool to help assess the relative contribution of investments when incentives are reactive (i.e. initiated by the provider).	The Threatened Environment Classification is most useful for identifying threatened habitat and ecosystem types. Different information is needed to assess threatened species status. Discretion and field survey will always be needed to determine what threats apply, what type of protection is needed, and how urgently attention is required (see explanation on next page).
Submissions and evidence	Identify threat category of environments, and recommend biodiversity protection action accordingly.	Biodiversity in Less Reduced and Better Protected environments is not unimportant or safe from threats.
Assessment of significance	Provides a national context for significance assessment. Contributes to assessment of representativeness because it may identify remaining indigenous vegetation representing indigenous communities, habitats and ecosystems that are much reduced and/or poorly protected at a national scale.	The Classification can inform an aspect of assessment of representativeness (by identifying environments that contain much reduced and/or poorly protected biodiversity) at one scale (national), but does not take its place. Limitations in the underlying land cover and LENZ datasets do not enable identification of all poorly protected and much reduced indigenous communities, habitats and ecosystem types. The Classification is not a substitute for on-the-ground survey of biodiversity for significance assessment, and is silent on landscape context.

State of the Environment reporting

Greater Wellington Regional Council recently used the Threatened Environment Classification to assist with their assessment of the state of biodiversity in Wellington Region (see: http://www.gw.govt.nz/story13109.cfm).

Management of reserve land

The Threatened Environment Classification can help set priorities for 'site-led' conservation management. For example, new funding has recently been provided to assist biodiversity protection on land managed by Environment Canterbury (Canterbury Regional Council). The Threatened Environment Classification was used as a guide for planning and prioritising the management of reserve land. Initially, new resources have been directed to:

- Weed control at the Kowhai River Protection Reserve near Kaikoura (native forest and scrub vegetation on Chronically Threatened land environments J3.2a, J3.2b)
- River engineering works at Rakaia Island to help protect native kānuka forest and dry shrubland conservation areas (Acutely Threatened environment J2.1b).

Incentives and assistance

The Threatened Environment Classification can assist with identifying threatened habitats and ecosystems. Ecological restoration (e.g. replanting on site, re-establishment of linkages, corridors and buffers) will be most urgently needed in environments where indigenous vegetation has been most reduced and modified in the past.

This User Guide uses the word 'assist' intentionally, because many distinctive indigenous communities, habitats and ecosystem types that are much reduced and modified are not differentiated by the broad-scale national databases underlying the Threatened Environment Classification (see Data limitations p. 27). For example, despite extensive loss and modification, lowland forest on alluvial surfaces on the South Island West Coast may be classified within Less Reduced and Better Protected environments. This is because the Threatened Environment Classification overlooks important distinctions within environments and indigenous cover classes that would show that lowland alluvial forest on the West Coast has been disproportionately cleared and modified compared to that on adjacent hillslopes. Therefore, at regional and local scales the Threatened Environment Classification will need to be supplemented by field survey and other, finer-scale, information sources.

When prioritising incentives and assistance, discretion will also be needed to determine the degree of immediate threat (remnants in gullies may be less at risk of clearance than relicts on flat accessible land) and what assistance or incentive is appropriate to secure their values (e.g. a forest remnant might be threatened by stock browsing rather than weeds and/or pests). The Threatened Environment Classification does not provide any such guidance.

There is evidence that threatened plant species may be concentrated in threatened environments (see Part Two p. 29). However, many features of relatively intact ecosystems and many threatened species may no longer persist in threatened environments, and are found only or mainly in Less Reduced and Better Protected environments (see p. 22) . Incentives and assistance for recovery of particular valued features such as species and community types should always consider their particular needs.

A report on investments Biodiversity Condition Fund in relation to the Threatened Environment Classification is at:
http://www.biodiversity.govt.nz/pdfs/biodiversity-condition-fund-benefits.pdf

Submissions and evidence

Environment Canterbury has made use of the Threatened Environment Classification in their submissions on Tenure Review proposals. For example, in their submission on the preliminary proposal for Killermont Pastoral Lease, Environment Canterbury noted:

> *"It is of concern that only tiny examples of dry lower slopes and foothills environments N4.1c and E4.1b, and no examples of the extensive outwash plains environment N6.1b are proposed for protection, given their threat status."*

In their submission on the substantive proposal for Richmond Pastoral Lease, Environment Canterbury wrote:

> *"Of the greatest importance, and therefore of the highest significance for protection, is the rapidly diminishing range of biodiversity values of the mid to low altitude habitats. For the Richmond lease the areas of mid-altitude terraces, dry foothills and lower outwash plains habitats contain significant examples of indigenous biodiversity that is listed as "at risk" or "chronically threatened" on a national scale. These areas include short tussock grasslands, montane, riparian and river terrace shrublands, and areas of hummocky moraines retaining relatively intact native vegetation cover, and numerous tarns and wetlands. Very little of the biodiversity represented across the lower altitude slopes has been protected within the land to be restored to full Crown ownership by the Substantive Proposal"*

Monitoring and reporting

The table below is a fictional example of annual reporting on initiatives with council involvement that led to maintenance, restoration or loss of indigenous biodiversity.

Table 4. A fictional reporting table based on the Threatened Environment Classification.

	Threat category	Projects
1	<10% indigenous vegetation left	Purchased 20 ha of coastal shrubland as a new council reserve. Assisted five private landowners with applications to the Biodiversity Condition Fund for assistance. Three applications were successful, funding: possum trapping in a lowland forest remnant (20 ha), fencing wetlands (5 ha), streamside restoration planting (200 m). Planted 25 traffic islands in the town centre and suburbs with threatened native species.
2	10–20% indigenous vegetation left	Provided financial assistance of $500K to private sanctuary initiative. Eradication of five notified environmental weeds in four of the five peri-urban council reserves in this threat category. Sustained control of cats, stoats, rats, and possums in three reserves. Lost 50 ha of kānuka shrubland to accidental spray-damage
3	20–30% indigenous vegetation left	Retired 50 ha of council-owned riverbed from stock grazing and instigated 3 ha of restoration planting on-site.
4	>30% left, <10% protected	Worked with QEII Trust to covenant 350 ha of tussock grassland and shrubland. 400 ha of red tussock grassland and shrubland was converted to pasture through a crown pastoral lease discretionary consent.
5	>30% left, 10–20% protected	Purchased grazing rights over 300 ha of kānuka shrubland and jewelled gecko habitat, to be managed for carbon storage and biodiversity protection.
6	>30% left, >20% protected	Intensive predator control over 1000 ha of forest park. Successfully reintroduced six kokako breeding pairs. New waste management area involved clearance of 6 ha of podocarp forest.

What the Threatened Environment Classification is not

This section provides a checklist of the things that the Threatened Environment Classification is not, and brief explanations to guide users. More in-depth background is provided in Part Two of this User Guide.

Not a substitute for field survey

There is a risk that a desk-based tool such as the Threatened Environment Classification might give users a sense of objectivity that is false. The Threatened Environment Classification provides national context, but in protection and resource management decision making, it cannot substitute for on-the-ground assessment of the indigenous biodiversity that is actually there and its landscape setting. It is based on national datasets that have limitations at local and property scales. More detailed assessments, involving local and regional ecological survey information, will be needed to support protection and resource management decision making.

Not a substitute for other frameworks

This User Guide does not suggest LENZ and the Threatened Environment Classification should replace the widely used biogeographic planning framework of ecological regions and districts (ERs and EDs). LENZ and the Threatened Environment Classification will complement most planning units (ERs, EDs, council regions and districts, catchments, sets of properties, single properties and more). Within these units, they add environmental data, identify areas of potentially similar ecological character (land environments), and provide national statistics on past loss of indigenous vegetation and legal protection within them.

Not a fine-scale tool

The national datasets that underlie the Threatened Environment Classification are not perfect, and have limited resolution; in other words, they are not designed to distinguish fine-scale detail. LENZ (and hence the Threatened Environment Classification) does not distinguish many important small-scale ecosystem types that may be distinctive and/or disproportionately reduced (see Part Two, p. 27). Limitations of the second national land cover database (LCDB2) also have important implications (again see Part Two, pp. 27-28). In particular, LCDB2 has low thematic resolution, underestimates recent loss of grasslands, and is of limited use for identifying wetlands and small-scale features. For example, eastern South Island non-forest ecosystems and habitats (grasslands and wetlands) are likely to be more reduced than the Classification suggests. Mixed native and exotic vegetation types (especially shrublands and grasslands) are not well distinguished from pure native or exotic communities. In the North Island, wetland ecosystems and very small forest remnants (<1 ha) are not distinguished (e.g. fragments of kōwhai forest on gravelfield on Kaiaua Coast in Hunua Ecological District), and diverse northern broadleaved forest types may not be distinguished from shrublands. Finer-resolution ecosystem, habitat and community classifications and maps at regional and local scales will be needed to support the Threatened Environment Classification and distinguish these and other important details.

Not appropriate for prioritising pest and weed control

As stated earlier, it makes sense to invest in pest, weed and fire control to maintain and restore remnants of much reduced habitats that are poorly protected elsewhere. Fragmented remnants close to towns, cities and roads are particularly vulnerable to weeds and fire. However, to maintain the sensitive biodiversity and ecosystem functions now lost from more modified landscapes, it is also important to maintain native habitats in places that have been safest from human land-use pressures, and investment in pest and weed control may be urgently needed here too. Strategies and plans for these threats will require additional information and tools.

Not a statement about how much is enough

The Threatened Environment Classification directs users to places that are likely to be most imminently threatened as a consequence of past land uses and by some current and future land uses, and are therefore priorities for additional protection and restoration. The Threatened Environment Classification does *not* define all that is important for the maintenance and persistence of indigenous biodiversity into the future, or how much is needed to achieve this. There is no implication (and no ecological rationale for assuming) that 30% of environments under some form of indigenous cover, and 20% of their land area under formal protection, is sufficient to maintain the full range of indigenous biodiversity, and/or to halt its decline.

Not a reserve planning tool

Threatened Environment Classification (and indeed LENZ) boundaries are inappropriate for reserve design. The Classification takes no account of landscape context (e.g. connectivity) and LENZ boundaries usually cut across continuous gradients (because of the way LENZ is built). The Threatened Environment Classification can enhance reserve design by helping to identify much reduced and poorly protected communities, ecosystems, and habitats that may be highly modified, but are nonetheless priorities to include in comprehensive reserves.

PART TWO:
DETAILS AND TECHNICAL BACKGROUND

The science behind the Threatened Environment Classification

Why does the Threatened Environment Classification focus attention on environments where native habitats have been much reduced and are poorly protected? The answers come from ecological research, including an emerging research area called systematic conservation planning, which enables more effective and efficient biodiversity protection. Some further background reading is suggested on p. 33.

The 'retreating options' problem

New Zealand is not alone in having a network of protected areas that is seriously deficient for the species and ecosystems most threatened by human land uses. Ongoing loss to land clearance and impacts of fragmentation and weeds means opportunities to protect this threatened biodiversity are retreating rapidly, while the biodiversity in steep, wet, cold, remote places is comparatively safe from direct habitat loss and is currently little impacted by fragmentation.

If the goal is to maintain a full range of biodiversity, the best protection strategy is to prioritise places where opportunities for conservation are retreating most rapidly – in other words, to first locate and protect places where the likelihood of imminent and irreversible biodiversity loss is greatest. Such a strategy does not involve any assumption that the places less imminently threatened are either safe, or superfluous to the goal of maintaining biodiversity; think of it simply as the most sensible battle-plan in the war to halt biodiversity decline.

How can we recognise retreating options?

Places where opportunities for conservation are retreating most rapidly are those with biodiversity that is most irreplaceable (few or no replacements exist or remain, so loss will be most irreversible and complete) *and* vulnerable to loss (advancing towards the cliff of extinction most rapidly, so protection is urgently needed). Opportunities might be retreating rapidly as a result of land clearance and/or because viability is threatened by fragmentation and edge effects, or by pests and weeds.

It helps to think about irreplaceability and vulnerability as separate attributes when prioritising protection and restoration. In practice, these are often strongly correlated (places that support the rarest biodiversity today are often also those marching most rapidly towards the cliff). However, some very rare and irreplaceable biodiversity (such as some old-growth forest types) may be mainly found within protected areas today. Past habitat loss (and current extent remaining) and poor legal protection together are factors that help to indicate irreplaceable *and* vulnerable biodiversity in New Zealand.

Habitat loss

At least three areas of ecological science tell us that past habitat loss makes biodiversity not only more irreplaceable, but also more vulnerable to future loss.

- First, one of the best known, and most fundamental relationships in ecology—the species–area relationship—tells us that the risk to biodiversity increases more rapidly as habitat loss advances. Figure 3 explains why: as a general rule, the relationship between the number of species contained in an area and the size of that area is not linear, but a curve. If this rule is applied to an environment, ecosystem, or habitat type, then as habitat loss advances, each additional increment of habitat loss will remove a larger proportion of the original species that it once contained.

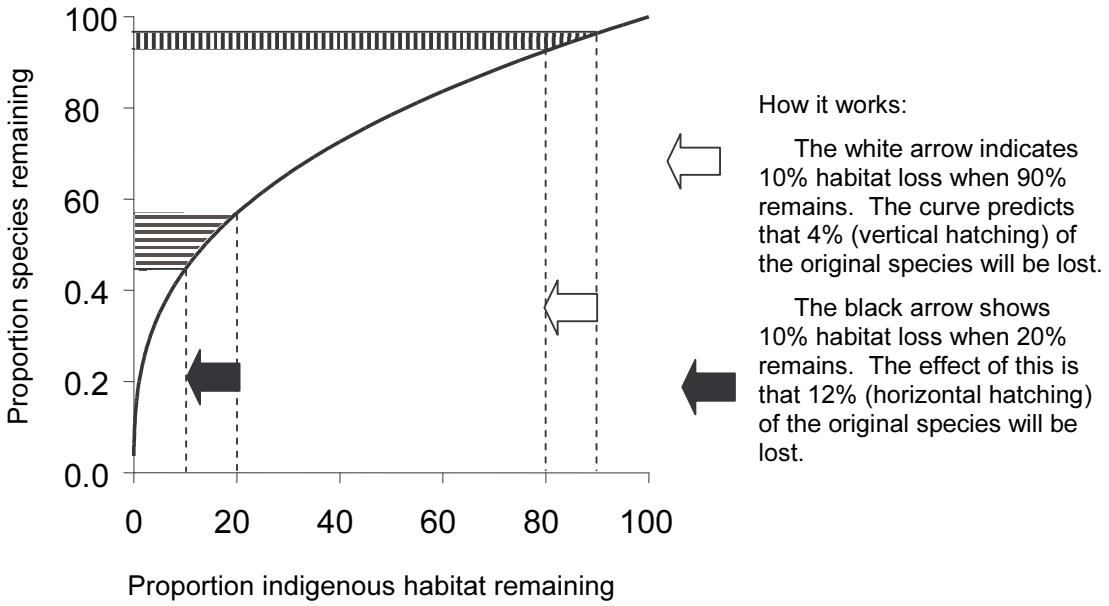

Figure 3. A generalised species–area relationship.

- Second, as loss advances, habitats become more fragmented, and this changes their characteristics. For example, habitat patches become more isolated and develop longer edges relative to their area resulting in much smaller-buffered core areas. Fragmentation has additional adverse impacts on remaining biodiversity, compounding the loss of biodiversity that would occur if area was reduced but the characteristics of habitats remained just the same as in non-fragmented habitats. These changes and their impacts gather pace as habitat loss advances.
- Third, essential natural processes like succession, dispersal, adaptation and evolution rely on the movement of species between habitat patches. As patches of habitat that are the sources and sinks of natural migrations across the landscape are progressively removed, these natural processes become increasingly compromised and dysfunctional, resulting in loss of viability, extinction debt (long-lived species persisting for a time in landscapes after they are committed to extinction by habitat loss), and, rapidly or slowly, species extinctions. The negative consequences for remaining biodiversity add to those of reduced area and fragmentation. This area of science is known as metapopulation dynamics.

In summary, this science tells us that incremental losses matter more for biodiversity once habitat loss has become advanced—that progressive losses have increasingly serious effects. This is why the best, high quality examples or samples of a type are not sufficient to ensure persistence, and why larger intact ecosystems, ecological sequences, corridors, and buffer areas have always been included in ecological criteria for protection.

Legal protection

It can be shown statistically that indigenous habitats and ecosystems that are legally protected by private land covenants and in public conservation areas are less likely to be cleared for alternative land uses in New Zealand: in other words, they are more vulnerable to clearance. The biodiversity of areas that are covenanted or reserved often receive some ongoing conservation management investment to reduce or remove threats (e.g. fencing, pest and weed control), whereas places that are not legally protected against clearance are, on average, less likely to receive inputs to secure biodiversity from other threats such as pests and weeds. In New Zealand, these inputs are especially important to protect biodiversity because our biota is particularly vulnerable to introduced herbivores, predators and weeds, and many indigenous species will not survive without them in the long term. These assumptions lead us to suggest that the biodiversity of environments that have protection over less of their area will be more vulnerable to clearance as well as other pressures such as pests and weeds, and the likelihood of irreversible biodiversity loss from these environments will therefore generally also be greater.

The most threatened environments

The first five categories of the Threatened Environment Classification direct attention to some of the places that are irreplaceable, vulnerable, and likely to contain some of New Zealand's most threatened ecosystems, habitats and species. These are places that are priorities for protection, because it is likely that opportunities to protect habitats, ecosystems and communities of this type are retreating most rapidly.

Environments that have lost much of their original habitat and are poorly protected are likely to contain some of New Zealand's most threatened ecosystems, habitats and species. These are also the places where further loss of remaining indigenous habitats would probably have the greatest negative impacts, and additional protection and the restoration of habitats, and their linkages and buffering, would provide most benefit. They are also the places with the highest rates of recent loss of indigenous cover (when loss is expressed as a proportion of what remains).

Past loss and current protection contribute to a continuum, or gradient, of risk to biodiversity, with high risk at one end and low risk at the other end of the continuum. There are no 'right' points to separate biodiversity more at risk from biodiversity that is more secure along this continuum. But categories (delineated by thresholds) are convenient. For this reason, the Threatened Environment Classification uses thresholds to define categories that are easy to

remember, and that follow logically from the pattern of accelerating risk to biodiversity as habitat loss advances (represented by the form of the species–area relationship).

Species–area relationships will vary across different biotic groups (e.g. vertebrates, plants, microorganisms), habitats, ecosystems and landscapes, and between islands and continents, although the basic form of the relationship remains the same. A pragmatic average for New Zealand (the curve in Figure 3) suggests that species loss will accelerate sharply, due to loss of area alone, once less than about 20% of original area remains.

However, the species–area relationship does not take into account fragmentation and the disruption to natural processes and metapopulations, which compound species loss. These other factors mean we would expect rapid loss of biodiversity to commence earlier, and declines to be more rapid, than suggested by the species–area relationship alone. This is supported by field studies overseas, showing rapid species loss and associated ecosystem changes set in once remaining indigenous habitat decreases below a threshold of about 30%.

In areas where more than 30% of the land still remains under some form of indigenous vegetation, biodiversity is more prone to extinction or decline if little of the remaining indigenous vegetation has formal protection. As explained earlier (p. 21), this is because the probability that indigenous species will persist in the long term is lower without conservation management investment that is assumed to be incentivised by, and associated with, formal long-term protection. Second, changing land-use patterns could reduce these types to the point where biodiversity loss increases rapidly (e.g. the current trend of agricultural intensification for dairy farming, future use of 'marginal' land that supports indigenous biodiversity to grow biofuel crops, subdivision and development of coastal and lowland environments). The logic of the species–area relationship suggests these risks are worst for biodiversity where the safety net of legal protection extends over a smaller area of habitat. Environments with less than 20% of their land area protected are 'threatened environments' because they contain New Zealand's habitat types with the smallest legal protection safety net.

Less Reduced and Better Protected environments

Biodiversity in Category 6 environments (Less Reduced and Better Protected, with >30% indigenous cover remaining, and >20% legally protected) will often be less imminently threatened by clearance and the factors associated with habitat loss, fragmentation, and poor legal protection described above. But it is important to emphasise that 'less reduced and better protected' should not be construed as 'unimportant', 'not requiring protection' or 'free from threat'. This User Guide suggests three reasons why.

First, areas of indigenous vegetation in Less Reduced and Better Protected environments are some of the few places where New Zealand's ecosystems remain in 'healthy functioning states' today. Healthy functioning states have high ecological integrity; they are dominated

by native species, and functioning natural processes (e.g. pollination, seed dispersal, nutrient and moisture cycles, seasonal feeding and migration patterns, breeding, dispersal) enable them to retain much, or most, of the complement of native species that they could potentially support. Countless natural processes and species depend upon the maintenance of large areas of native habitat in healthy functioning states. For example, large continuous areas are required to maintain linked elevation sequences and corridors, to ensure the persistence and continued evolution of genetic and ecological diversity, and to provide habitats for sensitive species that require large, intact, or undisturbed habitats. Many large-bodied, host-dependent, narrow-range and/or habitat-specialist species are dependent on large contiguous habitats. Sensitive species (many birds) and ecological processes (such as reproduction) need areas that are of high quality, buffered from pests and weeds, or relatively intact. Some rare communities too are now restricted to Category 6 environments (e.g. most, or perhaps all, of New Zealand's remaining old-growth forest). Large, diverse areas of indigenous habitat contain important ecological 'source' areas. These are areas that species populations depend upon for their persistence although they range or disperse more widely (to 'sink' areas) and may use them only intermittently (e.g. important breeding areas, seasonal food sources, migration paths). Their removal can have disproportionate flow-on effects. 'Source' areas for multiple species will always be incompletely defined by science, and protecting them requires application of precautionary principles.

Maintaining areas of indigenous vegetation in Less Reduced and Better Protected environments is therefore fundamental to the future persistence and viability of the full range of New Zealand's biodiversity. Reducing these remaining indigenous areas towards scarcity will not maintain biodiversity; it will compromise the persistence of a full range. The value of large intact areas extends, needless to say, far beyond biodiversity, to other ecosystem services (carbon storage, landscape stability, amelioration of climate and extreme events, water quality and quantity, amenity). In the coastal, lowland and montane zones of New Zealand it is now rare to find large intact areas that are rich in biological diversity, have the healthy processes required for the long-term persistence of biodiversity into the future, and provide ecosystem services in abundance.

Second, the Threatened Environment Classification takes a very optimistic view of loss of indigenous vegetation (and hence is a conservative underestimate of loss of indigenous biodiversity). It includes as 'indigenous vegetation' not only the primary (undisturbed, old-growth) habitats of indigenous species, but also many land cover classes that support habitats that are secondary. Secondary indigenous vegetation still supports or is dominated by indigenous species, but has changed and/or recovered from some disturbance or loss since human settlement. Secondary indigenous vegetation includes many early-seral indigenous cover types (e.g. native grasslands, shrublands and scrub). For example, podocarp forests on the floodplains and terraces of Westland have been disproportionately logged and cleared, most formerly woody wetland habitats have been burned and transformed to herbaceous states, and tussock grasslands have replaced former dryland, montane and low-alpine forest and shrubland types over vast areas of eastern South Island

high country. These transformed communities are nonetheless included in the estimate of indigenous vegetation remaining in the Threatened Environment Classification. In situations where secondary indigenous vegetation types predominate (including in Category 6 environments) more indigenous habitat loss, and loss of biodiversity, has occurred than is reflected by the statistics associated with the Threatened Environment Classification. Therefore, their remaining biodiversity is likely to be more at risk from the factors associated with habitat loss and fragmentation (above, p. 20).

Third, the Threatened Environment Classification does not imply, and it cannot be assumed, that legal protection for natural heritage over >20% of an environment is 'sufficient' to sustain the biodiversity associated with that environment; far from it. As explained earlier, poor legal protection simply indicates places where it is reasonable to (1) expect the fewest constraints to further clearance and modification of the indigenous communities, habitats and ecosystems that remain within an environment and (2) assume there is the greatest deficit of conservation management inputs to maintain the biodiversity of those types of indigenous communities, habitats and ecosystems. Recognising these as expectations and assumptions is important, because an increase in legal protection does not necessarily mean conservation management to relieve threats to biodiversity (e.g. if it is notional, short term, or with no provision for fencing or ongoing active management).

The distribution of past land clearance and poor legal protection across the landscape is unlikely to predict the intensity and impacts of many other pressures on and threats to indigenous vegetation. The New Zealand Biodiversity Strategy states that invasive pests and weeds pose the greatest single threat to biodiversity on land in New Zealand, 'surpassing even habitat loss'. Pests and weeds reduce the viability of biodiversity across all of New Zealand, including in protected areas, and conservation management that achieves complete ecological release from these threats is still feasible only over small areas. Other current pressures (such as pollution and fire) and some future threats may be only weakly associated with the patterns of past loss and protection. In the future, different incentives may divert land clearance and resource extraction pressure to particular environments that have not been targeted in the past, and are therefore not now identified by the Threatened Environment Classification as falling within a threatened environment.

An example: the Waitakere Ranges and the Threatened Environment Classification

These considerations suggest that policies intended to maintain biodiversity (halt rather than slow decline) are not needed to secure most rapidly retreating options only. They must also maintain indigenous vegetation cover in now comparatively intact and well-protected environments, and prevent its ecological integrity from being diminished by other threats, including pests and weeds.

An example that integrates many of the considerations discussed above is the Waitakere Ranges, west of Auckland City (Figure 4). Most of the Waitakere Ranges falls into environment Category 6 (Less Reduced and Better Protected), because there is more than

30% of these environments remains under some form of indigenous cover, and the upper ranges are protected in public regional parkland. The lower reaches of the ranges and foothills lie in private ownership, and contain lowland ecosystem types that are not represented in the upper ranges and the regional parkland. Some key points are:

- It is important to protect the remaining indigenous vegetation of the Waitakere Ranges and its foothills in its entirety, as it is one of the few large intact areas of indigenous forest in the region and contains a diversity of lowland and coastal vegetation types.
- Due to its size, it supports a number of endangered flora and fauna species and is capable of supporting lost species such as kiwi and kokako. It is a priority area for pest control in the Auckland Region. Intensive possum control is undertaken throughout the Ranges, with integrated pest control in several selected catchments.
- The Waitakere Ranges also provide a significant linkage and source area (providing food resources and breeding areas) and hence are the source of migrations to other natural areas in the region and a significant wildlife linkage with the island sanctuaries of the Hauraki Gulf (e.g. Tiritiri Matangi Island).
- They are close to New Zealand's largest urban population, and so are threatened by the spread of weeds, particularly in the lower reaches of the ranges and foothills.
- The ranges' lowland and coastal indigenous vegetation types are still under threat from subdivision and development, and are priorities for protection.

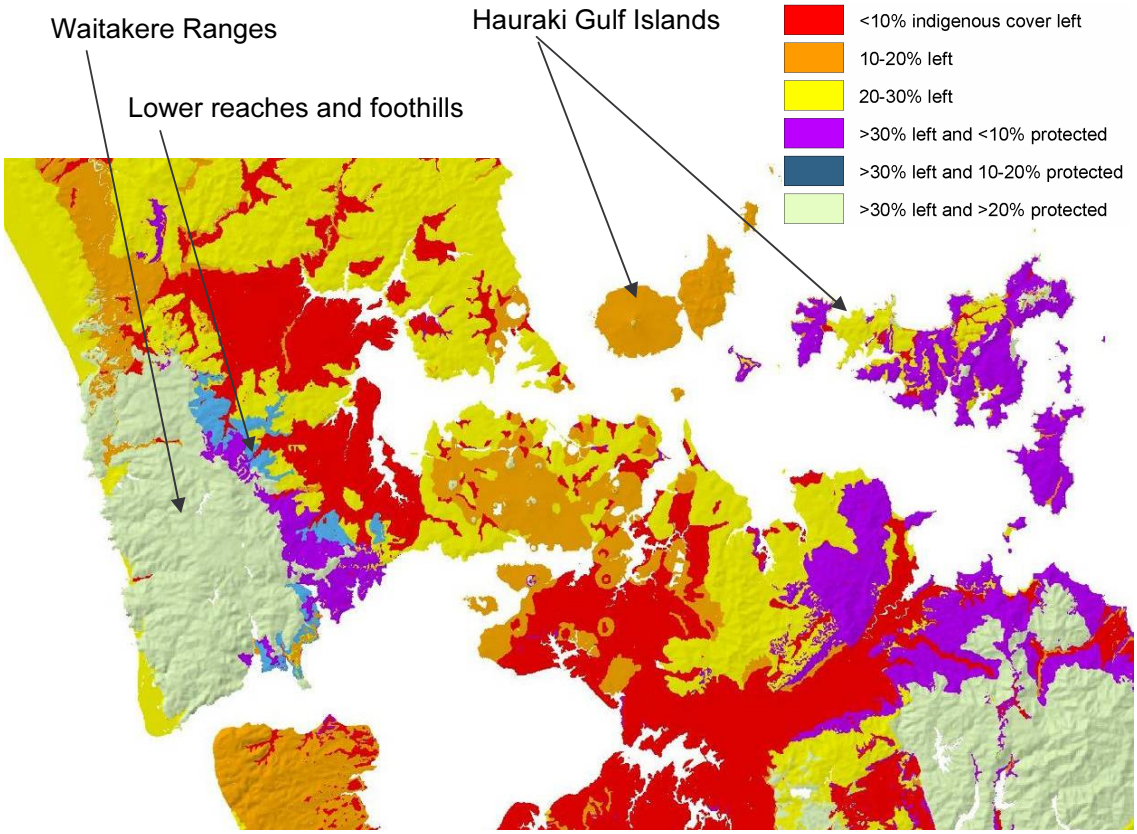

Figure 4. Threatened Environment Classification for the Waitakere Ranges and beyond.

The data behind the Threatened Environment Classification

Land Environments New Zealand (LENZ) identifies the diversity of New Zealand's abiotic (non-living) terrestrial environments based on 15 climate, soil and landform variables that are likely to influence species distributions.

Land environments are classified at four different national scales (Level I to Level IV, identifying 20 to 500 environments nationally—each level is nested within higher levels). Level IV environments relate most strongly to scales at which people perceive and use the landscape, and this is the level used for the Threatened Environment Classification.

The 500 Level IV environments offer a nationally comprehensive surrogate for the potential 'full range' of terrestrial ecosystems, habitats and biodiversity once found across New Zealand. Because climate, soil and landform drive the patterns of living organisms, it is reasonable to assume that each different environment supported a unique assemblage of ecosystems, habitats and species in the past – not different in all respects, but in important features, from that in other environments.

The Threatened Environment Classification uses LENZ as a framework for representativeness of the abiotic environment, rather like ecological districts and regions have been used. How much of the potential 'full range' remains in indigenous cover and how much is protected can be calculated from overlays of the available land cover and protection databases in a GIS. The databases which provide the information for the Threatened Environment Classification are:

Land Cover Database 2 (LCDB2), based on 2001/02 satellite imagery and which classifies New Zealand's vegetation cover into 43 cover classes. These classes were assigned to indigenous (22 classes) or exotic (21 classes) categories (Appendix 1). The resulting indigenous vegetation layer is used as a best estimate of the percent indigenous cover that now remains in each land environment, and thus the loss of indigenous cover from pre-settlement times to the present day.

Protected Areas Network of New Zealand (PAN-NZ), a spatial database of private and public land legally protected primarily for conservation or preservation of intrinsic natural value. It includes all public conservation lands and covenants administered for the purposes of natural heritage protection by the Department of Conservation, Queen Elizabeth II National Trust, Nga Whenua Rahui, as well as regional parks. The currently available database underlying this version of the Threatened Environment Classification has been updated to May 2005. The database was used to estimate the percent of each land environment that is now managed for natural heritage protection.

Data limitations

This section explains some of the most important features and limitations of the underlying data that must be taken into account when using the Threatened Environment Classification. Further reading recommended on p. 33 explains in more detail how the underlying databases were constructed.

Land Environments New Zealand (LENZ) is a classification of present environments (climate, soils, landform), and not ecosystems, vegetation, or a combination of vegetation and landform like most other classifications that have been used in ecology in New Zealand in the past (such as land systems). Instead, LENZ is built on factors that cannot be seen by an observer, and change continuously along gradients (such as temperature, rainfall, solar radiation) as well as those that can be seen (slope), or can be seen in some cases (soil, often through its effects on vegetation). Boundaries between many environments divide gradual, continuous climatic gradients. A common expectation of LENZ is that boundaries should be seen on the ground. But, like an expectation that contour lines represent a landscape of 20-m steps, this is not realistic.

Land environments are not uniform entities, and within each land environment there will be a diversity of living ecosystems and habitats present today that are a product of local variations in the environment at smaller scales, and the influence of recent and more ancient historical events. Not every environmental factor that influences living ecosystems was used to build LENZ and the resolution of the underlying variables is limited. For these reasons, LENZ typically does not discriminate distinctive ecosystems and habitat types arising from local-scale or extreme environmental conditions, and does not distinguish between freshwater habitats. Poorly discriminated habitats include limestone outcrops (karst), saline habitats, geothermal, coastal habitats lashed by wind and salt spray, lowland forest types, and various freshwater, wetland and floodplain ecosystem types that are important components of the 'full range' and often support distinctive and diverse biota. A first approximation of types of 'originally rare terrestrial ecosystems' has been compiled by researchers (see Further reading p. 33 and Links p. 34). Because LENZ does not take account of history, distinctive biogeographic types may not be discriminated (e.g. in the Waikato LENZ does not distinguish volcanic cones of different geological age that support different and distinctive communities).

Land Cover Database (LCDB2) provides broad classes of vegetation cover based on satellite imagery. The Threatened Environment Classification takes these cover classes 'at face value'. However, we know there are misclassifications and errors in the database (but not their full magnitude or locations), and therefore that the cover data are not perfectly accurate. For the purpose of the Threatened Environment Classification, cover classes were divided into either indigenous or exotic categories (Appendix 1). This was based on a subjective assessment by ecologists of whether the vegetation in a cover class was mainly indigenous or mainly exotic across all of New Zealand.

Many of the broad thematic cover classes of LCDB2 contain mixtures of indigenous and exotic vegetation. LCDB cover classes therefore cannot, and should not, be relied upon solely to assess whether the land cover in fact contains 'naturally occurring indigenous species' on the ground (see Glossary definition, p. 32). Field inspection will be needed to verify this. For example, 'depleted grassland' (assigned to indigenous) ground cover is often dominated by the exotic hawkweed *Hieracium pilosella*, but indigenous species may dominate in number. Conversely, 'low producing grassland' and 'mixed exotic shrubland' were assigned to the exotic category but often support native short tussocks and shrubs in places that have been more sympathetically managed.

The Threatened Environment Classification will probably underestimate the threat status of land environments that have much of their area under cover classes 'tall tussock grassland', 'depleted grassland', and the wetland classes 'herbaceous freshwater vegetation' and 'herbaceous saline vegetation'. All were categorised as indigenous, yet each class includes highly modified and invaded areas. LCDB has under-reported the conversion since about 1997 of these cover classes to improved pasture ('high producing grassland').

Protected Areas Network of New Zealand (PAN-NZ)

The protection dataset used for the Threatened Environment Classification has several limitations, such as the inclusion of some Crown land managed by the Department of Conservation for purposes other than conservation (e.g. buildings, gravel reserves, racecourses, cemeteries, marginal strips). These sources of error will tend to increase estimates of protected land in threatened environments. The precision of estimates is also reduced by inaccuracies in the digitisation of boundaries of protected areas. However, of all the protected areas administered by councils, only regional parks are included in this dataset. This is because many council protected areas are not digitised, or because the reason for protection is not always clear and/or associated with a decrease in biodiversity loss (e.g. central city amenity land). Furthermore, various types of privately protected land (some covenant types, management agreements, and even major biodiversity sanctuaries such as the ecological island at Mt Maungatautari in the Waikato) are not digitised and included in the protected area dataset of any agency. Consequently, the area of protected indigenous vegetation in some districts may be underestimated. Improved national biodiversity protection data will rely on continued co-ordinated endeavours of several agencies.

PAN-NZ provides information on whether an area or site is protected for biodiversity reasons or not. It is important to keep in mind that protection is not a binary measure, but rather a continuum: different levels of actual protection can be applied (simply a legal label but no action, fence an area, fence + predator control, etc.) with potentially different effects on biodiversity loss.

How well does the Threatened Environment Classification predict the presence of threatened species?

In general, the higher (and the colder, wetter and steeper) a land environment is, the more indigenous vegetation remains, and the greater the percentage of the land environment is legally protected (Figure 5, below).

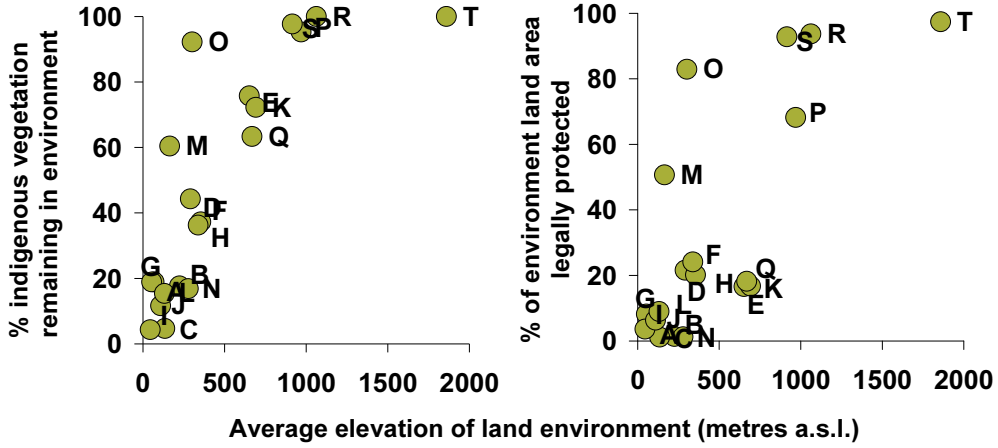

Figure 5. Percent indigenous vegetation remaining (above left), and land area legally protected (above right) and the average elevation (in metres above sea level) of the 20 environments at Level I of LENZ.

But does extensive loss of indigenous habitats and poor legal protection really mean biodiversity is threatened in threatened environments? Aren't most of New Zealand's threatened species found in environments served by parks and reserves? At least for plants (for which there are more reliable distribution data and knowledge than for many other groups) it does appear that most threatened species are concentrated in threatened environments. In 2004, national experts sorted species on the national list of threatened plants into five groups, based on the elevation zone they mainly occupied (Figure 6). They estimated that 88% of New Zealand's species of plant that are most threatened (classified as Acutely Threatened or Chronically Threatened) occur mainly (or only) in the coastal, lowland or montane zones.

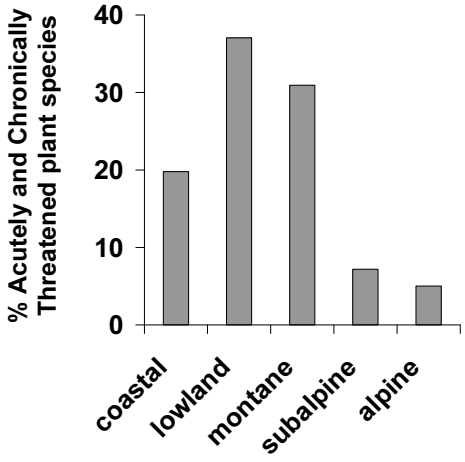

Figure 6. The percent of the national list of Acutely Threatened and Chronically Threatened plant species in five elevation zones (after de Lange et al. 2004: see Further reading p. 33).

Does this association between threatened plants and lower-elevation, threatened environments hold true at local scales? Stratified field survey (a carefully designed study that invests the same amount of search effort in each threat category) is needed to give a definite answer, but few such surveys have been carried out in New Zealand. Data from systematic searches of whole pastoral lease properties in inland Otago (Figure 7) suggest that the prediction does hold true, at least in that part of New Zealand. Table 5 shows the results of threatened plant surveys on each of two large leases, and on a group of six small leases, by similar teams, over similar time periods, using similar search methods. The three areas had different proportions of their land area in threatened environments, but in each case most of the threatened plant records came from threatened environments. Ecologists are continuing to collect data to test the relationship, and will also look at patterns in other species groups.

Table 5. Threatened plant records from inland Otago leases, in the five categories of threatened environments. The table shows the percentage of land in threatened environments, and the percentage of records of *all* threatened plants (Acutely Threatened, Chronically Threatened, and At Risk), and the percentage of records of Acutely Threatened and Chronically Threatened plants only.

Lease number (& ha)	Land area (%)	All threatened plant records (%)	Acutely Threatened and Chronically Threatened plant records (%)
1 (*10,462*)	15	53	82
2 (*21,810*)	80	77	75
3-8 (*13,707*)	65	89	98

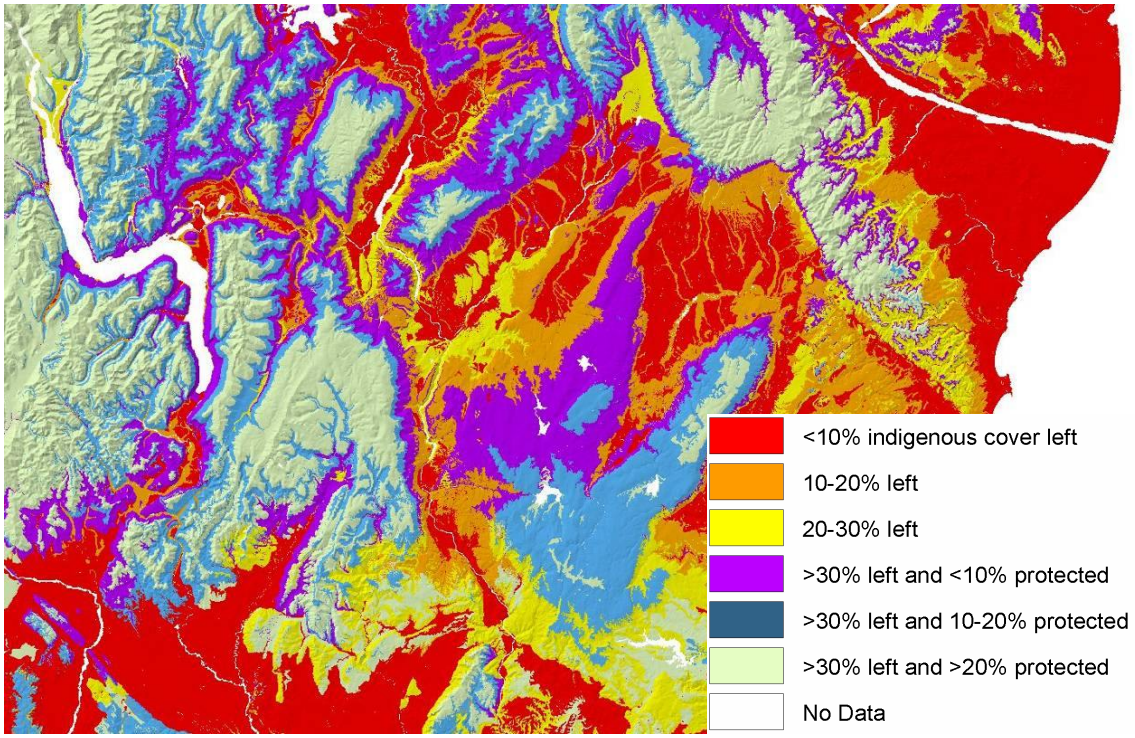

Figure 7. Threatened Environment Classification for inland Otago.

Access to the Threatened Environment Classification

Website

The Threatened Environment Classification is accessible through the Local Government Action-Biocommunity website (http://www.biocommunity.org.nz/).

Uploading and using the Threatened Environment Classification in GIS

The Threatened Environment Classification is free, and can be downloaded from http://www.biocommunity.org.nz/detail.php?ar_id=10053, or http://www.landcareresearch.co.nz/services/informatics/lenz/downloads.asp#threatenv
It can then be used by GIS users with access to LENZ (the Land Environments of New Zealand)

Instructions for uploading the Threatened Environment Classification, and this User Guide, can also be downloaded from the Local Government Action-Biocommunity website (http://www.biocommunity.org.nz/detail.php?ar_id=10080).

Maps

Non-GIS users can download maps of the Threatened Environment Classification for their region or district from the Action-Biocommunity website at:
(http://www.biocommunity.org.nz/detail.php?ar_id=10083).

Workshops

Workshops will be held around the country in August 2007 to familiarise users with the Threatened Environment Classification.

Updates

There is no guarantee that there will be an update to the Threatened Environment Classification. It can't be repeated in the future unless further full national updates of the land cover database are produced, using satellite imagery taken over as short a time period as possible (e.g. a single summer). At present, there is no commitment from national agencies to produce a land cover database to update and improve upon LCDB2 for herbaceous cover classes such as indigenous grasslands.

The Threatened Environment Classification may be improved by updating the version of the Protected Area Network of New Zealand, including the valid information on protected areas, provided by local authorities. Again, such updates will depend upon funding from, and coordination among, government agencies.

Glossary: terms used in this guide

Biodiversity (biological diversity): Biodiversity is the diversity of life on earth. It refers to the variety of all biological life (plants, animals, fungi and microorganisms), the genes they contain, and the habitats and ecosystems on land and in water where they live.

Ecosystem: An interacting system of living creatures and non-living parts (including sunlight, air, water, and nutrients). Ecosystems can be small or large, short-lived, or long-lived.

Habitat: The place or type of place in which a living thing naturally occurs, and which provides it with the characteristics and resources it requires.

Indigenous species: A plant or animal species that occurs naturally in New Zealand. A synonym is 'native species'.

Indigenous (or native) vegetation: A plant community containing naturally occurring indigenous species (i.e. species indigenous to New Zealand). It includes vegetation that has regenerated with human help following disturbance, but does not include plantations or vegetation established for commercial or aesthetic purposes.

Indigenous (or native) cover: Indigenous vegetation (as defined above) *or* a land cover type that may support little or sparse vegetation (or indeed no vegetation) but that remains little modified by non-native species. **Note** that in this User Guide, for simplicity and convenience, we use the term "indigenous vegetation" to include types of indigenous land cover that actually support little vegetation (e.g. Coastal Sand and Gravel, River and Lakeshore Gravel and Rock, Landslide, Alpine Gravel and Rock, Permanent Snow and Ice see Appendix 1, p. 36).

Land environment: An area whose boundaries encompass similar environmental characteristics caused by non-living (abiotic) variables such as climate, landform and soil.

Species: A group of organisms capable of interbreeding freely with each other but not with members of other species.

Taxon (pl. taxa): A named biological classification unit assigned to individuals or sets of species, for example species, subspecies, genus, or order.

Threatened species: A species that is vulnerable, endangered, or presumed extinct.

Further reading

New Zealand Biodiversity Strategy

Department of Conservation (DOC) and Ministry for the Environment (MfE) 2000: The New Zealand biodiversity strategy. DOC and MfE, Wellington, New Zealand. 144 p.

LENZ, LCDB, and PAN-NZ

Leathwick, J.R.; Wilson, G.; Rutledge, D.; Wardle, P.; Morgan, F.; Johnston, K.; McLeod, M.; Kirkpatrick, R. 2003: Land environments of New Zealand. David Bateman, Auckland, New Zealand.

Terralink. 2004: New Zealand Land Cover Database (LCDB2). Terralink International Limited, Wellington, New Zealand.

Rutledge, D.; Price, R.; Heke, H.; Auseill, A.G. 2004: National analysis of biodiversity protection status: methods and summary results. Landcare Research Contract Report LC0405/042 prepared for the Ministry for the Environment (unpubl.). 30 p.

Threatened Environment Classification

Walker, S., R. Price, D. Rutledge, R. T. T. Stephens, and W.G. Lee. 2006. Recent loss of indigenous cover in New Zealand. New Zealand Journal of Ecology 30: 169–177

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Williams P, Wiser S, Clarkson B, Stanley M 2006. A physical and physiognomic framework for defining and naming originally rare terrestrial ecosystems: first approximation. Landcare Research Internal Report LC0506/185.

Species area relationships

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Systematic Conservation Planning

Margules, C.R.; Pressey, R.L. 2000: Systematic conservation planning. Nature 405: 243–253.

Threatened species

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de Lange, P.J.; Norton, D.A.; Heenan, P.B.; Courtney, S.P.; Molloy, B.P.J.; Ogle, C.C.; Rance, B.D.; Johnson, P.N. 2004: Threatened and uncommon plants of New Zealand. New Zealand Journal of Botany 42: 45–76.

Help

Users in councils who have queries or require help may contact members of the Regional Council User Group are Shona Myers (Auckland Regional Council), Philip Grove (Environment Canterbury – Canterbury Regional Council), Tim Park (Greater Wellington Regional Council), and Tim Porteous (Greater Wellington Regional Council).

Links

Threatened Environment Classification

The Threatened Environment Classification and associated information and downloads are accessible from the Local Government Action-Biocommunity website http://www.biocommunity.org.nz/.

The Threatened Environment Classification table can be downloaded from http://www.biocommunity.org.nz/detail.php?ar_id=10053, or http://www.landcareresearch.co.nz/services/informatics/lenz/downloads.asp#threatenv

Statement of National Priorities for Protecting Rare and Threatened Biodiversity on Private Land

http://www.biodiversity.govt.nz/land/guidance/index.html

Originally rare ecosystems

http://www.landcareresearch.co.nz/research/obi.asp?Proj_Collab_ID=27

http://www.biodiversity.govt.nz/pdfs/originally-rare-ecosystems.pdf

Threatened species lists

The most up-to-date lists of threatened species are at:

http://www.doc.govt.nz/templates/MultiPageDocumentTOC.aspx?id=42704

Data layers

LENZ:

http://www.landcareresearch.co.nz/services/informatics/LENZ/

LCDB: Terralink 2004.

http://www.terralink.co.nz/products_services/satellite/land_cover_database_of_new_zealand

PAN-NZ

http://www.landcareresearch.co.nz/research/staff_page.asp?staff_num=1044

Appendix 1

Forty-three land cover classes (LCDB2) and their classification as either Indigenous or Exotic for the Threatened Environment Classification

Class No.	Class name	Classification
1	Built-up Area	Exotic
2	Urban Parkland / Open Space	Exotic
3	Surface Mine	Exotic
4	Dump	Exotic
5	Transport Infrastructure	Exotic
10	Coastal Sand and Gravel	Indigenous
11	River and Lakeshore Gravel and Rock	Indigenous
12	Landslide	Indigenous
13	Alpine Gravel and Rock	Indigenous
14	Permanent Snow and Ice	Indigenous
15	Alpine Grass/ Herbfield	Indigenous
20	Lake and Pond	Indigenous
21	River	Indigenous
22	Estuarine Open Water	Indigenous
30	Short-rotation Cropland	Exotic
31	Vineyard	Exotic
32	Orchard and Other Perennial Crops	Exotic
40	High Producing Exotic Grassland	Exotic
41	Low Producing Grassland	Exotic
43	Tall-Tussock Grassland	Indigenous
44	Depleted Grassland	Indigenous
45	Herbaceous Freshwater Vegetation	Indigenous
46	Herbaceous Saline Vegetation	Indigenous
47	Flaxland	Indigenous
50	Fernland	Indigenous
51	Gorse and or Broom	Exotic
52	Mānuka and or Kānuka	Indigenous
53	Matagouri	Indigenous
54	Broadleaved Indigenous Hardwoods	Indigenous
55	Sub Alpine Shrubland	Indigenous
56	Mixed Exotic Shrubland	Exotic
57	Grey Scrub	Indigenous
60	Minor Shelterbelts	Exotic
61	Major Shelterbelts	Exotic
62	Afforestation (not imaged)	Exotic
63	Afforestation (imaged, post LCDB 1)	Exotic
64	Forest – Harvested	Exotic
65	Pine Forest – Open Canopy	Exotic
66	Pine Forest – Closed Canopy	Exotic
67	Other Exotic Forest	Exotic
68	Deciduous Hardwoods	Exotic
69	Indigenous Forest	Indigenous
70	Mangrove	Indigenous