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Assessing significance for biodiversity conservation on private land in New Zealand

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Abstract: The assessment of ecological significance is a key part of a territorial local authority's (TLA) responsibility to provide for the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna as required under Section 6(c) of the Resource Management Act (RMA) 1991. While a number of methods have been used to achieve this, these have been largely unpublished and there is considerable variability in the approach taken by different TLAs. We propose four criteria (rarity and distinctiveness, representativeness, ecological context, and sustainability) for assessing significance of indigenous biodiversity in terms of RMA Section 6(c). These criteria could form the basis for a consistent national approach to significance assessment. These criteria have been developed from early assessment schemes such as the Protected Natural Areas Programme. While there is no one "right" system for conservation assessment, we hope this paper will stimulate discussion amongst the ecological community on the best ways to undertake significance assessment.

Keywords: conservation evaluation; Resource Management Act; representativeness; ecological significance.

Introduction

The assessment of significance is a key component of conservation and is most often used to evaluate the relative importance of indigenous biodiversity values at one site compared with others (Usher, 1986). Up until 1991, significance assessments in New Zealand were primarily made under the Reserves Act 1977, National Parks Act 1980 or Conservation Act 1986, with the focus being on public land. However, with the introduction of the Resource Management Act 1991 (RMA) there was now a mandate for territorial local authorities (TLAs; regional, district and city councils – the bodies responsible for administering the RMA) to consider indigenous biodiversity on private land. In particular, Section 6(c) of the RMA requires TLAs to provide for the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna. This, in turn, places a responsibility on TLAs to assess the relative values of different sites in order to determine where they must provide support to protect biodiversity.

This paper outlines an approach for assessing the significance of conservation values on private land appropriate to the purposes and intent of the RMA. Part II of the RMA introduced the idea of "sustainable management" of natural resources, and we believe this demands a different approach for significance assessment to that used under earlier New Zealand legislation. This paper presents an ecologist's view of significance assessment within the context of the requirements of Section 6 (c) of the RMA, not a legal interpretation.

Historically, the selection of sites for protection within reserve systems has been largely *ad hoc*, being determined by non-scientific considerations. Most reserves were located in areas containing low economic values, such as mountainous regions with little commercial timber or potential for agricultural development. However, starting in the 1970s there has been a strong scientific interest in reserve selection and design. This interest was initially stimulated by island biogeography theory (MacArthur and Wilson, 1967), but has since been expanded to consider a much wider range of factors when determining which sites should be selected for protection (Norton, 1999). A large literature has developed on the different methods to evaluate and choose areas for protection and it provides the basis for development of the assessment system proposed here (Usher, 1986; Margules and Austin,

1991; Pressey *et al*., 1993; Forey *et al.*, 1994; Noss and Cooperrider, 1994; Margules and Pressey, 2000).

Ecological evaluation has, in the past, focussed on terrestrial sites and habitats, so that the methodologies have been developed to address site selection and nature conservation on land. Where lake, river or marine conservation has been the purpose, then modified versions have been developed (Raven *et al.*, 1998). In New Zealand, aquatic systems have been evaluated as part of larger sites [e.g. during Protected Natural Area Programme (PNAP) Surveys], and there is no provision for assessment of waterbodies for biodiversity or ecological value under RMA. However, TLAs do have responsibilities for aquatic biodiversity. The system proposed here has not been used on sites that are solely aquatic, and we recognise that it needs to be tested in this area.

The proposed system is easy to implement, is relatively objective and does not require large amounts of baseline data. This is important in New Zealand where TLAs often lack natural resource information and the finances to collect it. There is obviously no one "right" system for conservation assessment, but we hope this paper will stimulate discussion amongst the ecological community on the best ways to undertake significance assessment, discussion which so far has been largely unpublished.

New Zealand context

The legal basis for biodiversity conservation on private land in New Zealand is found in the RMA. The RMA unifies land and water planning and is based on the identification and avoidance of adverse effects on the environment. It is a complex and relatively new piece of legislation, so case law and experience are still growing. The purpose of the RMA is (Section 5):

> "(1) . . . to promote the sustainable management of natural and physical resources.
>
> (2) In this Act, "sustainable management" means managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety, while
>
> (a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and
>
> (b) Safeguarding the life-supporting capacity of air, water, soil and ecosystems; and
>
> (c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment"

This places a responsibility on TLAs to take biodiversity and ecological matters into account in a wide range of their actions, including activities as diverse as land and water management, resource consent processes (incorporating assessments of environmental effects), river control, transport planning and road maintenance. We believe that the "sustainable management" phrase creates an important difference between significance assessment under the Conservation or Reserves Acts and the RMA.

Section 6 of the RMA identifies a number of matters of national importance that must be considered in implementing the Act including:

> "In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the following matters of national importance: . . .
>
> (c) The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna"

This section of the Act indicates that the TLAs must identify "the cream" of sites within their boundaries, but does not preclude them from managing the ecological values of all areas. Sections 5 and 6 of the RMA place a requirement on TLAs to understand the ecological and biodiversity values in their area so that these values can be managed in a sustainable manner. It is interesting to note that the word "biodiversity" did not appear in the 1991 legislation because it only became widespread in planning circles after the 1991 Earth Summit in Rio de Janeiro. However, it was added in a 2003 amendment to the RMA. The approach developed to address RMA Section 6(c) has generally been to prepare lists and maps of significant sites, with accompanying descriptive and evaluation text. These are then used by the TLA in carrying out its functions (e.g. assessing the effects of particular activities on ecological values or developing rules specific to areas or habitat types to restrict the type of activity that can be undertaken). The requirement under RMA Section 6(c) for TLAs to develop lists and maps has also been confirmed by case law from the New Zealand Environment Court.

Implementation of Section 6(c) has, however, posed problems for many local authorities. Often intense conflict has arisen between private landowners, conservation interests (especially national non-government conservation organisations) and TLAs on the mapping and listing of "significant natural areas" in local authority plans. The reasons have included: use of inaccurate maps or errors in recording data; use of old assessment information; use of assessment

information carried out for a non-RMA purpose; misunderstanding of the term "biodiversity" by landowners and some members of TLA staff and elected bodies; fear by private landowners of the consequences for land management of significance assessments; the novelty of the idea in New Zealand that conservation of biodiversity can or does take place on private land as well as on public land; poor consultation processes between TLAs, landowners and other interested parties; lack of ecological expertise within TLA staff; unrealistic time frames for the survey, analysis and consultation phases of assessment and planning; inconsistency of approach between different TLAs; a lack of definition of "significant" in the RMA. The work described in this paper has arisen from these debates and presents a significance assessment system that is designed to address these difficulties.

Significance assessment in New Zealand

Reviews of significance assessment in New Zealand are given in Whaley *et al.* (1995), Shaw and Beadel (1998), and Norton and Roper-Lindsay (1999). Early systems (e.g. Kelly, 1972; Nicholls, 1974) aimed to identify priority sites for conservation management. However, application of criteria was often subjective and lacked the range of evaluation criteria necessary to assess indigenous biodiversity. More objective ranking-schemes were developed in the late 1970s for use in setting priorities for reserve selection and management such as pest control (e.g. Park and Walls, 1978; Ogle, 1981; Shaw, 1994). These schemes used a range of criteria including representativeness, size, habitat diversity, habitat modification, species richness and rarity for ranking sites. The PNAP was established in the early 1980s to meet the conservation objectives in the 1977 Reserves Act, in particular the preservation of representative samples of all classes of natural ecosystems [Section 3(1b)]. Seven criteria were used in the PNAP: representativeness; diversity and pattern; rarity and special features; naturalness; long-term ecological viability; size and shape; buffering, surrounding landscape and boundaries (Kelly and Park, 1986; O'Connor *et al.*, 1990). Identification of "significant" sites involved defining the range of variation for each criterion within an area (usually an ecological district) and then scoring individual sites against this range. These assessments allowed for a sifting of sites to identify the most significant in terms of the criteria used. Subsequent to the PNAP, the Nature Heritage Fund developed a conservation evaluation system based on a smaller set of criteria (representativiness, sustainability, landscape integrity and amenity/utility) for determining sites that should be purchased by central government to protect their biodiversity values (Harding, 1994).

Throughout the 1990s the idea that reservation or setting aside land was the only way that biodiversity and conservation values could be managed was being replaced by ideas about wider landscape management for conservation (e.g. Norton and Miller, 2000; Meurk and Swaffield, 2000). While the PNAP approach provides an important basis for developing a significance assessment system relevant to biodiversity conservation on private land in terms of the RMA, it has some drawbacks. In particular: (1) there is considerable redundancy among the criteria (e.g. size and shape are effectively part of long-term viability, while natural diversity is a component of representativeness); (2) the criteria are used to assess a mixture of existing site attributes and potential attributes without clearly distinguishing between these; (3) some criteria are difficult to assess objectively, especially naturalness (see next section); (4) the focus has been on securing areas for protection within the public conservation estate and designers of the criteria did not envisage the continuation of productive land uses such as grazing. Our alternative set of criteria for assessing significance draws heavily on the PNAP approach, but addresses the drawbacks mentioned above.

Of the criteria commonly used in other assessments, only naturalness is not included in our proposed set. Naturalness has been widely used as a conservation evaluation criterion (Usher, 1986; O'Connor *et al.*, 1990) and is commonly defined as an ecosystem state characterised by the lack of human disturbance and intervention. This is usually assessed by determining the relative proportion of native versus exotic species and by the absence of human disturbance. The concepts of natural and naturalness have been extensively discussed in the conservation literature and three broad definitions occur (Hull and Robertson, 2000): (1) A state of the environment at some point in the past; (2) a state of the environment that exists in the absence of humans; (3) a slow or "natural" rate of change. However, all three are difficult to justify in the New Zealand context. Some *previous point in time* is often taken to be a time before recent anthropogenic impacts; in New Zealand this might be pre-European settlement (i.e. pre-1850) or pre-Polynesian settlement (over 750 years ago). Whatever date is chosen, there is no evidence to suggest that ecosystems have remained the same since then. Attempts to find a state that *exists free of human impacts* is also very difficult to achieve, especially given the pervasive impacts of global change and, in New Zealand, recent extinctions and invasions of species. The third definition of naturalness, *a slower*

rate of change, invokes a social preference that is difficult to define scientifically.

The concept of naturalness seems redundant when most New Zealand ecosystems have been affected to some extent by almost 800 years of direct human impacts. Furthermore, it would seem risky to equate low naturalness with low significance, as sites with exotic species can still be significant because of their potential to develop into ecosystems dominated by indigenous species, either because exotic species play a key role buffering or enhancing connectivity in remnant natural areas, or because they provide habitat for indigenous fauna (*cf.* Miller, 2000). For these reasons we have chosen not to use naturalness for assessing indigenous biodiversity on private land. We believe the concept of representativeness provides a better criterion to identify significant remaining examples of indigenous vegetation.

Assessing ecological significance of a site under the RMA

Evaluation criteria can be used to assess the ecological significance of a site in terms of its contribution to the conservation of indigenous biodiversity. The criteria can not in themselves identify which sites should be protected. Instead they provide a structured assessment of the ecological values of the site that can then be used as a basis for subsequent decision making about management including protection. The distinction between significance assessment and subsequent protection is an important one and its confusion has contributed to some of the conflict over implementation of RMA Section 6(c) in New Zealand. Significance assessment is a relatively objective process, whereas deciding on the options that will best protect the values of a site involves both ecological and social considerations. In particular, decisions on the best methods for protection need to take into account the views and aspirations of the local community, the attributes of the landscape within which the protected site is located (e.g., current and potential land management), and the financial resources available for implementing protection.

To date, TLAs have used a range of systems and criteria for determining ecological significance. These have included lists from PNAP surveys, lists prepared by TLAs based on Department of Conservation (DOC) lists but modified through local community input, and systems and criteria developed specifically for or by the TLA. These have met with varied degrees of success, as measured by the ease with which Section 6(c) planning provisions have been accepted. Systems developed specifically for TLAs have many similarities, although they vary because of local community issues and priorities. We believe there is room for an ecologically sound and consistent approach that could be used throughout the country. Local variation could then come through the ways in which TLAs address the mechanisms used to "provide for protection".

We propose the use of only four criteria for significance assessment; rarity and distinctiveness, representativeness, ecological context, and sustainability (Fig. 1). We believe these criteria enable a comprehensive, objective evaluation of a site. The first three criteria are site criteria. They reflect key levels of ecological organisation and provide information about the site's current state. The fourth criterion, sustainability, considers the site's long-term viability, recognising the dynamic nature of the ecosystems at a site. This is a critical difference from other systems and moves away from the reservation and "lock-up" approach to protection, making the link to "sustainable management" provisions of the RMA. These four criteria incorporate the range of criteria that have been used in previous evaluation schemes (Table 1). The ownership (public/private) of a site is not a factor in making the assessment of ecological value. We believe these four criteria provide sufficient information for assessment of the ecological values of terrestrial and freshwater sites in New Zealand within

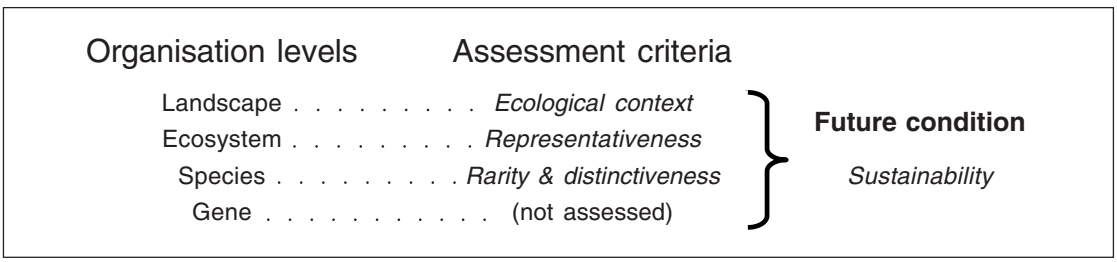

Figure 1. Relationship between the assessment criteria used here (in italics) and the different levels of ecological organisation.

Table 1. A comparison of significance assessment criteria used in New Zealand evaluation systems.

This paper	Protected Natural Areas Programme	Nature Heritage Fund
Rarity and distinctiveness	Rarity and special features	Representativeness (part)
Representativeness	Representativeness; Diversity and pattern; Naturalness (part)	Representativeness (part)
Ecological context	Buffering; Surrounding landscape and boundaries (part)	Landscape integrity
Sustainability	Long-term viability; Size and shape; Buffering, surrounding landscape and boundaries (part); Naturalness (part)	Sustainability Amenity and utility (part)

the context of RMA Section 6(c).

We propose that a site is assessed first against the three site criteria, and scored as positive or negative for each. If there is a positive for any one criterion, it is then assessed against the sustainability criterion. A site is considered "significant" if it is positive for one or more site criteria, and positive for the sustainability criterion. If the site has no positive site criteria, or if it has positive site criteria, but negative for sustainability, then it is not considered to be a "significant natural area" in terms of the RMA Section 6(c). However, it could still have value for cultural, landscape, amenity, historical or scientific reasons, as well as potential for restoration. It could still warrant special management, and may well be considered in any landscape ecology approach to planning or restoration.

Rarity and distinctiveness

Rarity and distinctiveness refer to the presence of unusual species within a site. Rarity refers to the presence of species that are uncommon at a particular spatial scale. Rarity is assessed using a classification system such as that developed by the IUCN and used in their Red Lists and Red Data Books. In New Zealand the IUCN system has been modified to reflect the local situation (de Lange and Norton, 1998; Molloy *et al.*, 2002). The presence of species listed in classifications such as these provide a trigger for including a site in a significance assessment.

Distinctiveness refers to unusual species at a site (e.g. the presence of a nationally common species at a distributional limit) or to the presence of species that are otherwise uncommon within an area. Distinctive species may or may not be rare nationally, and they can be common nationally and rare locally. The assessment of distinctiveness is harder than for rarity and must be based on a good understanding of species and habitat distributions. Factors to consider in assessing distinctiveness include the presence of a species at its national distributional limit, which only occurs in that area (e.g. an endemic species), or is particularly uncommon in the study area (e.g., TLA area or ecological district), although it may well be common elsewhere.

In significance assessment, the joint criterion of rarity/distinctiveness can be assessed in an objective manner, with the criterion either being relevant or not relevant.

Definition

A site is considered positive for the rarity/distinctiveness criterion if it is known to support a species that is listed as Acutely Threatened in the current version of the New Zealand Threat Classification System (Molloy *et al.*, 2002), or supports a species that:

- is at a national distributional limit;
- only occurs in that area (e.g. an endemic species);
- although common elsewhere, is particularly uncommon in the study area.

Representativeness

Representativeness is considered one of the most important criteria for any assessment of significance (Usher, 1986; O'Connor *et al.*, 1990). The concept of representativeness is based on the notion that a reserve system should contain the full range of natural ecosystem variation characteristic of an area (Austin and Margules, 1986; Kelly and Park, 1986). Representativeness is based on comparisons with the natural character of the landscape (i.e. prior to recent human impacts; O'Connor *et al.*, 1990). A commonly used measure of representativeness is to compare ecosystem pattern in the present landscape with that which existed at some time in the past (e.g. prior to

recent human impacts associated with European settlement). This comparative approach provides an evaluation of how much the landscape has changed.

Two steps are involved in assessing representativeness. The first involves developing a biogeographical framework within which to assess representativeness. In New Zealand there has been reliance on the Ecological Regions and Districts classification (McEwen, 1987) for this. The second step involves an assessment of the past and current extents of natural ecosystems that occurred in the area prior to recent human impacts. Assessing past extent can be difficult, especially in highly-modified environments, but is necessary to estimate how representative current patterns are of past patterns. Evaluation of past extent can be based on broad landscape and bioclimatic units or derived ecosystem classification systems such as Land Environments of New Zealand (LENZ; Leathwick *et al.*, 2003), historical records and palaeoecological information (Strittholt and Boerner, 1995; Leathwick, 2001). Current extent can be assessed from satellite imagery (e.g. the Land Cover Data Base in New Zealand), aerial photography and ecological survey (Caicco *et al.*, 1995; Awimbo *et al.*, 1996). Once past and current extents of natural ecosystems have been assessed it is then possible to calculate how representative the current extent of different ecosystems are of their historical extent; the most significant ecosystems in terms of conservation evaluation are those that are least well represented in the modern landscape.

One of the problems of assessing representativeness is in deciding at what level an ecosystem type is "under-represented" (Norton, 1999). Molloy and Forde (1980) and O'Connor *et al.* (1990) suggest that a minimum goal for New Zealand should be the protection of at least 10% of each broad landscape or habitat class, so any ecosystem for which less than 10% remains would be considered under-represented. While it might be politically expedient for an agency or government to set targets to protect natural areas for conservation, such targets are of little value in themselves unless they take into account the spatial arrangement of ecosystems. We suggest that any ecosystem that has been reduced to less than 10–20% of its original extent should be carefully considered in terms of this criterion. Clearly the size and spatial arrangement of the individual patches of a depleted ecosystem type will need to be considered when deciding which areas are significant. Miller and Wells (2003) suggest that an area where an under-represented vegetation type is regenerating, even among exotic species, may still be considered significant. The "quality" aspect of representativeness is addressed through the sustainability criterion.

In significance assessment, the criterion of representativeness can be evaluated in an objective manner by taking advantage of modern computer mapping technologies, but the final decision of whether a particular ecosystem is under-represented requires a good knowledge of ecosystem pattern within the area of interest and within adjacent areas.

Definition

An area is considered positive for the representativeness criterion if it:

- supports an ecosystem that is now at less than *c.*10% of its former extent in the ecological district; or
- supports a high quality example of an ecosystem that is now at less than *c.*20% of its former extent in the ecological district.

The exact percentages in these cases should be determined for each ecological district at the time of assessment.

Ecological context

A remnant ecosystem patch does not occur in isolation. It is part of a larger landscape with which it interacts or connects in a variety of ways (Forman, 1995). These connections are critical for the functioning of ecosystems and habitats. They may be direct physical connections, such as a stream flowing into a wetland, or more complex links that involve transfers between different parts of the landscape (such as the transfer of genetic information through pollen and seed movement, seasonal migrations or species dispersal). Individual remnant patches are strongly affected by the surrounding environment, and many of the species that occur in these patches also make use of the surrounding environment. Ecological context is likely to be particularly important for animals that are able to actively move between patches and make use of corridors. Ecological context is important in assessing waterways, which are linear systems, and which are dependent on the wider catchment for maintaining their conditions (e.g. nutrient levels). It is also a valuable surrogate in assessing the value of an area to mobile animals that might not be present at the time of survey. We believe that a full assessment of ecological context encompasses the identification of significant habitats of indigenous fauna if correctly applied. For example, if a particular grove of trees provides a critical seasonal food resource for an indigenous bird it could be considered significant under this criterion (*cf.* Miller, 2000).

Three aspects of ecological context are particularly relevant when assessing the significance of a site; the potential to provide buffering to another site, the potential to enhance connectivity between sites, and

the provision of critical resources for a species. Edges, which can extend for more than 100 m into forest remnants, are the contact zone between a remnant and its surrounding environment, and are typically warmer, windier, and drier than interior sites and as a result are dominated by plants and animals typical of disturbed sites, rather than of interior sites (Murcia, 1995). A site might be considered significant because it reduces edge effects in an adjacent site. The viability of fragmented natural systems also often depends on maintaining links or connectivity between remnants. While there has been considerable debate over the importance of connectivity and corridors in the conservation literature (e.g. Hobbs, 1992; Simberloff *et al.*, 1992), we believe the value of linking habitats along which animals can move is clear cut. Because of habitat loss, some animal species may be dependent on resources in particular parts of the landscape at particular times of the year (e.g. kowhai flowers provide nectar for kereru in spring). The viability of species and populations is therefore dependent on the long-term sustainability of these resources (*cf.* Miller 2000). A site might therefore be considered significant because of its ecological context, even though it might not be an under-represented ecosystem or contain rare or distinctive species. Such a site need not be dominated by indigenous vegetation. A site dominated by exotic species might be considered significant because of its ecological context and the habitat values it provides (e.g. a pine plantation surrounding a key native forest remnant; Norton, 1998).

The assessment of ecological context is more difficult than assessment of representativeness or rarity/distinctiveness, since there is no clear cut number, area or quality that can be set as a threshold for a positive evaluation. The assessment must be made for each area considering ecological patterns within and around that site, and the ecological requirements of the individual species that are most likely to be affected by that context. The key factor in using ecological context as an evaluation criterion is the actual or potential role the site performs for particular indigenous species.

Definition

An area is positive for the ecological context criterion if it:

- enhances connectivity between patches; or
- buffers or similarly enhances the ecological values of a specific site of value; or
- provides seasonal or "core" habitat for specific indigenous species.

Sustainability

Sustainability is a secondary criterion or qualifier for the three criteria described above. This, we believe, is where Section 5 of the RMA is addressed and where there is a critical difference from significance assessment under the Reserves Act. Sustainability relates to the likely future condition of a site, including its ability to retain the ecological values that have been identified (e.g. the presence of rare species) and/or its potential to better provide for particular values in the future (e.g. the potential of a weed infested forest remnant to provide future habitat for key threatened species). In this respect it could be considered as a measure of the ecosystem functioning within a site. We believe that only those places where ecosystems are "working normally" should be considered as "significant" under Section 6(c). However, this can include appropriate management to sustain the values at the site.

If an area is identified as significant because its ecosystem type is under-represented, because it contains rare or distinctive species, or because of its ecological context, then under the sustainability criterion it also needs to have the potential to continue to be significant in the future (e.g. the site is able to sustain the rare species present). Sustainability, then, is not just about what is happening to a site at present, but includes what might happen to a site given appropriate management. Applying the sustainability test provides an assessment of the extent to which ecosystems are functioning and provides guidance on values under threat, and management options for these values.

Assessment of sustainability requires a good understanding of the processes that are important in sustaining the ecological values of an area (e.g. disturbance regimes, nutrient and energy cycling, pollination and dispersal mutualisms). The sustainability of a natural area as habitat for indigenous species is not necessarily dependent on the exclusion of productive uses (e.g. agriculture); sustainability may be more dependent on maintaining the current management regime than excluding such management (e.g. grazing of some tussock grasslands). Factors that should be considered when assessing sustainability include: type of ecosystems, habitats, species present and their ecological requirements; presence of disturbance, including plant and animal pests, management activities (e.g. stock grazing, extent of fences, water extraction or discharges); size and shape of area; isolation; conservation management required to achieve self-sustainability.

In significance assessment, application of the sustainability criterion is relatively objective. Based on the assessor's knowledge of the ecosystem in question and the threats (past, present and potential) that the site experiences, it is possible to assess the site as positive (values sustainable) or negative (not sustainable) for this criterion.

Definition

A site is considered positive for the sustainability criterion if:

- key ecological processes remain viable or still influence the site; and
- the key ecosystems within the site are known to be or are likely to be resilient to existing or potential threats under some realistic level of management activity; and
- existing or potential land and water uses in the area around the site could be feasibly modified to protect ecological values.

Scale and the assessment of significance

Significance can not be assessed independently of scale. What is significant at one spatial scale may not be significant at another. For example, many birds and reptiles (e.g. saddleback and tuatara) are nationally very uncommon, but can be locally common on individual island refuges. Conversely, some nationally common species such as bellbird can be locally very uncommon (e.g. in the Auckland area). Spatial scale has been a key consideration in ecological evaluation in New Zealand for many years (Kelly and Park, 1986; O'Connor *et al.*, 1990) and the development of the ecological district framework in the 1970s was based on a realisation that ecological evaluation needed to be undertaken with reference to spatial scale. The ecological region and district framework (McEwen, 1987) has been widely used by ecologists as the basis for ecological research and environmental management and is commonly used as the spatial scale of reference for assessing representativeness within district plans.

Ecological districts do not, however, always match local authority boundaries. For example, the local authority area of Waikato District encompasses five ecological districts which lie in two ecological regions, and extend beyond the local authority boundary. However, in other cases local authority boundaries are similar to ecological district boundaries. For example, Banks Peninsula District covers the majority of the Banks Ecological Region, including the Akaroa, Herbert and part of the Port Hills Ecological Districts. Ecological districts provide the most logical spatial scale at which to assess ecological significance and have been used widely for this (e.g. within the Auckland Region, individual TLAs have undertaken significance assessments using ecological district boundaries). When one ecological district lies in two local authority areas some co-operation and cross boundary considerations will need to be made.

It has, however, been suggested that the assessment of significance should be based on the LENZ classification (Leathwick *et al.*, 2003) rather than ecological districts (e.g. W.G. Lee, Landcare Research, Dunedin, unpublished evidence presented to the Environment Court for the Royal Forest and Bird Protection Society [RMA500A/00]). This view has arisen through a misunderstanding of the basis and purposes of the LENZ classification. The LENZ classification is based on computer modelling of a range of climatic, substrate and landform attributes to generate a series of land units (environments) that are internally consistent for these attributes but differ from other land environments. The system is hierarchical, with the classification developed at four nested spatial scales comprising 20, 100, 200 and 500 land environments. Individual land environments are usually not spatially discrete areas and can occur over a substantial area of New Zealand depending on the classification scale. Land environments are an approximation of potential ecosystem character. As such their value for significance assessment lies not as a scale of reference but as an approximation of what ecosystem pattern might have been prior to human settlement. The LENZ classification is therefore a key component in the assessment of representativeness.

Application

The ways in which these criteria are applied in assessing significance will vary depending on the local situation. The following example is based on an assessment of significance on the west coast of New Zealand's South Island (Smith and Norton, 2001). In this study the approach taken to identifying significance involved three main steps:

(1) Remote sensing (satellite images and aerial photos) and information technology (GIS) was used initially to identify those ecosystems that had been most affected by human actions (*representativeness*). At the same time, published and unpublished information on the distribution of rare species was obtained (*rarity and distinctiveness*) giving some assessment of qualitative change as well as providing information about two other criteria. Based on the information from these assessments, an initial list of sites that might be considered as significant within the study area was produced.

(2) A field check was undertaken to confirm that these sites did exist (e.g. they hadn't been cleared or drained) and that they comprised the ecosystem types that the GIS analysis indicated. Sites were surveyed from public roads and other public vantage points, and from the air. The criteria of *ecological context* and *sustainability* were also assessed at this stage. Based on the field check, a list of "possible" significant

natural areas (SNAs) was produced. The term "possible" was specifically used to describe them as there had not been any formal site visits at this stage to confirm the values present.

(3) The "possible" SNA list was then used as the basis for discussions with landowners and comprehensive site assessments of all sites. This involved visits by local authority staff and elected representatives to landowners explaining what the significance assessment process involved, why a site had been identified on their property, and the implications this identification had for the land owner. At the same time an ecologist undertook a detailed site assessment. Following this, a formal SNA list for use in local authority planning, including reports on individual SNAs, was produced.

Conclusions

The assessment of significance on private land is an important component of private land biodiversity conservation (Norton and Miller, 2000). We have outlined an approach to significance assessment in this paper that we have found to work well in the New Zealand situation. However, as with all approaches to significance assessment it is not perfect and relies on the experience of the ecologist(s) undertaking the assessment. Nonetheless we believe this approach provides a robust and efficient method for significance assessment and one that can be widely applied within New Zealand and elsewhere. The strengths of this approach are the inclusion of criteria that focus on three key levels of biological organisation (namely landscape, ecosystem and species), and a strong reliance on the objective criteria of rarity/distinctiveness and representativeness.

In implementing the approach outlined here we believe it is fundamentally important that TLAs: clearly distinguish between the objective ecological process of significance assessment and the more subjective planning and social processes of providing for protection; continue to use the ecological district classification as their primary scale of reference; use the LENZ classification system as the basis for assessing representativeness; and manage ecological values under Section 5 RMA in a wide range of activities.

We believe that the approach outlined in this paper meets the requirements of the RMA Section 6(c) and can thus assist local authorities to make a rigorous appraisal of ecological values in their district or region that complements existing work carried out on the public conservation estate.

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