FORUM ARTICLE

Halting indigenous biodiversity decline: ambiguity, equity, and outcomes in RMA assessment of significance

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Published on-line: 27 August 2008

Abstract: In New Zealand, assessment of 'significance' is undertaken to give effect to a legal requirement for local authorities to provide for protection of significant sites under the Resource Management Act (1991). The ambiguity of the statute enables different interests to define significance according to their goals: vested interests (developers), local authorities, and non-vested interests in pursuit of protection of environmental public goods may advance different definitions. We examine two sets of criteria used for assessment of significance for biological diversity under the Act. Criteria adapted from the 1980s Protected Natural Areas Programme are inadequate to achieve the maintenance of biological diversity if ranking is used to identify only highest priority sites. Norton and Roper-Lindsay (2004) propose a narrow definition of significance, and criteria that identify only a few high-quality sites as significant. Both sets are likely to serve the interests of developers and local authorities, but place the penalty of uncertainty on non-vested interests seeking to maintain biological diversity, and are likely to exacerbate the decline of biological diversity and the loss of landscape-scale processes required for its persistence. When adopting criteria for assessment of significance, we suggest local authorities should consider whose interests are served by different criteria sets, and who will bear the penalty of uncertainty regarding biological diversity outcomes. They should also ask whether significance criteria are adequate, and sufficiently robust to the uncertainty inherent in the assessment of natural values, to halt the decline of indigenous biological diversity.

Keywords: collective action; conservation evaluation; interests; precautionary principle; representativeness; uncertainty

Introduction

Significance assessment in the RMA

In New Zealand, the Resource Management Act (1991) (hereafter RMA) is the major statute for agency-based decision-makers determining whether indigenous habitats and ecosystems on private land may be cleared or protected against harm. Assessment of 'significance' is central to this determination. Agencies with statutory functions under the Act are required by Section 6(c), as a matter 'of national importance', to recognise and provide for the protection of 'areas of significant indigenous vegetation and significant habitats of indigenous fauna'. This responsibility is assigned to local authorities (territorial authorities, regional councils and unitary authorities), who must provide for the protection of significant areas in their districts or regions. Section 6(c) is not the only part of the RMA relating to the maintenance and protection of indigenous biological diversity (see for example §5(2)(b), §7(d), §30, and §31) but is particularly important because developers may be granted consent to destroy or modify sites deemed not to contain significant values, or when negative impacts on significant sites are considered to be adequately mitigated.

New Zealand Biodiversity Strategy goal for indigenous biodiversity

The worldwide decline of biological diversity is a result of loss and simplification of ecosystems by human activities and intensive land uses. Habitat destruction results in total loss of some ecosystem and habitat types from landscapes, and degrades ecosystem functions and processes through fragmentation and the removal of ecological connections, sequences, and ecotones. Depending on the species, it may take a substantial length of time before adverse consequences of ecosystem and habitat loss and fragmentation affect local and regional species richness (Helm et al. 2006). As Tilman et al. (1994) put it: 'because such extinctions occur generations after fragmentation, they represent a debt—a future ecological cost of current habitat destruction'.

Most of New Zealand's coastal, lowland, and montane terrestrial environments have undergone extensive clearance and modification of indigenous ecosystems, and loss has been extreme (>90%) in environments over nearly a quarter of the total land area (Walker et al. 2006). These landscapes are committed to further loss of biological diversity. Ongoing clearance of indigenous habitat (Green & Clarkson 2005; Walker et al. 2006) will exacerbate the loss and '…the more fragmented a habitat already is, the greater is the number of extinctions caused by added destruction' (Tilman et al. 1994). Pests and weeds ('our second historical legacy'; Ministry for the Environment (MfE) 1997) compound this problem.

The ongoing loss of New Zealand's indigenous biological diversity has recently been the subject of a national strategy (the New Zealand Biodiversity Strategy or NZBS; DOC & MfE 2000), which also represents New Zealand's obligation under the international Convention on Biological Diversity. Goal Three of the NZBS is to 'Halt the decline of New Zealand's indigenous biodiversity'.

The NZBS addresses all branches, levels, and agencies of government in New Zealand (p. 127). It identifies local authorities as key players in its implementation (p. 120) and assigns responsibility to them for a range of specific actions (e.g. pp. 41–44: land; 52–54: freshwater; 96–97: Maori; 102–103: community participation and awareness; 111–113: information, knowledge and capacity). The NZBS observes (p. 37): '[RMA] provisions to promote the protection of significant indigenous vegetation and habitats have not been effectively implemented across New Zealand'. One explanation offered is 'difficulties in defining the meaning of "significant"'.

In this paper, we discuss the source of these difficulties. Our approach combines theoretical perspectives from both ecological and social science. More specifically, we follow Brower (2008) in combining several theories about how interests compete in public policy debates (Downs 1957; Schattschneider 1960; Olson 1965; Stone 2001; McFarland 2004). We begin by considering that these difficulties arise from ambiguity in the RMA. In general, we argue that there are many ways to define significance legally and technically; and each interest group is likely to define significance differently, in a manner consistent with its goals (whether those goals be development, jobs, water provision, biodiversity protection, carbon sequestration, or heritage conservation). Similar to Salzman and Ruhl (2000), we describe the various interests involved in significance assessment. We then take two sets of significance assessment criteria as cases for examination. We ask the following questions: Who benefits? Who loses? Who bears the cost and the risk of something going awry? Will these criteria maintain indigenous biological diversity in New Zealand, or will they exacerbate its loss?

Difficulties in defining the meaning of significance

Ambiguity in the RMA

Some assert that there are 'objective and neutral standards of evaluation that…come from a vantage point outside politics, untainted by the interests of political players' (Stone 2001, p. 12). However, many others have recognised that analytical standards used to define problems, set policy goals, and assess solutions are neither neutral nor objective, but politically constructed (e.g. Stone 2001, p. xii).

There are few policy areas more contentious than the ability of individuals and corporations to exploit, modify, or destroy natural resources. In politically polarised areas such as these, public-policy makers and legislators may employ ambiguity to achieve general acceptance (Palmer 1995, pp. 61–62; Stone 2001, pp.157–162, 243–-245; Pardy 2005, p. 34). Ambiguity yields statutes and regulations obscure enough to please all parties, vague enough to be unenforcable, and so ill-defined that failures to implement the policy will be difficult to detect and impossible to litigate. Ambiguous policies sound lofty but may accomplish little (Edelman 1960).

Murray and Swaffield (1994) illuminate four foundational 'myths' of the RMA. First, they suggest the term 'resource' is culturally constructed (an ecological entity only takes meaning as a resource when it has been classified and recognised for potential use by humans) and anachronistic (evoking familiar, positive images of a cultural heritage based on resource exploitation). They point out that the term 'resource' departs from the ecological view of ecosystems as complex, interdependent webs (rather than discrete exploitable elements) and hides the threat this ecological view poses for development interests 'in so far as it may require stronger limits on resource exploitation' (p. 49). Next, they propose that the term 'sustainable management' enables a diversity of irreconcilably different interests to express support for shared ideals (e.g. 'wellbeing', 'responsibility to future generations'; also see Noss 1991) while maintaining their own particular interpretations of its meaning (see Saunders 1990; Elder 1991, p. 834; Gowdy 2000; Kashian 2005, p. 1026). Third, they suggest that the RMA advances the myth of 'integration', and evades acknowledgment of the 'critical tradeoffs' (p. 50) required to undertake use and development *while* meeting needs of future generations, safeguarding ecosystems, and avoiding adverse effects on the environment. Fourth, they make the case that the RMA espouses the anachronistic '1960s myth' of rational decision-making (see also Stone 2001, pp. 12 & 232–257) and 'disguises the socially contentious nature of both scientific prediction and rational planning' (Murray & Swaffield 1994, p. 50). In practice, RMA trade-offs are often mentioned (but in positive terms, e.g. 'balance'), and discretionary, subjective, case-by-case decisions about balance are supported by neither objective environmental bottom lines nor substantive rights for affected parties (Pardy 1997, 2005; Armstrong 2001).

The RMA is consistently and 'remarkably' (Murray & Swaffield 1994, p. 50) evasive on just how its fundamental conflicts are to be reconciled, and (following a pattern often observed in ambiguous statutes; Stone 2001, p. 43) devolves the resolution of these conflicts to local government. The RMA provides no definition of 'significance'. In its absence, different interests may write their different interpretations of significance, and those interpretations can and do vary considerably.

Interests in determining significance

Competing interests

Determination of significance under the RMA usually involves three factions: vested interests (interests with a measurable financial stake in the outcome of a policy decision), agencies, and non-vested-interest parties. These parties (groups of individuals that are not necessarily organised, referred to as 'interests') have different goals, and according to their vision of what is best, each interest is likely to propose different definitions and solutions (Stone 2001, p. 12). Our analysis of interests below relies on the assumptions of rational choice theory (e.g. Downs 1957): that an individual is informed enough to determine what her goals are, rational in her thoughts and competent in her actions, and will act in a way to further her goals.

Vested interests

Where developers have a financial interest in gaining approval (resource consent) to exploit, destroy, or modify indigenous ecosystems and species, they and their advocates are vested interests. In the process of significance assessment, vested development interests seek development consent and the ensuing profit. Their primary interest is not protection of the environment and biological diversity, but development (Salzman & Ruhl 2000, p. 675). Indeed in many cases, protection of biological diversity will stand in direct conflict with development.

The vested development interest will prefer a narrow definition of significance that sets high bars or thresholds; in other words, they are likely to advocate for significance criteria that are difficult to attain. Narrow definitions are also attractive to the development interest because they set high thresholds for the recognition of environmental harm. If significance and seriousness of harm are difficult to establish, little will be off-limits to development.

In advocating for narrow significance criteria, which place the burden of proof of environmental harm elsewhere, vested interests often assert that their enterprise is public spirited and that their preferred outcome adds to social, economic and/or cultural well-being. Stone (2001, p. 29) describes this as 'classic political strategy, captured in the famous assertion by Charles Wilson that "what's good for General Motors is good for the country"'. When defending their stance, advocates of narrow criteria may also strategically attempt to contain an issue by defining it in narrow terms, failing to mention (or even denying) links to other problems, and treating the issue in isolation (e.g. Schattschneider 1960; Pralle 2006, pp. 15–16). Finally, they may attempt to limit participation and restrict access to the debate, e.g. by defining a high level of expertise as a requirement to participate in the debate (see Schattscheider 1960; Pralle 2006, p. 51).

Local authorities

Local authorities (district and regional councils and unitary authorities) are elected, and many expect them to act on behalf of a broad range of constituents, despite much evidence that this is the exception rather than the norm (e.g. Downs 1957; Niskanen 1971). For example, some might expect local authorities, given their statutory role, to maximise a public good such as biological diversity by minimising development consents that adversely affect it. In actuality, developers and regulatory authorities often want the same thing (see Salzman & Ruhl 2000) and their interests and desires often differ from those of their electorate (see Downs 1957). The coincidence of interests between developers, elected officials, and public agency staff is so frequent and flagrant that there is a rich lexicon of common phrases (e.g. the fox guarding the henhouse) and various technical terms to describe it (co-optation and agency capture (Selznick 1949); the iron triangle (McConnell 1966; Lowi 1979); regulatory capture (Levine 1998)).

There are many reasons why developers, councillors, and local authority staff would favour development – and hence narrow definitions of significance that set high bars or thresholds – at the expense of biological diversity. Local authorities may favour such criteria in part because loss of biological diversity is less measurable (Green & Clarkson 2005) and visible than local or regional economic growth. Also, consents may function as 'political steam valves' (Salzman & Ruhl 2000, p. 678) that dissipate pressures on agencies from vested interests in such forms as litigation or public pressure through media attention. Criteria that simplify assessment and reduce the scope of what is significant may also be attractive for local authorities because this will minimise their assessment, conservation, and protection duties. Thus, without implying that this outcome is universal (in practice there is considerable variation in this area, and some councils have comprehensive inclusive significance criteria), or that corruption, conspiracy, or intentional collusion are to blame, there are persuasive reasons why both agencies and developers may promote narrow significance criteria, even when this means environmental harm (Salzman & Ruhl 2000, p. 678).

Non-vested biodiversity protection interests

Those wishing to maintain biological diversity have little or no *financial* stake in the outcome. These non-vested interests would prefer criteria that are broad enough to include the full suite of features that are (or may be) important for maintaining and restoring biological diversity into the future.

Because natural systems are exceptionally complex, and knowledge is incomplete, assessment of biodiversity 'value' (the degree of importance for maintaining biological diversity) will remain uncertain and imprecise (Myers 1993). The preference of the non-vested biodiversity interest is for significance assessment criteria that are robust to this uncertainty ('robustly fair' in the sense of Moilanen et al. (2008), that the probability of net environmental harm is small). Such criteria would reliably err on the side of caution, applying the precautionary principle (Raffensperger & Tickner 1999) to place the burden of uncertainty of harm in the issuing of consents on the developer. This requires thresholds for significance assessment that are inclusive and low, rather than exclusive and high.

Two sets of significance criteria

To what extent have the different desires and interpretations of different interests shaped definitions of significance for biological diversity in New Zealand? To answer this question, we next examine two sets of criteria that have been used to determine the significance of indigenous biological diversity in relation to Section 6(c) of the RMA. We discuss how they have expressed their different ideals, goals and problems – and the adequacy of their solutions for achieving the maintenance of biological diversity.

Criteria from the PNAP: 'An urgent task of national importance'

New Zealand's Protected Natural Areas Programme (hereafter PNAP) commenced in the 1980s as an emergency response to visible and rapid disappearance of indigenous landscapes, habitats, and communities caused by government subsidies for land development in the 1970s and early 1980s (Kelly 1980; Kelly & Park 1986). Criteria for ecological evaluation used in the PNAP (Myers et al. 1987) drew on earlier work in New Zealand and research in Europe and North America (e.g. Ratcliffe 1971, 1977; Tans 1974; Gehlback 1975) and have been adapted for assessment of 'significance' under the RMA by Whaley et al. (1995) and others.

Criteria were used to evaluate natural areas in the PNAP in two phases: the first phase involved rapid ecological survey of ecological districts (McEwen 1987) to identify what natural areas remained, while the second phase ranked the areas to identify the 'best, or most representative' examples as priorities for protection (Kelly & Park 1986, pp. 26, 43). There is a manifest tension between the two phases.

The goal of the PNAP derives from the Reserves Act (1977) '...ensuring, as far as possible, the survival of all indigenous species of fauna and flora, both rare and commonplace, in their natural communities and habitats…'. Kelly & Park (1986, p. 28) articulated this goal as maintaining 'natural characteristics, component species and gene pools, and ecological and evolutionary processes'.

The principal PNAP criteria (*representativeness, rarity and special features*) seem to attempt to address this goal and the problem of rapid clearance and decline. They are inclusive in scope. For example, when interpreting *representativeness*, Kelly & Park (1986) were concerned with maintaining natural ecological processes and patterns in time and space, including typical and commonplace ecosystems, as well as the rare and threatened. They recognised the importance of maintaining 'ecological patterns that occur along the major environmental gradients of a district', 'places where ecological succession will eventually lead to a vegetation approximating the original', and 'vegetation that has been substantially modified' (p. 28). They interpreted the concept of 'original' according to an enabling 'longer view' as 'things taken together [that] make New Zealand distinctive' (p. 29). The *rarity and special features* criterion was broad, including distinctive 'communities', 'ecotones, mosaics and sequences etc.' (Myers et al. 1987, p. 60). The scientists developing the PNAP criteria also engaged explicitly with the problem of reserve adequacy and minimum areas: Kelly (1980, p. 80) proposed that where possible a high-quality '10% of the original area of each broad landscape and habitat class should be preserved'. We note that Kelly (1980, p. 80) accepted that protection of such a modest proportion would ultimately halve the variety of species able to survive.

However, second-phase PNAP criteria address the different problem of how to accommodate development interests. The solution was to rank sites and focus attention on 'best examples' – encapsulated in the slogan 'Help Protect the Best of What Remains' (Commission for the Environment 1985). Kelly and others recognised a direct conflict between ranking and the goal of persistence, and stated their discomfort, e.g.

> There is widespread fear in conservation circles that selection or 'ranking' procedures tend to focus on the few best natural areas, and cast aside the rest as unimportant. We believe this fear is a real one. Ideally, the PNA Programme should facilitate landscape conservation by presenting information that illustrates the landscape value of **all** natural areas, particularly in those districts where few natural areas remain. In practice, however, the pressure of market forces requires a selection to be made. There is, in fact, an implicit risk that the PNA Programme could actually work **against** the quality of the overall natural landscape of a district, if in its implementation, its focus was only on the few top priority places for representative reservation (Kelly & Park 1986, p. 26).

Despite those ideals and concerns (see also Myers et al. 1987, p. 56), secondary ranking criteria (*naturalness, long-term ecological viability, size and shape, buffering and surrounding landscape*) were applied in the PNAP to exclude all but the 'best, or most representative examples' (Kelly & Park 1986, p. 26), a 'key site' and/or 'at least one adequate sample' (Kelly 1980, p. 85). Representative value of an ecological unit was considered to be high if <10% of that type remained (Myers et al. 1987, p. 67), but there was no stated goal to protect the minimum baseline suggested by Kelly (1980) of 10% of original extent of each ecosystem type. In application, the PNAP, at least in the 1980s, focused on the 'highest rated sites' of each type as 'priorities for future conservation effort' (Myers et al. 1987, p. 73).

The priority-site approach, and PNAP secondary criteria, were applied less strictly in later PNAP surveys, due to increased awareness of the scarcity of indigenous biological diversity in many landscapes, and better scientific understanding of the importance of even small and modified habitat remnants; for example for the survival of mobile species such as kererū (e.g. Clout & Craig 1998; Spurr & Anderson 2004) and invertebrates (e.g. Kuschel 1990). Yet where PNAP criteria have been adapted for significance assessment in the RMA, the 'best examples' idea appears often to have been adopted without questioning its adequacy or suitability for maintaining biological diversity. For example, local authorities have applied both inclusive and ranking criteria from the PNAP to identify significant sites, while elsewhere PNAP priority-site lists have been transferred wholesale to schedules of significant sites. In these cases, the tacit goal of significance assessment is unlikely to be the maintenance of biological diversity, and more likely to be the minimisation of transaction costs for local authorities and accommodation of development interests.

Criteria from Norton & Roper-Lindsay (2004): 'The cream philosophy'

Norton and Roper-Lindsay (2004) proposed a different set of significance assessment criteria for the RMA. As they explained, their proposal ('the cream philosophy') is based on their vision of an ideal world:

> In an ideal world we believe sites identified as being ecologically significant…should be the cream of the District or Region's biodiversity values—the best areas containing high biodiversity values and exhibiting a good range of healthy ecosystem processes. The threshold for each criterion should therefore be high. Accordingly there may be very few or even no sites identified as SNAs [Significant Natural Areas] on private land in an area where there has been widespread and intensive damage or loss of biodiversity values (such as the Waikato, perhaps?) (Roper-Lindsay & Norton 2005, p. 3).

Norton and Roper-Lindsay (2004) do not discuss the goal of maintaining indigenous biological diversity for present and future generations. The NZBS, which pre-dates their paper by four years, is not mentioned, nor is the problem of global or national loss of biological diversity, nor its causes. As their goal Norton and Roper-Lindsay (2004) most often refer to 'sustainable management' (pp. 295, 298). But as Murray and Swaffield (1994, p. 49) would predict, theirs is a 'particular' interpretation of this ambiguous term. Use and development appear to be included, but protection is not envisaged, at least not if protection entails discontinuation of land uses such as grazing (p. 297). Although no limitation on protection from harm is prescribed in the RMA or judicial precedent, Norton and Roper-Lindsay (2004) represent such a form of protection ('reservation') as 'lock-up' (p. 298).

The problem for significance assessment identified by Norton and Roper-Lindsay (2004, p. 295) is to evaluate the relative importance of the 'values' at one site compared with another. In other words, the problem they perceive is how to exclude some areas that may be important for maintaining indigenous biological diversity, in order to identify a set of *priority* areas, which they suggest are the only *significant* areas. They do not mention long-term maintenance of ecosystems and indigenous biological diversity, nor explain how their criteria will be adequate to sustain and safeguard biological diversity now and in future. In a later explanation (Roper-Lindsay & Norton 2005, p. 4) they appear to recommend that these goals, problems and purposes of the Act are dealt with by other, unspecified, 'more comprehensive approaches'.

Norton and Roper-Lindsay (2004) propose four significance criteria as a solution to their goal and problem. Their first criterion (*rarity and distinctiveness*) is not inclusive but is restricted to species. They propose that a site is significant only if it contains a species that is classified as acutely threatened and hence close to extinction (i.e. nationally critical, nationally endangered, or nationally vulnerable; Molloy et al. 2002), a species at (and not just near) its national distribution limit, and that is endemic, or particularly uncommon in the study area (they do not define 'study area').

The *representativeness* criterion of Norton and Roper-Lindsay (2004) is restricted to ecosystems already reduced to extreme scarcity in the landscape. They must also be 'natural' ecosystems (pp. 299, 300), which for them means having occurred in New Zealand 'prior to recent human impacts'. No definitive threshold for scarcity is suggested. Once an expert has judged that an ecosystem is 'natural' and reduced to less than 10–20% of its subjectively assessed former extent, they propose it would be more valuable (and less expedient) for an expert to consider the 'size and spatial arrangement of the individual patches…when deciding which areas are significant'. The third criterion of Norton and Roper-Lindsay (2004) (*ecological context*) might identify as significant many areas that are important for the maintenance of biological diversity.

It may matter little whether sites exceed recommended thresholds and meet qualifications for significance in the first three criteria or not, for Norton and Roper-Lindsay (2004) then propose *sustainability* as an overriding qualifier. They propose the only significant sites are places where an expert deems the ecosystem to be 'working normally', with 'ability to retain the ecological values that have been identified' (p. 301). If 'working normally' is interpreted by the expert as proximity to a state 'prior to recent human impacts', it is most unlikely that any ecosystem reduced to scarcity (representative by their criterion), or supporting species that are acutely threatened (rare and distinctive by their criterion), would be regarded as significant.

Thus, the criteria of Norton and Roper-Lindsay (2004) seem to be well designed to achieve an 'ideal world' where relatively few or possibly no sites are identified as significant. If sites deemed non-significant by these criteria were to be cleared, very little would remain of biological diversity in a local authority district.

Discussion

Equity in significance assessment for biodiversity

> …discussion among ecologists about ecological criteria to ensure that assessment focuses on ecological matters and not management or politics is good (Roper-Lindsay & Norton 2005, p. 4).

Development interests often have a strong, monetary incentive and , though few in number, are likely to dominate through superior organisation and persistence (this is 'the logic of collective action'; Olson 1965). Devolution of responsibility for significance assessment to numerous local authorities will promote this predisposition, for three reasons. First, devolution to local levels is likely to keep debate off the national radar, and hence contain the scope of debate (Pralle 2006, p. 29), which will tend to favour the status quo (Schattschneider 1960). Second, decentralisation tends to privilege local needs over national goals (see Duane 1997; Koontz 2002, cited in Pralle 2006, pp. 207–209), so vested interests are more likely to find sympathy at local authority levels than at the national level. Third, case-by-case definition resulting from devolution will make it more costly for a dispersed, non-vested interest to challenge development proposals and significance definitions.

Economics and political science thus predict that, on balance, preferences of vested development interests will dominate definitions of significance assessment emerging under regional and local devolution. They also predict that to limit public attention the vested interest will prefer that significance assessment is perceived as a narrow issue, restricted to ecological, not political, matters and limited to a comparison of one site versus another to determine whether or not it is 'the cream' within a district. In contrast, it would suit the goal of the non-vested interest to broaden the question and participation – to relate significance assessment for biological diversity to national and global concerns about its decline (Schattschneider 1960; see also Pralle 2006, p. 23).

We propose that the very first questions local authorities should consider when adopting biodiversity significance criteria involve equity – and therefore politics. They are: (1) 'Whose interest do these particular criteria serve?' and (2) 'Where do these criteria place the penalty of uncertainty?'

Whose interest do these criteria serve?

Narrow definitions of significance such as that proposed by Norton and Roper-Lindsay (2004) leave little off-limits to development. Assessments using ranking to identify best examples ('the cream') will also suit vested development interests. Authors of the PNAP criteria acknowledged the function of secondary (ranking) criteria to accommodate development interests, and stated their fear these would work against the future survival of ecosystems and species across the landscape. In contrast, Roper-Lindsay and Norton (2005) propose that 'the cream philosophy' will benefit biological diversity (and by extension non-vested interests who would prefer that biodiversity was maintained), because having many 'significant' sites might encourage local authorities to 'have no interest in management of areas outside the sites'.

We are not persuaded that what's good for developers is likely to be good for the country's biological diversity, or fair to those who prefer it maintained. Some of our misgivings involve the uncertainty burden, which we discuss shortly. But first, we explain on ecological grounds why broad, inclusive, and precautionary significance criteria would better serve the goals of non-vested interests wishing to maintain biological diversity.

We suggest biodiversity significance criteria serving vested interests can be recognised by two features: (1) high bars for significance and/or (2) qualifiers that are irrelevant to the goal of maintaining biological diversity, but would compromise this goal if disqualified sites were modified or destroyed by development. Pernicious qualifiers include:

(1) A requirement to rank sites and identify best examples. Whether or not a particular fragment is the 'best example' (Kelly & Park 1986, p. 26; Myers et al. 1987, p. 68) or 'the cream' (Norton & Roper-Lindsay 2004, p. 296; Roper-Lindsay & Norton 2005, p. 3) is irrelevant to the question of whether it is important for maintenance and persistence of biological diversity. Progressive elimination of less pristine remaining ecosystems in a fragmented landscape will compromise natural processes required for ecosystem and species persistence, and contribute strongly to the ongoing decline in biological diversity (Tilman et al. 1994; Cabeza & Moilanen 2001, 2003). A 'best examples' approach overlooks important biological diversity sustained by often small, highly modified remnants (Kuschel 1990; Clout & Craig 1998; Spurr & Anderson 2004). Finally, 'best examples', 'the cream', and ranking or scoring approaches all conflict with modern conservation planning principles developed internationally for efficient and effective conservation (Margules & Pressey 2000). They are inefficient because 'the cream' is usually a suite of intact but similar sites, rather than a full range of diversity (Pressey & Nicholls 1989), and they are ineffective because they give priority for protection to the habitats and species least vulnerable to threatening processes (see also (3) below).

(2) A significant site must be able to retain its values indefinitely. This idea, proposed as a ranking criterion by Myers et al. (1987) and promulgated by Norton & Roper-Lindsay (2004), seems to pre-date modern landscape and metapopulation ecology paradigms. As elaborated by Wallington et al. (2005), it perpetuates an outdated equilibrium concept and overlooks modern understanding of ecosystems and populations in landscapes as dynamic (non-equilibrium; e.g. DeAngelis & Waterhouse 1987) and interdependent (e.g. Hanski 1998). Because local species populations persist in a balance between extinction and colonisation of different habitat patches, and ecosystems are not naturally stable but change through time, there is no reason to expect particular values (e.g. a population of a species) to persist at a given site over ecological or evolutionary time, nor is persistence at a given site necessary to the survival and continued evolution of a species, population, or ecosystem. Survival and continued evolution of a species (its 'potential… to meet the reasonably foreseeable needs of future generations' (RMA §5)) may well depend on the protection of current habitat at a given site that may not sustain it at some point in the future. Currently unoccupied and transiently used habitats are also important. For example, Hanski (1998) states: 'Managers should absorb the key message of classic metapopulation dynamics: currently unoccupied habitat fragments may be critical for long-term persistence.'

Indigenous remnants in fragmented landscapes can be expected to lose species directionally (Tilman et al. 1994). Sustaining biodiversity here requires halting loss and restoring ecosystems; further loss reinforces and propagates the extinction debt being paid off. But the 'sustainability' and 'long-term ecological viability' qualifiers of Norton and Roper-Lindsay (2004) seem to suggest it may be wasteful, rather than ecologically prudent, to protect sites unlikely to retain certain values in future. History shows the idea that a resource unexploited is a resource wasted is a powerful idea (Hays 1959) with destructive consequences in natural resource management (e.g. in forestry 'sustainable management'; Langston 1995). In this case, a 'sustainability' criterion 'making the link to "sustainable management"' (Norton & Roper-Lindsay 2004, p. 298) appears to promote a feedback loop that grows extinction debt. We note that in 2004 the Environment Court rejected sustainability as a significance criterion (RMA A128-2004 [62–63])

(3) An ecosystem must be, or resemble, one that existed 'prior to recent human impacts'. This qualifier is also irrelevant to assessing a site's importance for maintaining biological diversity now and in the future. Ecosystems closely resembling pre-settlement states typically have little potential for commercial use and are cheaply available, but the biological diversity represented may be less urgently in need of protection from development than that in more modified ecosystems. Setting aside the question of whether any present ecosystem now remains in a state existing 'prior to recent human impacts', it is certainly important to protect sites that remain in 'healthy functioning states' (see (5) below). However, maintaining a high proportion of New Zealand's indigenous biological diversity, and particularly its most threatened species, often depends on the maintenance of highly modified (and usually more imminently threatened) ecosystems and habitats in landscapes where there is little or no trace of primary (i.e. pre-settlement) ecosystem character. Seral ecosystems, habitats, and communities, whether or

not resembling those prior to human settlement, are essential – and arguably *the* most important and major contributors in many places – for the maintenance of New Zealand's biological diversity today and into the future. They comprise diverse assemblages of indigenous species, provide habitat for the substantial portion of the indigenous biota that is absent from primary or old-growth communities, and their future recovery is needed to ameliorate the extinction debt in the landscape incurred by past habitat loss. This may be why Kelly & Park (1986, p. 28) suggested it 'would be wise to take a broad and enabling view of the concept "natural"'.

(4) A species must be acutely threatened, at the edge of its distribution, or endemic to that particular area for its habitat to warrant protection. Extinction debts may be paid off, and species predicaments revealed, many decades after the damage is done (e.g. Helm et al. 2006; Vellend et al. 2006). If the goal is to maintain biological diversity, it is necessary to protect and enhance habitats of species recognised to be declining, naturally rare, and/or locally endemic across their natural range before their decline becomes irreversible. High thresholds and qualifiers, such as those proposed by Norton and Roper-Lindsay (2004) for rarity and distinctiveness, provide a rationale to disregard the likely effects of ongoing clearance of many such species, including accelerated or precipitated declines, reduced genetic diversity (i.e. within-species biological diversity), lowered likelihood of long-term persistence, and/or loss of tractable opportunities for population recovery.

(5) A habitat or ecosystem type must be reduced to dire scarcity (e.g. 10–20% of its former extent). New Zealand's cooler, wetter, steeper and more remote environments have not been the primary focus of resource exploitation in the past. Protection of the less reduced primary and seral ecosystem types remaining in these places is fundamental to the maintenance of biological diversity, including the continued evolution of genetic and ecological diversity. Unlike those now reduced to scarcity, less reduced ecosystem types often form part of linked or intact elevation sequences and/or have less obstructed natural processes (e.g. pollination, seed dispersal, nutrient and moisture cycles, seasonal feeding and migration patterns, breeding, dispersal). Among other things, they provide habitats for species that require larger and more contiguous areas (e.g. large-bodied, host-dependent, narrow-range and/or habitat-specialist species), and sensitive species that require habitat that is of relatively high quality and/or buffered from pests or weeds. They may contain 'source' areas that some species populations depend upon for 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), so their removal can have disproportionate adverse flow-on effects.

Where do these criteria place the penalty of uncertainty?

> In salient respects, [the precautionary principle] applies to biodiversity more than to any other environmental problem (Myers 1993, p. 74).

In assessing significance for biological diversity, uncertainty needs to be managed by adopting precautionary, inclusive, and attainable criteria (low bars) if the goal is to guard against irreversible harm (Myers 1993; Kriebel et al. 2001).

As described above, environmental harm is invited by using high thresholds (or bars) and pernicious qualifiers to exclude all but 'the cream' from a suite of sites recognised to deserve protection. High thresholds and qualifiers also place the burden of uncertainty (e.g. the risk that development or unsympathetic use will harm or reduce biological diversity) not on the developer, but on the non-vested interest seeking to maintain biodiversity. In other words, narrow exclusive criteria may be 'robust' (Norton & Roper-Lindsay 2004, p. 303) to the uncertainty of obtaining a consent for development or use (which is costly to business). However, they will not satisfy the desire of the non-vested biodiversity interest for criteria that are 'robust' in the sense of being unlikely to deliver unfavourable outcomes for biodiversity (Moilanen et al. 2008).

Norton and Roper-Lindsay (2004; Roper-Lindsay & Norton 2005) also propose that the non-vested interest should bear the burden of two further, important, sources of uncertainty. First, there is uncertainty associated with consigning maintenance of biological diversity to a 'more open' yet undefined, and in most local authority districts non-existent, 'comprehensive system for protection and management of biodiversity' (Roper-Lindsay & Norton 2005, pp. 3–4), in place of the protection of a comprehensive set of significant sites. 'Community buy in' (p. 3) for the maintenance and restoration of indigenous biological diversity is important, and local authorities may (and some do) manage and provide incentives to encourage voluntary enhancement of significant sites and others. But an unspecified 'all encompassing approach' avoiding 'site protection which often proves confrontational' (pp. 3–4) closely resembles the comforting but mythical idea that 'integration' of ecological and economic concerns can exist without trade-offs (Murray & Swaffield 1994). We do not disparage education and altruism, but economics suggests these cannot fix the compulsive (non-voluntary) problem of ongoing decline (Hardin 1968). Further, the capacity, information, and agency culture required to build the proposed 'comprehensive system' seem unlikely in local authorities 'lacking natural resource information and the finances to collect it' (Norton & Roper-Lindsay 2004, p. 296) and relying on occasional expert advice to minimise biodiversity transaction costs.

Second, non-vested interests would bear the burden of uncertainty that experts hired by vested interests and local authorities will be objective, precautionary, and act in their interest. Norton and Roper-Lindsay (2004) repeatedly claim that their criteria are 'objective' (pp. 296, 298, 299, 300, 301, 303), yet also advocate that expert knowledge should overcome many acknowledged difficulties, make final decisions, and interpret vague and ambiguous guidelines. An assessor's 'knowledge' (e.g. pp. 300, 301) does not render her opinion objective. Thus, the criteria of Norton and Roper-Lindsay (2004) depend deeply on the '1960s myth' (Murray & Swaffield 1994, p. 50; see also Hays 1959; McFarland 2004) that an assessor's opinions are rational, comprehensive (Kuhn 1962), and capable of 'objectively' determining a site's significance (Davies 1986). Also, experts (and their opinions) are often selected (and excluded) according to one's interest. Professional standards can restrain bias, but 'professional' experts serving client interests outside the ambit of peer review have little incentive to adhere to professional norms, and may not do so (Wilson 1989, pp. 60–61). While this is true of professionals serving any interest, it is particularly unwise to depend on experts proclaiming solutions in which they, and/or their client, have a financial interest. In sum, dependence on purportedly neutral and objective experts in significance assessment may lend an unwarranted appearance of scientific rigour to ambiguous criteria and subjective decision-making. At variance with the precautionary principle, this could legitimise decidedly subjective decisions and render decision-making impervious to challenge by those deemed too 'non-expert' (and by implication, ill-informed and irrational) to participate.

Significance assessment to halt indigenous biodiversity decline

Having considered equity, we suggest local authorities should consider their biodiversity goal and the ecological consequences of adopting different criteria sets. In other words, they should ask: (1) What is the goal for biodiversity? (2) How much biodiversity do we have left? (3) How much do we wish to retain? (4) If we are to meet this goal, then how must we define significance? We offer some suggestions.

What is the goal for biodiversity?

Local authorities represent vested- and non-vested-interest constituents, but their RMA functions include 'the maintenance of indigenous biological diversity' (RMA §30 and §31) and to sustain '…the potential of natural [biological diversity] resources…to meet the reasonably foreseeable needs of future generations' (RMA §5). In our view, these functions are consistent with the NZBS Goal 3 for biodiversity, to maintain a full range of indigenous biological diversity and enable its persistence (and continued evolution) into the future. To maintain biological diversity means to change from 'the current decline to a level of stabilisation' (DOC & MfE 2000, p. 8) or, in other words, to halt the loss and simplification of the biological diversity that now remains in the landscape.

If we are to meet this goal, then how must we define significance?

We would regard a site that is important to achieve maintenance of biological diversity as 'significant'. This contrasts with the narrower assumption of Norton and Roper-Lindsay (2004) that significance indicates 'the cream' (p. 296). We see the key question as: 'is this site important for the maintenance of biological diversity into the future?', and not 'is this site the cream?'

Our definition (and question) requires a future-looking concept of *representativeness* that explicitly incorporates the goal of long-term maintenance of biological diversity, and advances beyond a notion that past New Zealand ecosystems can and should be fossilised. We suggest a concept that:

> (1) Recognises that ecosystems are dynamic, and accepts that change – evolutionary, climatic, successional, cyclical, seasonal, meteorological, and stochastic – is an inherent property of ecosystems
> (2) Has regard for the abiotic (physical) and biotic (ecological and evolutionary) *processes* that sustain biological diversity across the landscape and in aquatic systems, not just in specific sites
> (3) Recognises potential for ecological restoration in fragmented landscapes and environments where the original vegetated cover has been significantly reduced

Maintenance of biological diversity (i.e. future *representativeness*) requires protection of the long-term capacity of a landscape to support species populations. Survival of inherently dynamic ecosystems and their component species will not be achieved by preservation of a few isolated 'high quality' sites, and elimination of less pristine (and more vulnerable) remaining ecosystems and truncation of remaining species metapopulations. This outcome will not maintain the 'variability among living organisms, and the ecological complexes of which they are a part, including diversity within species, between species, and of ecosystems' (RMA §2). Fragmentation, loss of connectivity, and the consequent disruption of processes and metapopulations appear to accelerate rapidly once indigenous habitat in a landscape decreases below about 30% of original cover (e.g. Andrén 1994; Fahrig 2002). Incremental losses of habitat matter more once habitat loss has become advanced in a landscape: progressive losses have increasingly serious effects on species diversity and ecological processes (e.g. Tilman et al. 1994; Rosenzweig 1995; Hanski 1998).

Sites '…containing high biodiversity values and exhibiting a good range of healthy ecosystem processes' (Roper-Lindsay & Norton 2005, p. 3) that remain mainly in New Zealand's cold, wet, steep places are important for biodiversity. They are significant by either of our definitions. But in landscapes where indigenous habitats have been most extensively cleared in the past, and remain under the greatest development pressure today (Walker et al. 2006), the questions 'is this site important for the maintenance of biological diversity?' and 'is this site the cream?' will usually yield different answers. The former question would reveal most, if not all remaining indigenous habitats to have value, whereas the latter would recognise postage stamps, or perhaps even nothing at all.

Conclusions

In this paper, we propose that difficulties in defining significance in the RMA arise from the ambiguity of the statute. This enables different interests to (legally) define significance differently, in a manner consistent with their goals.

We conclude there are persuasive reasons for local authorities to consider questions of equity when adopting biodiversity significance criteria. Criteria serving vested interests feature high bars for significance and/or pernicious qualifiers. These leave little indigenous biodiversity off-limits to development, and place the burden of risk of harm to biological diversity on non-vested interests. To serve non-vested interests, local authorities would need to manage the uncertainty inherent in significance assessment by adopting inclusive and precautionary criteria and guidelines that place the uncertainty burden on developers.

We also suggest that local authorities consider the ecological outcomes of the significance criteria they adopt and apply. In recognising few sites as significant by dint of having restrictive criteria, they are likely to promote ongoing, cumulative loss and simplification of the biological diversity that now remains in the landscape. Ecological theory and empirical studies indicate restrictive criteria with arbitrary high bars and qualifiers will exclude sites that require protection if a full range of biological diversity is to persist; we suggest such criteria cannot be described as 'ecologically sound' (Norton & Roper-Lindsay 2004, p. 298).

In contrast to other areas of the law, most modern environmental law consists of (1) ambiguous, discretionary concepts that are socially acceptable because they favour 'business as usual', and (2) lists of prohibitions for particular narrow situations that permit environmental harm in all others (Birnie & Boyle 2002, pp. 44–47; Pardy 2005). In significance assessment under the RMA, 'sustainable management' provides the former (an ambiguous concept that promotes business as usual); Norton and Roper-Lindsay's (2004) criteria appear to propose the latter (prohibitions limited to narrow situations). Neither effectively protects the environment. Rather, both facilitate cumulative environmental degradation (Armstrong 2001; Pardy 2005). In New Zealand, the devolution of natural resource decision-making authority and case-by-case subjective decisions on what constitutes 'balance' might appear participatory and hence democratic, but are not (see Pardy 1997, p. 72). Devolution and case-by-case decisions will predictably intensify the dominance of vested development interests and further facilitate cumulative damage to environmental public goods, including indigenous biodiversity.

We are aware of the political impasse that leads to the above approaches. If the alternative – a mutually coercive rule (Hardin 1968; Pardy 2001) – were politically palatable, it would surely be in place. We agree with Norton and Roper-Lindsay (2004) that it is the role of ecologists neither to presume where the public interest in biodiversity lies, nor to prescribe the 'right' criteria to achieve some purportedly 'acceptable', or 'balanced' level of maintenance or decline. But we can state what seems obvious to us. The idea that New Zealand can maintain its biological diversity while continuing to draw down its already depleted stock of indigenous ecosystems has no foundation in ecological science. For local authorities to fulfil their RMA function to provide for maintenance of indigenous biological diversity, they would need, for a start, to halt the ongoing clearance of indigenous vegetation and loss of habitats of indigenous species. This means capping loss at current levels. In significance assessment, this would require a simple general rule such as the following: 'remaining indigenous vegetation and habitats of indigenous species are significant'. If the intent is to allow biodiversity decline, but merely to slow the rate of decline, then local authorities would need significance criteria that are broad and inclusive. Such criteria would neither set high bars nor include irrelevant qualifiers. They would need to be inclusive enough to recognise the national importance of a diverse range of remaining indigenous vegetation and habitats of indigenous species, including the highly modified and the relatively pristine, the seral and primary (old growth), the dynamic and changing, different patch sizes and configurations, those species that are still apparently common and those in all stages of decline.

Acknowledgments

The authors acknowledge CRI capability funding from MoRST and support from Lincoln University, the

University of Waikato, Wildland Consultants, Auckland Regional Council and the Department of Conservation. We are indebted to many people whose ideas and comments have shaped and improved the manuscript, including Steve Christensen, Ellen Cieraad, Jeff Connell, Mark Davis, Karen Denyer, Wren Green, Mike Harding, Rod Hay, Geoff Hulbert, Kelvin Lloyd, Matt McGlone, Colin Meurk, Bernie Napp, Tim Park, Hamish Rennie, and two anonymous reviewers. Matt McGlone was a discerning content editor. SW , RTTS and AB thank the Applied Environmental Decision Analysis hub (AEDA) funded by the Australian Government's Commonwealth Environment Research Facility (CERF) for hospitality, and especially Hugh Possingham, Atte Moilanen, and Bob Pressey for improving our thinking.

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Editorial Board member: Richard Duncan
Received 19 September 2007; accepted 11 March 2008

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