LANDSCAPE AESTHETIC EXPERIENCE AND ECOSYSTEM SERVICES

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ABSTRACT: Needs, definitions, and methods for assessing landscape aesthetic experience as an ecosystem service within the New Zealand context are reviewed. Formal and transactional approaches to the understanding and investigation of aesthetic experiences are compared, and the rationale for considering aesthetic ecosystem services in a landscape context explained. Different approaches to measuring aesthetic values and experiences are considered historically, showing the ways in which scientists, planners and landscape architects have attempted to incorporate aesthetic considerations into land management. Contemporary approaches to evaluation of aesthetic ecosystem services are noted, and illustrated through New Zealand examples. A number of research issues and directions are identified.

Key words: landscape assessment methods, non-material cultural services, aesthetic values, benefits.

INTRODUCTION

This chapter examines methods and implications of framing landscape aesthetic experiences in New Zealand as cultural ecosystem services. The framework for ecosystem services adopted by the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment 2003) categorises aesthetics as 'non-material' cultural services. While material services such as those provided by production (e.g. food provision) are typically assigned economic value through markets, non-material services are not explicitly valued in this way. This can lead to imbalanced decision-making and, frequently, the loss or degradation of these important services (UK National Ecosystem Assessment 2011). A key objective of the ecosystem services framework is to ensure that non-material services, such as aesthetics, are assigned value (Royal Society of New Zealand 2011). This chapter first examines how aesthetics are addressed within an ecosystem services framework, the terms used, and the importance of the landscape scale in aesthetic experiences associated with ecosystems. It then asks why it is important to consider the benefits of aesthetic experiences in planning and managing ecosystem services, and reviews different approaches to measuring aesthetic experiences. Current knowledge relating to defining aesthetic experiences as ecosystem services in the New Zealand landscape is summarised, including examples of recent assessment practice. The chapter concludes with a discussion of contemporary research challenges for the design, planning and management of landscape aesthetic experiences within ecosystem services frameworks.

WHAT ARE AESTHETIC EXPERIENCES AND WHY DO THEY OCCUR?

Questions about the nature of aesthetic judgements, values and experiences, why and how they occur, and whether they are changeable or fixed have been debated by philosophers since classical times, and the consideration of these issues in relation to landscape is also complex and nuanced (Thompson 2004). This chapter is not the place to attempt a review of such a rich field. Instead we focus on how aesthetic matters have been considered in the practical planning and management of ecosystems and landscapes. Gustavsson (2012) identifies two contrasting positions: a 'modern' approach seeks to identify regular and predictable relationships between the formal characteristics of the environment that stimulate an aesthetic response and the nature of that response, while a 'post-modern' approach is more concerned with understanding the active construction of meaningful aesthetic experiences in particular contexts, with all their diversity and contingency. This distinction parallels the contrast drawn by Hartig (1993), between 'interactive' approaches, which analyse the elements that structure nature experience, and what he terms 'transactional' approaches, which focus on experience of nature as a holistic event.

A key feature of the formal, interactive (i.e. 'modern') approach is the differentiation between objective stimulus (a formal attribute or quality in the environment received via visual, auditory, somatosensory, gustatory or olfactory sensory systems) and the subjective response of the human subject or subjects. Hence, investigation is focused on formal properties in the environment that are associated with particular human aesthetic responses, the nature and intensity of those responses, and the factors that influence the relationship. The concept of aesthetic services within ecosystem services frameworks is largely formal in its theoretical and practical expression, assuming that aesthetic responses are dependent on measureable qualities of ecosystems that can be identified through empirical research, and which can be managed in an instrumental way. However, as will become clear, this has both advantages and limitations. One of the major research challenges is to ensure that analysis of ecosystem services does not overlook or marginalise the opportunities and implications of understanding aesthetic experiences as transactional; that is, actively made in context.

The contrasting approaches and their implications are well illustrated by the question of what shapes aesthetic experience. An important and influential scholarly tradition argues that aesthetic responses to ecosystem or environmental characteristics are hereditary or biological in origin (e.g. Appleton 1975; Ulrich 1983; Kaplan and Kaplan 1989; Parsons 1991). Drawing on the functional approach to perception it is argued that humans seek supportive habitats, with features essential to their survival and well-being. These include physical configurations that provide information and locomotion (e.g. Lynch 1960; Gibson 1979; Kaplan and Kaplan 1982; Golledge and Stimson 1987); prospect and refuge (Appleton 1975) and safety (e.g. Schroeder and Anderson 1984; Nasar 1993); closeness to nature (e.g. Kaplan and Kaplan 1989), rest and psychological restoration (e.g. Kaplan 1995); and the display of pride to others (e.g. Lowenthal and Prince 1965; Nassauer 1988; Gobster 1997). These characteristics of aesthetic response are more or less universal, unchangeable, and fundamental to human acceptance and enjoyment of a landscape (Parsons and Daniel 2002), and can therefore be used as

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design and management parameters (Kaplan and Kaplan 1982).

The alternative, more situated approach argues that aesthetic perceptions, judgements, and responses are made actively in context (Bourassa 1990; Hartig 1993). Rather than measuring aesthetic attributes and values, the focus is upon understanding aesthetic 'experience' as a dynamic meaningful transaction between individuals, social groups, cultures and environments. Thus knowledge, needs, memories and expectations all contribute (Gregory and Zangwill 1987) and aesthetic responses to ecosystems are conditional and changeable (Meinig 1979). For example, an individual who initially views a wetland as ugly may subsequently come to consider it beautiful after learning it plays important roles in maintaining water quality and supporting native biodiversity. While evidence suggests that most people prefer ecosystems that they perceive as healthy, many cannot interpret what makes an ecosystem healthy (Gobster et al. 2007). However, if it is presumed that human aesthetic response is transactional and hence adaptable, then it might be possible through aesthetic and environmental education to improve the relationship between human aesthetic responses and ecosystem management, in order to build support for multiple and healthy ecosystem services (Nassauer 1997).

People who gain positive aesthetic experiences from an ecosystem are also more likely to support it or protect it from degradation or loss (Gobster et al. 2007). For example, national parks and reserves have been designated and protected from development in New Zealand and elsewhere for over a century because they evoke powerful feelings of affect and well-being (Figure 1). The reverse is also true. People tend to alter or change healthy ecosystems if they do not make them feel good. For example, diverse and highly stratified riparian edges that are rich in species diversity and play important water management functions are frequently 'tidied up' and simplified (Nassauer 1989; Parkyn and Quinn 2006; Kenwick et al. 2009), resulting in the degradation of some of the ecosystem services they provide. Creation of these more simplified ecosystems is motivated in part by aesthetic preference (Lowenthal and Prince 1965; Nassauer 1988; Gobster 1997) including a sense of 'care' (Nassauer 1988, 1989, 1995). Recognition of the fundamentally dynamic nature

of the relationship between ecosystem attributes and human aesthetic experience and actions opens the possibility of using planning, design and management, in addition to education, to deliberately shape new aesthetic norms that support healthy ecological functions (Nassauer 1999a; Meurk and Swaffield 2000; Gobster et al. 2007). This in turn leads to a consideration of the need and potential for a healthier, more 'ecological' aesthetic rather than the commonly supported 'scenic' aesthetic (e.g. the picturesque) that many prefer, but which is often associated with degraded ecosystem functions (Eaton 1989; Sepänmaa 1993; Gobster 1997).

Whether adopting a formal or transactional perspective, it is clear that biology, socio-cultural and individual background and life experience all play important roles in determining how we experience and behave in the landscape. Values and behaviour may indeed have some genetic predisposition, but are clearly modified by socio-cultural and individual factors (Bourassa 1988; Nassauer 1999b; Fry et al. 2009). The use of the term 'aesthetic values' often reflects the objective and formal approach to measuring elements in landscape believed to be responsible for an aesthetic experience, but the term fails to capture the more transactional approach to 'constructing aesthetic experiences of and through landscape actions'. As the preceding discussion makes clear, we believe the connection of aesthetics to action in landscape is fundamental to ecosystem services management, and so for the purposes of this chapter, we use the term 'aesthetic experience' to denote aesthetic relationships and benefits within ecosystem services frameworks.

DEFINING AESTHETIC EXPERIENCE IN ECOSYSTEM SERVICES FRAMEWORKS

Ecosystem services frameworks generally refer to the benefits that humans receive from their sensory experiences of ecosystems (through sight, hearing, taste, smell and touch) and typically conflate the benefits to humans with the ecosystem attributes (services) that provide these benefits. Some frameworks refer to 'aesthetic values' (e.g. Millennium Ecosystem Assessment 2003; Royal Society of New Zealand 2011), and while this term is not defined, both sources provide 'beauty' as an example of a value.

FIGURE 1 Protecting ecosystems and landscapes for the positive aesthetic experience they provide - Dawn in Abel Tasman National Park.

Beauty is of course widely debated but is popularly understood to be 'the quality or aggregate of qualities in a person or thing that gives pleasure to the senses or pleasurably exalts the mind or spirit' (Merriam-Webster Dictionary 2013). If we accept this popular definition as that intended in the Millennium Ecosystem Assessment (2003), at least some of these values are qualities and attributes of an ecosystem and the benefit they provide is a feeling of pleasure. Other conceptual frameworks more clearly differentiate the ecosystem attributes providing the ecosystem services from their benefits to humans (De Groot et al. 2002, 2012; De Groot 2006; Boyd and Banzhaf 2007). For example, De Groot et al. (2002) refer to 'aesthetic information' as an ecosystem service category, provide 'scenery' as an example of an aesthetic service, and a feeling of 'enjoyment' as the benefit of this service. Boyd and Banzhaf (2007) suggest that 'amenity and fulfilment' are examples of aesthetic benefits and 'natural land cover in viewsheds' is the ecosystem service providing the benefits. They argue this differentiation is essential in defining a workable accounting system to facilitate land-use decision-making and management.
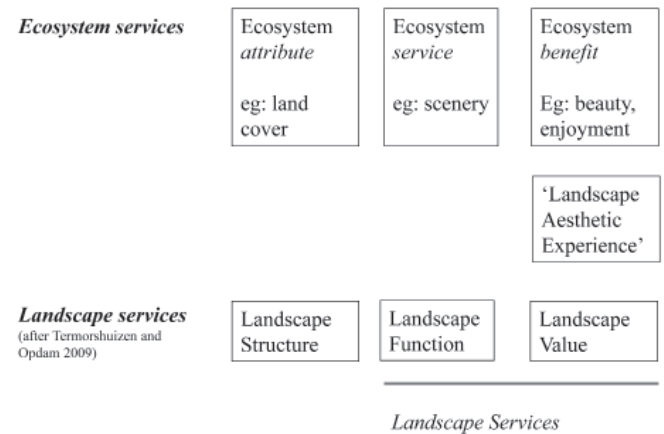
Importance of the landscape scale in aesthetic experiences of ecosystem services

The ecosystem services framework is multi-scale in space and time (Millennium Ecosystem Assessment 2003), so that ecosystem services can be valued and weighed at many levels of decision-making. It is vital to consider the scale of valuation and decision-making because land-use change occurring at one spatial scale can lead to significant effects at both finer and coarser scales (Wiens and Milne 1989). Despite this, few studies evaluating ecosystem services have considered the effects of spatial scale in either their analysis or valuation of these services (De Groot et al. 2010). While humans can perceive their ecosystem at many spatial scales, most of their perceptions of, and interactions with, ecosystems occur at the landscape scale (Wiens 1992), which is considered by many to be the most important scale at which to identify and value aesthetic experiences (Gobster et al. 2007). In landscape ecology, landscape is defined as 'kilometres wide' (Zonneveld 1979; Naveh and Lieberman 1984; Forman and Godron 1986; Forman 1995), or a 'few to many kms^2'(Wiens 1992).

The term 'landscape' itself is a contested and plural concept and is used in a wide range of ways, both internationally and in New Zealand (Swaffield and O'Connor 1986; Swaffield 1993, 1998). For example, landscape may be defined objectively as either coupled human-natural *systems* or the form and patterns of particular *areas* of land; or subjectively as the *appearance* of land and its scenic qualities, or pragmatically as the making and shaping of everyday outdoor spaces such as green networks, parks, streets and gardens. Recent scholarship is placing emphasis upon landscape as a collective practice, acquiring meaning to people, not from what they see or measure, but from their direct and collaborative involvement in diverse land-shaping activities (Ingold 2000). Based on a review of recent literature, Stephenson (2007) concluded that despite this plurality in landscape meaning and usage, there is an underlying conceptual framework to landscape that comprises biophysical *structures, forms and appearance; meaningful relationships* between humans and their surroundings; and human and ecological *processes, functions, or actions.* The New Zealand Institute of Landscape Architects (NZILA) suggests a somewhat different tripartite framework for landscape assessment, of *biophysical* attributes, pattern and process; *sensory* qualities; and associated *meanings*, which combines structure and

process as 'objective' attributes, but separates out sensory qualities and meanings (NZILA 2010). The Stephenson model reflects academic usage. The NZILA categories reflect the dominant approach that has evolved through expert evidence presented to the Environment Court by landscape practitioners on visual and landscape matters relating to the Resource Management Act 1991 (RMA). Either of these models can provide a useful point of reference for investigation and evaluation of aesthetic dimensions of landscape, but it is vital to be clear about the definition being used in a particular situation or project, and the purpose of the application.

Termorshuizen and Opdam (2009) have analysed the relationship between concepts of landscape and ecosystem services, and argued for the use of the term 'landscape services'. This term clearly links ecosystem services with the particular landscapes that people perceive and with which they interact. In recognition of the importance of the landscape scale in determining human aesthetic experience and land use decisions, we use the term 'landscape aesthetic experiences' as the aesthetic benefits people receive through their senses and interactions with landscapes. We consider ecosystem services to be the features and functions in the landscape that provide or facilitate these experiences (Figure 2).

FIGURE 2 Terminology-Locating ecosystem aesthetic services within landscape.

The need to consider landscape aesthetic experiences as ecosystem services

The ecosystem services framework is focused upon decision-making about change, and what and who this change affects (Millennium Ecosystem Assessment 2003, p. 38). Such change may include human-induced changes in land use and land cover resulting in inputs to, discharges from, and harvesting of ecosystems; the construction of infrastructure and buildings; and the management of resources such as soil, water, and exotic and indigenous species. Human management of ecosystems and the services they provide is influenced by what people value, experience and use in different ecosystems, and a range of people, with different types of knowledge, need to be involved in land use decision-making, including both traditional and local knowledge (Millennium Ecosystem Assessment 2003), in order to ensure the quality and legitimacy of decision-making.

Changes in aesthetic ecosystem services such as landscape aesthetic experience can affect individual and collective well-being in a range of ways. A change in the appearance of a landscape may result in different levels of effect or preference, which in turn may influence people's enjoyment of viewing or travelling through a landscape (Andrews 1979; Merriman 2007).

This is typically a primary focus of landscape aesthetic assessment within the planning system. Furthermore, if a large number of people are affected by the change, it may reduce the frequency and duration of visits, the 'willingness to pay' for experiences, and the level of visitor satisfaction reported afterwards (Hanley et al. 1998), which may lead in turn to significant financial and social impacts on landowners and communities that provide tourist-related services. In the longer term, changes in aesthetic experience may significantly alter land values. For example, there is a strong association between residential land values and views and proximity to settings with higher amenity, such as waterfronts, higher ground with views, bush reserves, and open rural land (Earnhart 2001). Land-use changes that result in what is felt to be a significant degradation in aesthetic experience are therefore of primary concern to landowners and the wider community, and a focus of contest in the planning system. At a deeper level, changes in the condition and character of ecosystems and landscapes can lead to personal and collective loss or enhancement of identity or feelings of belonging (Davenport and Anderson 2005). Such change can occur incrementally, leading to cumulative feelings of dissatisfaction or disorientation over time, and change that occurs outside one's control is particularly strongly felt and opposed (Wolsink 2007). Arguably, many so called 'landscape' issues associated with development are as much about a sense of loss of involvement and control, as about any particular aspect of change.

The effects of changes in aesthetic experiences can be localised, only affecting a particular community, or can extend to wider communities of interest and concern. Planners are familiar with the so-called 'nimby' (not in my backyard) effect, by which people and communities resist changes imposed on their locality (Emmerlin 1996). In a small and highly connected, albeit thinly populated, country such as New Zealand, networks of association typically extend far beyond local communities, and changes to iconic landscapes rapidly stimulate concern and opposition from people who live far away. There is a very strong association between the sense of identity and well-being of New Zealanders and New Zealand's aesthetically important landscapes (Bell 1996), and this has been demonstrated historically by the significant social and political debate resulting from land-use changes perceived to be damaging to landscape aesthetic experience. For example, the protests against the Manapouri Hydro Power project in the 1970s are an example of New Zealand wide social mobilisation against change in a remote but widely valued landscape (Grundy and Gleeson 1996). More recently, changes to high country landscapes following tenure review and proposals for development in peri urban and coastal locations have become causes célèbre for the wider conservation movement (Peart 2004). Understanding the nature and characteristics of landscape aesthetic experiences, defined in a range of ways, has therefore become a critical part of New Zealand resource management.

IDENTIFYING AND VALUING LANDSCAPE AESTHETIC EXPERIENCES

A key objective of ecosystem services frameworks is to facilitate the cost–benefit analysis of all ecosystem services within decision-making. Economists attempt to develop methods to assign a value to each ecosystem service using the same standardised unit, such as dollars (e.g. Mäler 1991; Grambsch et al. 1993). These values serve as proxies for their relative worth to decision makers. However, cultural services, such as ecosystem services that support aesthetic experiences, and the experiences

themselves, are difficult to measure in meaningful ways (Boyd and Banzhaf 2007). Firstly, the ecosystem services (or units of value) that support particular experiences are difficult to define. There has been a long-standing debate regarding what elements and combinations of elements contribute most to aesthetic experiences (Thompson 2004). Secondly, these elements change with the landscape context (e.g. whether it is metropolitan, agricultural, or wild) (Gobster et al. 2007). In addition, the question of *whose* unit of value is in question, because the aesthetic experience changes with personal situation, social group characteristics and culture. Finally, many ecosystem services are public goods or services or commons, and cannot be exclusively owned or traded (Vejre et al. 2012). Given this complexity, many question whether it is even possible to define a dollar value that is a meaningful proxy of the value of aesthetic benefits.

Measuring landscape and scenic aesthetics

This section summarises the types of planning-related methods that have been used to identify and value aesthetic experiences in landscape, as a basis for considering the recent development of ecosystem services frameworks. The basic approaches and the issues they attempt to address are well illustrated by the debates over the past 40 years about assessment methodology. Before the 1970s methods to identify and analyse elements and landscapes of 'scenic beauty' were expert-based, on the assumption that most people lack the necessary expertise in aesthetic principles to make aesthetic decisions (Carlson 1977). Some scholars still argue this (e.g. Carlson 1995; Nohl 2001). Thus rural and forest landscapes were inventoried and analysed based on principles such as form, balance, contrast, character or diversity of elements (USDA Forest Service 1973). While landscapes might be compared on this basis, there were few attempts to assign numerical values to the elements that contributed to visual or landscape quality. They were given equal value, and described by words and graphically (Zube et al. 1982).

The widespread introduction of environmental assessment procedures in the 1970s, for example as required by the US National Environmental Policy Act of 1969 (and now also in New Zealand embedded in the RMA), meant that planners and managers of publicly-owned land needed to develop a more defensible and simpler way of valuing aesthetic elements in the landscape. They started to apply categories, numbers or weightings to the different elements contributing to aesthetic experiences in order to indicate the relative contributions of these to overall quality, and hence predict and manage the impact of proposed change. Scores for any particular management area were summed in order to arrive at a total denoting its relative importance in terms of providing an aesthetic experience, and these numbers then became the basis for management decisions. For example, in the USDA Forest Management system (USDA Forest Service 1974) visual quality was assumed to be most correlated with variety or diversity of elements in the landscape, such as vegetation, form and colour patterns. This attribute was given a higher numerical value than other attributes, such as rarity and uniqueness.

However, there was little empirical research evidence to support the connection between visual elements and an aesthetic experience, or to support the assumption that one element was more important than another (Arthur et al. 1977; Kaplan 1985). In addition, adding up the weightings was criticised as invalid as a summary measure of aesthetic quality because the attribute measures (i.e. the values of particular elements) were typically ordinal not ratio data. Counting the number of aesthetic elements

present in an area was therefore adopted as another way of arriving at an overall aesthetic value for an area rather than adding up the weights applied to elements (Biswas and Coomber 1973). However, Arthur et al. (1977) argued that aesthetic elements were not of equal value, and there was little evidence to support the assumption that people viewed the landscape in terms of individual elements. They argued instead that aesthetic experiences were determined by the integration of elements, or the aesthetics of the whole landscape being viewed, and that numerical weightings should be avoided and replaced by evaluative words, such as high, medium and low.

A second shift in emphasis in the 1970s was greater consideration of the 'users' of landscapes. Initially the user was considered by assigning a sensitivity rating to a landscape based on the distance between public viewpoints and the managed area (USDA Forest Service 1973). Arthur et al. (1977) also argued that park users should be involved in determining whether landscape elements constituted a positive or negative aesthetic experience, and the 'pyschophysical' approach (Zube et al. 1982) was developed to seek measurable and predictable relationships between human preferences and landscape attributes. A good example is the 'scenic beauty estimation' method (Daniel and Boster 1976), which uses multiple regression to determine which landscape attributes are best able to predict landscape preference, and hence enables land managers to model and compare the effects of different possible management regimes on 'scenic beauty'. This technique became widely used internationally, including within New Zealand (e.g. Mosley 1989), in part because of its practical utility in environmental management, planning and design (Zube et al. 1982) and the apparent objectivity of the process compared with expert-based assessment (Daniel and Vining 1983).

However, the psychophysical approach can in turn be criticised for failing to reveal why users prefer one attribute to another (Kaplan 1985). Without this understanding landscapes cannot be effectively designed, planned or managed in support of positive aesthetic attributes. Cognition-based techniques have therefore been widely used to investigate the reasoning behind the aesthetic landscape preferences of humans in general, and of specific groups and individuals in specific landscape settings (Zube et al. 1982; Kaplan and Kaplan 1989). This understanding can also better allow for the design, planning and management of healthier landscapes in support of other ecosystem services. For example, Nassauer (1988) demonstrated that farmers in the American Midwest preferred landscapes that display 'care', and that this aesthetic experience was supported by elements in the landscape such as straight crop rows, uniform green, and weed-free fields. Nassauer (1999a) therefore argued that if aesthetic experience needs were met by landscape components that supported key ecosystem services, landowners would be more likely to implement these components and maintain their ecosystem services through time. For example, landowners would be more likely to support the implementation of riparian buffers in support of pollution control if landowner aesthetic experience needs, such as care, were met.

One of the limitations of the early work on preference was the lack of spatiality in the assessments, which focused more upon the relative contribution of attributes rather than their spatial association within landscapes. Furthermore, these assessments frequently did not consider the effects of landscape management on the achievement of other management goals, such as the preservation of biodiversity conservation. In an attempt to rationalise land use decision-making and develop a system whereby multiple factors could be considered in support of both ecological as well as socio-economic goals, McHarg (1969) developed a comprehensive regional planning method for the identification and analysis of biophysical features and functions of landscapes. It used sieve mapping of resources, such as topography, soils, and vegetation communities, to evaluate their suitability for a particular land use. The maps comprised layers that cumulatively indicated the least and most suitable areas for different land uses. Visual quality was assessed as a layer and assumed to relate to ecosystem health. This method was simple, easily understood, and allowed different socio-economic and biophysical factors (or ecosystem services) to be assigned a common unit of measurement to facilitate decision-making. It also appeared to provide clear evidence in support of planning and management decisions.

However, critics argue the sieving system is invalid as it assumes that each of the resources depicted is of equal value, whereas in reality some resources are more influential in decision-making than others (Lyle 1999). In addition, Hopkins (1977) challenged the measurement approach, which again used ordinal not ratio data, and because different biophysical and cultural variables are treated as independent variables, whereas many are interdependent, such as soils and topography. In response to these criticisms, many landscape architects and planners have shifted to use a mapping process based on Hills (1961), which involves the inventory and analysis of resources (e.g. soils, vegetation communities, topography) to identify landscape units with common characteristics. These are then analysed for the limitations and potentials to support different land uses (Lyle 1999). Although Hills (1961) did not specifically mention aesthetic experiences as a resource to be inventoried, this method is still considered by many to be the most reliable and valid system for making land use decisions in support of multiple resources or ecosystem services (Brown 2008). There are a number of New Zealand examples of this type of 'landscape' approach, including the land use capability (LUC) assessments (Lynn et al. 2009), the ecological districts and regions analysis (McEwen 1987), land systems analysis (Schmidt et al. 2005) and environmental domains (Leathwick 2002).

None of these New Zealand science-based systems explicitly include aesthetic character, but the assessment of landscape aesthetics based on identifying spatial areas of similar character has been particularly influential in Europe, and similar methods have been widely used by landscape architects in New Zealand. The Countryside Character Assessment process (Swanwick and Land Use Consultants 2002) has been applied comprehensively in England and Scotland and, since the launch of the European Landscape Convention (Council of Europe 2000), is influential across Europe. In terms of assessing aesthetic experience, the characterisation approach describes what makes landscapes distinctive, rather than ranking their relative importance, and describes the character of *all* landscapes, including less celebrated or 'everyday' landscapes (Tveit et al. 2007). This characterisation stage is recommended by the New Zealand Institute of Landscape Architects as an important step in moving from relatively objective description of landscape patterns and processes towards evaluation of their relative aesthetic qualities or values (NZILA 2010).

A critical factor in the evaluation of these different methods is the scale of measurement used and whether it is used correctly and appropriately. A common feature of the debates on assessment has been the argument that authors have regularly claimed a higher order of precision for their findings than the basic data can

support. Table 1 shows the basic categories of measurement and gives examples of types of approach for each. A major challenge in integrating aesthetic considerations into an ecosystems services framework is the difficulty of obtaining higher order measures of preference or beauty – which is fundamentally always a relative quality, not an absolute one.

TABLE 1. Measuring aesthetic experiences of landscape using different categories of measurement

Type of measure	Example of method
Nominal – named categories	Countryside character classification
Ordinal – ranked categories	Sieve mapping
Interval – evenly spaced ranks	Choice models and hedonic pricing Scenic beauty estimation – *depending on how the preference data are obtained. Many surveys only use ordinal categories but then attempt to apply interval-based analyses*
Ratio – interval measures tied to a meaningful zero point	*There are no examples in this category, as there is no absolute point of reference for 'beauty'*

Identifying character areas (nominal categories) does not in itself therefore provide a basis for evaluation. For that it is necessary to apply defined criteria or indicators. Ode et al. (2008) use attributes of stewardship, coherence, disturbance, historicity, visual scale, imageability, complexity, naturalness and ephemera to describe and then evaluate landscapes, linking each of these characteristics to aspects of landscape aesthetic theory. The use of different 'factors' or categories of evaluation has also become widely embedded in landscape assessment practice in New Zealand since the introduction of the RMA, with its different sections highlighting relevant matters to be taken into account in resource management decisions. The so called 'Pigeon Bay' factors first emerged as part of an evaluative checklist in the 1993 Canterbury Regional Landscape Study (Boffa Miskell and Lucas Associates 1993) and have subsequently been used and refined in a number of important Environment Court hearings and determinations, and the 'modified' factors now provide an important point of reference in assessment of outstanding natural landscapes (NZILA 2010). Table 2 compares the categories identified by Ode et al. (2008) from the academic literature, with the amended Pigeon Bay categories as used in an update of the Canterbury Regional Landscape Study.

TABLE 2. Theoretical and practical examples of assessment criteria

Ode et al. (2010)	Amended Pigeon Bay factors
Naturalness	Natural science factors – the geological, topographical, ecological and dynamic components of the landscape
Disturbance	
Imageability	Expressiveness or 'legibility' – how easy it is to 'read' the processes that formed a landscape
Visual scale	Aesthetic values
Complexity	
Coherence	
Ephemera	Transient values
	Whether the values are shared and how widely they are recognised
Stewardship	Values to tangata whenua
Historicity	Historical association

The development of increasingly sophisticated digital modelling has also reinvigorated the psychophysical approach based upon measuring responses to landscapes and deriving critical parameters, which can now be spatially and visually modelled in an integrated way (Ghadirian and Bishop 2008). The aim of such an approach is to develop models to predict the spatial effect of particular changes in landscape management (Gret-Regamey et al. 2007). For example, in New Zealand, Brown and Brabyn (2012) have built a predictive model of visual landscape quality based on GIS parameters and a regional survey of preferences (see below).

Economic evaluation

A key feature of ecosystem services frameworks is their alignment with economic valuation, and this has resulted in increased focus on economically valuing different features in the landscape in support of aesthetic experiences. Stated-preference approaches are most often used, particularly the contingent valuation method, which asks people what they are willing to pay for a certain benefit. For example, Grala et al. (2012) asked Iowa residents and farm operators what they would be willing to pay to support the planting of windbreaks to increase their enjoyment of rural landscape scenery. However, the use of stated preferences has been widely criticised because of the potential that respondents may not reveal their true preferences, either because the question asked is hypothetical or because they feel that their answers may influence unfavourable decision-making in the future (Cesar 2000). For example, even though landowners may highly value a landscape feature for aesthetic reasons, they may wish to remove it for financial reasons, or at least modify it in some way. If they believe that assigning a high value to such features in a survey will lead to more intrusive policy and planning rules, they may decide to place a low aesthetic value on it in their response. In addition, the aesthetic value placed on a landscape element by one viewer may not represent that of other or all viewers. This is of particular concern where the respondent owns the land with the aesthetic feature but the feature is valued by the public. Furthermore, the aesthetic value placed on an element at one spatial scale may not capture its aesthetic value at another scale.

Revealed-preference methods attempt to step back from the direct measurement of respondents' views and focus instead upon their actions. Hedonic pricing is often used for valuing landscape elements for their aesthetic benefits by revealing the value of a product or service that is embedded in the price of a marketed commodity. For example, people buy homes for several attributes, such as their proximity to a natural feature. If that attribute is removed and the property revalued, the assumption is that the change in the price represents the extent to which the particular attribute is valued (TEEB 2010, p. 19). Using this approach Thibodeau and Ostro (1981) found that house purchasers in southern Sweden were willing to pay £3,200 more for a home with a view of high quality meadows and pasturelands. The travel cost method, another revealed-preference method, indicates the value of the aesthetic experience by estimating what it costs to travel to an aesthetic feature. The further away the feature, the more people are presumed to be willing to pay. Alternatively, some research estimates what it would cost to access another feature providing a similar aesthetic experience if the aesthetic feature (such as riparian buffer) were not there (Environment Agency 2010). Revealed-preference methods are criticised for being expensive and time-consuming because of the need for high quality data, large data sets and complex statistical analysis (TEEB 2010, p. 19), and the travel cost method may mis-value situations where users live within close proximity to the landscape

FIGURE 3 A sublime landscape – Lake Manapouri, Fiordland.

and are likely to travel by foot or cycle.

Techniques for measuring aesthetic experiences therefore range from those based upon expert judgment using principles derived from fine arts, to those based on the relationship between public preference and landscape attributes, to those seeking to assign economic value to particular attributes (Zube et al. 1982). Dearden (1980) distinguished between user-independent and user-dependent approaches, which remains a useful broad categorisation. There is also a large body of work (which we have not reviewed here), based on various qualitative forms of social science, that seeks to better understand the finer nuances of landscape experience from a phenomenological perspective. Some examples of this are provided in the next section. Assessments of aesthetic experiences in landscape have also placed varying emphasis upon the spatial dimensions of these experiences. Some techniques are largely a-spatial, and focus primarily on identifying universal relationships between landscape attributes and preference or beauty, while others are primarily spatial, such as character assessment, focused on the particular qualities of a landscape. In the recent decade or so, advances in digital modelling have enabled this distinction to be broken down, although fully integrated methods are complex and still under development (Bishop 2005).

Aesthetic experience of landscape in New Zealand

The dominant public framework of aesthetic values and landscape experience in New Zealand landscapes is shaped by colonisation and post-colonial relationships, and the dynamics arising from the Treaty partnership between Maori and the Crown. Together with the increasing diversity of communities in New Zealand these pose particular challenges in defining and identifying aesthetic ecosystem services. Smith (2010) provides insight into the aesthetic experience of landscape from an indigenous Maori perspective, in her account of Songs of Lament of Taranaki Māori, in which she describes a series of concentric relationships, ranging from the observed 'scenery' familiar to a European aesthetic – of 'wind-blown trees, the sun's rays on the mountain peak and clouds radiant in the evening sky' (Smith 2010, p. 50), to a layer of awareness of assigned meanings of natural phenomena – such as portents of disaster or markers of significant events, to deeper layers of introspection – of personal familiarity and association, of whānau, hapū and iwi, and of genealogies and histories. 'The rush of thoughts,' Smith notes, '…is overwhelming' (2010, p. 50). Finally, the layers coalesce around the core of identity, the inhabited landscape, hau kainga, the essence of home, where aesthetics, meaning and identity become embodied in and through everyday actions.

There is also extensive scholarly analysis of the aesthetic values brought by settlers from Europe, ranging from written accounts of early English settlers (Shephard 1969), to anthologies of landscape prose and poetry (e.g. McNaughton 1986), accounts of tourist experience (Bell and Lyall 2002) and interpretations of landscape in other media such as film (Le Heron 2004). The historical accounts tell a story of initial encounters between aesthetic frameworks shaped in Europe and the unfamiliar New Zealand environment and its indigenous culture (Park 1995). Some describe attempts to 'frame' the new aesthetic experiences in familiar ways (Pound 1986). Others refer to the persistence of dominant frameworks such as the sublime and the picturesque, particularly in popular culture and legislation (Bowring 1995; Swaffield 1997; Read 2005). Still others speak to the gradual adaption and emergence of a more situated aesthetic framework, informed both by multigenerational inhabitation and by changing artistic and theoretical paradigms (Stephenson 2010a). The result is a complex palimpsest of values and experience that defies unitary synthesis.

One notable feature of post-colonial aesthetic experiences of New Zealand landscape is the legacy of the sublime and the picturesque. In the late 18th century (just as European contact with New Zealand was developing) debate over the aesthetics of landscape was dominated by three contrasting aesthetic categories concerning landscape experience: the sublime, the beautiful, and

FIGURE 4 A picturesque landscape – Christchurch Botanic Gardens.

the picturesque (Price 1810). According to this classification, the sublime is an aesthetic response to the power of nature associated with natural experiences that are literally 'awesome'. The beautiful is evoked by landscapes that are refined, graceful, smooth and curvilinear. The picturesque is associated with a sense of age, complexity, and rich layering. As the name suggests, these landscapes can be appreciated as a painterly composition.

The sublime has been particularly associated with mountains and their dynamic weather conditions, rivers, and primary indigenous forest (Figure 3). Appreciation of the experience of the sublime has provided impetus and justification for the establishment of national parks and reserves, and in legislation, public land management, and popular culture continues to underpin contemporary landscape aesthetics and their expression. For example, the RMA recognises the importance of outstanding natural landscapes, and river conservation orders were initially intended to conserve wild and scenic rivers. The sublime in New Zealand is often conflated with experience of the picturesque, which has evolved as an aesthetic category associated with the conscious framing of *visual* landscape experience – both through selecting the viewpoint and through manipulating the landscape itself – the scene (Figure 4). It has become a dominant paradigm that underpins landscape design and planning (Read 2005), but is frequently taken for granted, and Bowring (1995) has shown how the meaning has frequently been 'emptied out' of the picturesque through its clichéd use in urban settings, such as parks and subdivisions with familiar scenes of grassland, winding paths and groups of trees.

The picturesque is also closely related to the structure of feeling known as 'the pastoral' (Hunt 1992), which highlights the values of rural living. The origins of the pastoral are as old as European urban democracy, and the pastoral is typically set in counterpoise to civic life, and embodies considerable nostalgia for a simpler life (Williams 1975). Pastoral sentiment has been a feature of European settlement of New Zealand from the mid-1800s, and continues to be a major driver of peri-urban subdivision developments (Swaffield and Fairweather 1998)

and globalised amenity landscapes (Cadieux and Hurley 2011) such as high country lakesides (Swaffield and Brower 2009). It is therefore a significant factor in aesthetic values of rural landscapes, and Swaffield (1997) argued that pastoral sentiment was embodied in the RMA in the way in which it seeks a 'sustainable' use of natural resources.

CONTEMPORARY RESEARCH ON AESTHETIC LANDSCAPE EXPERIENCE

There is limited empirical scientific research on contemporary aesthetic experiences of landscape in New Zealand. Swaffield and Foster (2000) summarised findings on community perceptions of high country landscapes, and Swaffield and Fairweather (2003) synthesised the findings from a number of tourism studies in the 1990s focused on landscape preferences for coast, rural landscapes and small towns. Results from a number of more specific, predominantly rural, studies include Egoz et al. (2001), Stephenson et al. (2004), Stephenson (2007), Pflüger et al. (2010), Wilson and Swaffield (2010), Brown and Brabyn (2012) and Kerr and Swaffield (2012). Results from professional workshops and community consultation undertaken in relation to landscape issues under the RMA typically remain within the 'grey' literature as reports submitted to clients and councils, although some is now available online (e.g. Boffa Miskell 2007).

Newton et al. (2002) provided an analysis that helps classify the empirical findings of these studies, arguing that there are two distinct orientations in aesthetic responses to 'natural' landscapes in New Zealand. Drawing on a number of Q-sort studies, and informed by theoretical examination of the aesthetic relationship between nature and culture, they identify preferences for 'wild nature' and 'cultured nature'. 'Wild nature' highlights the value of aesthetic experience of natural settings unmodified by humans or signs of civilisation, while 'cultured nature' highlights the value of settings where cultural activities such as production, recreation, or inhabitation are seen as an integral part of nature. Both categories value diversity and 'picturesque' qualities, but the first regards the presence or evidence of humans as negative, whereas the second

FIGURE 5 Wild and cultured landscapes, Central Otago.

positively values the combination of humans with nature.

These two categories largely capture the empirical results from a wide range of New Zealand studies. 'Wild nature' highlights the aesthetic value of indigenous forest and landform associated with wild and scenic rivers (Mosley 1989), the absence of human artefacts and activities in wilderness (Kliskey and Kearsley 1993), the importance of mountains and lack of development in high country (Swaffield and Foster 2000), running water in braided rivers (Pflüger et al. 2010), clear water and lack of exotic weeds in spring-fed streams (Kerr and Swaffield 2012), and water views and indigenous land cover (Brown and Brabyn 2012). 'Cultured nature' embraces values such as heritage and human occupancy, living in nature, and stories and evidence of human occupation (Swaffield and Foster 2000; Swaffield and Fairweather 2003; Stephenson et al. 2004; Stephenson 2007, 2010a; Wilson and Swaffield 2010); and accessibility, recreation, and safety for human use (Swaffield and Foster 2000; Swaffield and Fairweather 2003; Kerr and Swaffield 2012) (Figure 5).

Recent studies

Four of the more recent examples noted above illustrate the different ways in which landscape aesthetics are currently being investigated and reported in New Zealand within an ecosystem management context. They are presented in the order of the categories of approach to landscape assessment described by Zube et al. (1982): expert, psychophysical, cognitive and experiential.

The Banks Peninsula Study (Boffa Miskell 2007) is an example of an expert-led assessment that also includes key informants from the community. It followed a long period of tension and contest over landscape policies for the area, and included but was not limited to consideration of categories of landscape highlighted in section 6 of the RMA. The study followed professional protocols of systematic collection and collation of resource information from a range of sources, which were then mapped using GIS, and incorporated community workshops. The outcome of this study was a series of maps that identified areas of landscape character (similar in some ways to the UK approach of Countryside Character assessment: Swanwick 2002), and also identified areas of land that met the criteria for additional policy protection under the RMA. The primary mapped outcomes of this study were therefore nominal measures (categories) of landscape.

Brown and Braybn (2012) explicitly adopted an ecosystem services framework to investigate 'social landscape values' in two regions (Otago and Southland) based largely on the 'psychophysical' paradigm. They describe their approach as public participation through GIS (PPGIS). Participants were recruited through random mail sample of residents, visitor intercepts, and advertising, and asked to undertake a web-based survey to identify the location of 'landscape values' in two conservation conservancies. 'Scenic/aesthetic' values were one of 13 potential 'landscape values' identified theoretically, of which seven were included in the Otago/Southland survey. Analysis correlated public preferences with biophysical attributes of land. The results were consistent with many other studies seeking formal aesthetic values in landscape, identifying the particular importance of water views and indigenous forest cover. Brown and Brabyn (2012) extrapolated the findings to a national level using GIS-based landscape character classification (Brabyn 2009). They predicted the distribution of six values from the Otago–Southland study across the whole country, generating maps of landscape value. They found a good association between higher 'values' and the location of coastlines and mountain areas, with more variability of values within rural landscapes. The prediction of values, and potentially of change in values due to changes in land cover, is a key feature of this approach to assessment, expressed as ordinal measures.

At a smaller scale, Kerr and Swaffield (2012) also explicitly adopted an ecosystems services framework, combining the Q-sort method with a choice experiment (an econometric technique) to investigate cultural service values of small rivers and streams in Canterbury. The context for the study was the increasing use of groundwater to support irrigated agriculture (principally dairy intensification) in Selwyn District. Controversy over the development included concerns that increased drawdown was adversely affecting the recreational and amenity values of spring-fed streams and the Selwyn River, which in its middle reaches is spring fed during most of the year. Amenity values are defined under the RMA (s 7(c)) as being 'those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes' which Kerr and Swaffield (2012) interpreted as cultural service values.

Q-sort was used to identify the most salient attributes of 'amenity', using photographs shown to small samples of key informants drawn from farming, recreational and conservation interests. In the second stage of the study the attributes that were most significant drivers of respondents' perceptions of cultural service values were incorporated into a choice experiment that required respondents to choose preferred combinations of attributes from a series of options. These were designed so that subsequent analysis can identify the utility related to different attribute levels, hence providing a comparison of the values assigned to different attributes. Inclusion of an economic attribute allowed dollar values to be assigned. Kerr and Swaffield (2012) found that clear water and safety for swimming were the most widely valued attributes, while presence of weeds in the riverbed, additional days when the river was dry in winter, and costs of management were all negative values. For some respondents, bankside grass, shade trees and indigenous riparian vegetation were also highly valued. This approach therefore identified the salient attributes of landscape aesthetic experiences measured nominally, as well as their relative value.

Stephenson's studies of Bannockburn and Akaroa (Stephenson et al. 2004; Stephenson 2007, 2010a) provide a fourth example, based on in-depth semi-structured interviews with key informants in local communities to identify 'insider' values of particular

landscapes. They focused on the question 'what is important to you about this landscape?' and compared the responses to conceptual categories identified from the academic literature. Results indicated that insiders or local residents placed more emphasis on intangible values (e.g. stories, practices, and genealogies), and adopted a broader and more free ranging perspective than that emerging from experts. Particularly valued aspects of a local landscape were places where landscape forms, relationships and practices interacted, for example where an historical feature, such as a water race, expressed a continuing function and was part of a wider landscape narrative that gives the area identity. This highlights the point made earlier that aesthetic 'values' are actively constructed and reconstructed through everyday practices. The 'measurement' of experience in this type of approach is nominal. It identifies places and networks of valued experiences, but does not assign relative importance to them.

DISCUSSION – CHALLENGES, RECENT DEVELOPMENTS AND NEW DIRECTIONS

The overview of why and how aesthetic landscape experiences can be understood and measured within an ecosystem services framework has identified a number of challenges for both researchers and practitioners. The most notable feature of the published record and of professional practice is the diversity of approaches to identifying and assessing aesthetics-related ecosystem services and their benefits to humans. Progress has been made since the Millennium Ecosystem Assessment (2003) to clarify the terms and definitions and to clearly differentiate the ecosystem services from the benefits of these services to humans (De Groot et al. 2002, 2012; De Groot 2006; Boyd and Banzhaf 2007), suggesting the information we get through all our senses constitutes the aesthetic ecosystem service (De Groot et al. 2002), and the benefit we get from this information and our response to it constitutes the landscape aesthetic experience. Boyd and Banzhaf (2007) argue that this distinction is essential for developing an effective accounting system where both material and non-material cost and benefits are weighed in order to make effective landscape design, planning and management decisions. However, the formal separation of elements that is needed for measurement and accounting can also disguise and underplay the critical role of active engagement people have with landscapes and ecosystems in shaping experience. Understanding situated experience requires a more holistic approach, and we have argued that the term 'aesthetic experience' is preferable to that of 'aesthetic value' (as used by the Millennium Ecosystem Assessment 2003) precisely because it expresses the key role played by cultural and individual involvement *with* landscape in shaping aesthetic relationships (Bourassa 1988; Nassauer 1999b; Fry et al. 2009).

There is a diversity of approaches to identifying and evaluating such aesthetic ecosystem services. However, many of the assessments have only considered the experiences of certain groups of people and have often not considered both public and private or bicultural interests. Most New Zealand studies have been in response to specific resource management issues and therefore may only consider the aesthetic services contributing to those issues. Some professional organisations have attempted to contribute to the development of more standardised approaches and methods. For example, in 2009–2010 the New Zealand Institute of Landscape Architects Education Foundation conducted a series of workshops among its members that resulted in the preparation of a guideline that identified the essential stages for landscape assessment (NZILA 2010). However, it did not

specify particular methods, in part to preserve the ability of practitioners to choose a method best suited to the problem context. The Environmental Defence Society (Peart 2005) also issued useful guidance that distils current assessment practice into a simple working framework, but again does not specify methods for assessment. The lack of consistency across studies and projects has attracted adverse comment from the Environment Court, which seeks more certainty (NZILA 2010).

However, the absence of a single methodological framework is not just a New Zealand phenomenon. Zube et al. (1982) identified a range of 'paradigms' of assessment internationally, and Daniel and Vining (1983) recognised that each had particular advantages. A very recent review of visual impact assessment of highways in the US (NCHRP 2013) finds that little has changed – there is still a wide range of legitimate approaches, each with different benefits and limitations. Nonetheless, some countries have developed common frameworks for the purpose of planning – notably the Countryside Character Assessment approach in the United Kingdom. A pressing research question in New Zealand is to define more clearly the needs and opportunities for greater consistency in landscape assessment generally, and for aesthetic ecosystem services assessment in particular. What common features might such an approach need, what roles must it fulfil and what criteria must it satisfy? What are the priorities? How could a more consistent framework be developed and implemented?

Stephenson (2010a) illustrates very clearly the differences between 'insider' and 'outsider' experience of landscape, the former being deeply embedded in local history and community, the latter more focused upon immediate 'surface' qualities. Recognising, measuring and managing different types of landscape relationship across space and time is particularly challenging within an ecosystem services framework, as they lead to different types of aesthetic experience, and different intensities of response. Furthermore, these experiences do not equate directly with spatial scale. For example, some proposals to change very specific local landscapes evoke intense and different feelings in both locals and in people who may live far away – as illustrated in debates over proposed hydro projects on the West Coast. Valid expression of these differences is particularly difficult in any single measurement framework. The embedded and situated nature of landscape aesthetic experiences and the scale dependency of such experiences therefore present a major challenge to the scientific investigation of aesthetics as cultural ecosystem services, and work is needed to clarify the most important dimensions in an improved assessment framework.

Distinguishing between public and private interests in aesthetic experience is also a major conceptual and practical challenge. There are two dimensions. First, it is difficult to separate out the collective public interest, which may require some policy intervention, from private interests that are typically managed through market mechanisms. Second, it is difficult to manage situations where there are public interests in privately owned land, or private values associated with publicly owned land, and where the 'services' cross cadastral boundaries (Vejre et al. 2012). Historically governments have acquired land highly valued for its public landscape aesthetic experiences (e.g. as national parks and reserves). More recently, planning legislation has been used to assert a public interest over particular areas or aspects of private land, such as areas identified as outstanding natural landscapes under the RMA. However, the preparation and implementation of policy to protect the features of private land that are associated with valued aesthetic experiences is fraught with controversy,

FIGURE 6 Searching for an ecological aesthetic – Christchurch.

and many local governments, communities and landowners lack the financial resources to manage areas in order to protect or enhance their aesthetic, and other, ecosystem services for the long term (McWilliam et al. 2010a, b, 2011, 2012). This raises three further questions. How can aesthetic experiences in New Zealand be enriched and effectively managed in the absence of the significant public financial support that is more common in industrialised countries such as Europe? Can the growing number of collaborative local ecosystem management partnerships in New Zealand be better supported to incorporate consideration of aesthetic services in their work? How can urban communities be enrolled constructively in provision and management of aesthetic ecosystem services?

Gobster et al. (2007) argue that people are more likely to protect ecosystem services they perceive as having high aesthetic value, and destroy or inadvertently damage those they perceive as having low aesthetic value. However, human aesthetic preferences are not always aligned with multiple and healthy ecosystem services (Nassauer 1999a; Gobster et al. 2007). Further research is required to understand the landscape patterns and conditions that elicit positive aesthetic responses and their visual and functional relationships with other services that define healthy ecosystems. Is it possible to develop a New Zealand approach to changing human aesthetic experiences through education, planning, design and management in order to develop a healthier 'ecological aesthetic' (Figure 6) more in tune with long-term ecosystem health? For example, can Nassauer's strategy (1999a) of identifying and managing 'cues for care' be adopted to gain public support for other ecosystem services in the landscape? Alternatively, could

education programmes be effective in realigning the aesthetic experiences of people in support of healthy ecosystems? For example, people are less likely to indulge in antisocial behaviour in natural areas if they are aware of the link between their behaviour and an impact, know how to behave appropriately, and feel responsible for the stewardship of the area (Gamman et al. 1995; Johnson and Van de Kamp 1996). Thus educational tools can be effective in altering some destructive environmental behaviours (e.g. Johnson 1989). Programmes that fulfil similar objectives may be equally as effective in altering some of our aesthetic experiences in support of healthy ecosystem services in production and urban landscapes.

It is clear that whereas aesthetic ecosystem services form only a relatively small part of the ecosystem services framework, they raise complex conceptual and practical challenges. They can also have significant influence on the way in which a much wider range of ecosystem services is managed – both positively and negatively. While the need to measure and account for such services suggests a formal approach that separates and measures each element of the aesthetic experience, the potential to use aesthetic experience in a creative and positive way in ecosystem service management requires recognition and adoption of a more transactional approach, focused on actively shaping aesthetic experiences through engagement with landscapes and ecosystems. Striking the balance between these imperatives and their respective methods presents a vital challenge for science, and it is likely that successful pathways will be transdisciplinary rather than based in any single discipline or profession.

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