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PERSPECTIVE

The shared landscape: what does aesthetics have to do with ecology?

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Abstract This collaborative essay grows out of a debate about the relationship between aesthetics and ecology and the possibility of an ''ecological aesthetic'' that affects landscape planning, design, and management. We describe our common understandings and unresolved questions about this relationship, including the importance of aesthetics in understanding and affecting landscape change and the ways in which aesthetics and ecology may have either complementary or contradictory implications for a landscape. To help understand these issues, we first outline a conceptual model of the aesthetics–ecology relationship. We posit that:

1. While human and environmental phenomena occur at widely varying scales, humans engage with environmental phenomena at a particular scale: that of human experience of our landscape surroundings. That is the human ''perceptible realm.''
2. Interactions within this realm give rise to aesthetic experiences, which can lead to changes affecting humans and the landscape, and thus ecosystems.
3. Context affects aesthetic experience of landscapes. Context includes both effects of different landscape types (wild, agricultural, cultural, and metropolitan landscapes) and effects of different personal–social situational activities or concerns. We argue that some contexts elicit aesthetic experiences that have traditionally been called ''scenic beauty,'' while other contexts elicit different aesthetic experiences, such as perceived care, attachment, and identity.

Last, we discuss how interventions through landscape planning, design, and management; or through enhanced knowledge might establish desirable relationships between aesthetics and ecology, and we examine the controversial characteristics of such ecological aesthetics. While these interventions may help sustain beneficial landscape patterns and practices, they are inherently normative, and we consider their ethical implications.

Keywords Landscape perception · Scenic beauty · Ecological aesthetics · Landscape change · Context

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Introduction: human experience and the aesthetics–ecology debate

The arts and sciences are essential ways that we come to know the world, but much of our response to the environment is determined through individual experience of landscapes. Environmental phenomena extend from sub-microscopic to global scales and change over time spans that range from milliseconds to millennia. In landscape ecology the processes studied can be as small as the home range of a spider or larger than a continent. But it is difficult for people to understand, care about, and act purposefully upon phenomena that occur at scales beyond our own direct experience. Because humans so powerfully affect environmental phenomena, we contend that that it is highly meaningful and relevant to understand human interaction with ecosystems at the scale of landscapes, defined here as the physical patterns we perceive as making up our surroundings.

The scale at which humans as organisms perceive landscapes, what we term the *perceptible realm*, is particularly important because this is the scale at which humans intentionally change landscapes, and these changes affect environmental processes. At this scale, landscape perception thus becomes the key process for connecting humans with ecological phenomena. Particularly relevant to this paper, aesthetic experiences evoked through perception of the landscape powerfully and regularly engage people with ecosystems. This implies that landscapes that are perceived as aesthetically pleasing are more likely to be appreciated and protected than are landscapes perceived as undistinguished or ugly, regardless of their less directly perceivable ecological importance. Aesthetic experiences may thus lead people to change the landscape in ways that may or may not be consistent with its ecological function.

In this essay we explore the relationship between landscape aesthetics and ecology and discuss some issues for planning, design, and management that can arise when aesthetic goals come into conflict with ecological ones. In our past work, we have each addressed various aspects of the aesthetics–ecology relationship and have challenged each other's thinking over the years. Our goals in this collaborative effort are to identify areas where we have come to agree about the aesthetics–ecology relationship and to clarify those areas for further scrutiny in research and application. We also point out where our perspectives diverge and suggest where additional work might resolve these differences.

While this essay builds upon on a great deal of research and scholarship by others, it is not our aim here to present an exhaustive intellectual history of landscape aesthetics and landscape ecology. We provide much of that background in our earlier papers and include selected references to those papers for readers below. We also acknowledge an increasing amount of new research and scholarship addressing landscape aesthetic and ecological relationships. This work ranges from philosophical investigations to quantitative empirical research, and focuses on urban, rural, and wildland landscapes in the US, Europe, Asia, Australia, and the Pacific. While reviewing this work was beyond our scope in this paper, we urge those who are interested in this essay to seek it out.

Our efforts also relate directly to an evolving discussion about the integration of pluralistic viewpoints and paradigms within the field of landscape ecology. The aesthetics–ecology relationship is a powerful but widely misunderstood manifestation of nature–society interactions, and we believe the landscape scale of human experience that we describe in this paper represents a strong entry point for transdisciplinary study of such interactions. By exploring the significance of this particular scale of human experience, diverse perspectives from the natural and social sciences and the humanities may have a stronger basis for developing unifying, integrative concepts for addressing sustainability issues.

In the sections that follow, we first establish the basis for our shared conceptual model of the aesthetics–ecology relationship and then discuss the model in some detail. We next describe how both landscape context and personal–social situational context can fundamentally influence this relationship, and briefly review several key examples. Last, we discuss how landscape design and observer knowledge interventions might serve to make aesthetic and ecological relationships more complementary in order to achieve ecological goals, and we discuss the practical and ethical implications of such interventions. We hope that this work will help to advance transdisciplinary research and theory-building as well as promote beneficial landscape change through planning, design, and management.

Interactions between aesthetics and ecology in landscape perception

Considering landscapes, what does aesthetics have to do with ecology? We contend that there is an intimate yet complex relationship between aesthetics and ecology that has important implications for those interested in landscape ecology—including natural scientists, modelers, geographers, land planners, designers, and managers. This relationship also is relevant for social scientists, environmental philosophers, and others studying the causes and consequences of landscape change. Aesthetics has not been a principal concern of many of these individuals, however. Indeed, some would argue that aesthetics has little if anything to do with the ecology of landscapes.

But we think there are important reasons why considering aesthetics helps to anticipate landscape change and its environmental impacts. First, as we have stated above, landscape aesthetics provides a critical linkage between humans and ecological processes. As humans, our sensory system is tied closely to our emotions, and of our emotions, pleasure has a fundamental influence on how we respond to the stimuli of our world. Philosophers, psychologists, artists, and designers call the pleasurable human response that results from perceiving the properties of environmental stimuli an aesthetic response. In the spatial-temporal milieu of landscape, this response might more appropriately be thought of as aesthetic experience. Most important for its ecological implications, aesthetic experience ties our feelings of pleasure to the perceived world, a landscape that may only imperfectly reflect the ecological functions it embodies. Of course, every species seeks suitable habitat by responding to perceived cues in its environment. For *Homo sapiens*, the aesthetic pleasure derived from landscape experience is both a reflection of evolutionary history and a key driver of contemporary environmental behavior, including land use, development policies, and real estate markets. An important issue confronting human-environment research and management practice, and directly addressed in this paper, is the extent to which this behavioral response can and should be modified through design or knowledge interventions.

Second, aesthetic experience can drive landscape change. This is most obvious in the context of leisure activities, but it pervades even the most mundane aspects of daily life. Our desire to see, live in, and visit beautiful places and to avoid or want to improve places we perceive as ugly fundamentally affects landscape change. This desire is reflected in landscape policy and management, where aesthetics has been widely recognized as a non-commodity resource (or more recently, an ‘‘ecosystem service’’) among more traditional commodity-oriented resources like food and fiber. The connection between aesthetics and landscape change was made explicit in US and UK law and policy in the late-1960s. Expert- and perception-based methods were developed to assess landscape aesthetic quality for the dual purposes of identifying areas to protect for public enjoyment and for minimizing or mitigating the aesthetic impacts of development or production-oriented uses such as timber harvesting. These assessment methods focused largely on landscape scenery and were applied to public wildlands in America as well as to afforestation of public lands in UK, with an emphasis on maintaining cultural expectations of naturalness. This approach to aesthetics characterized landscape management policy in many countries around the world for decades, but has more recently been criticized for emphasizing the visual enjoyment of natural-appearing scenery, encouraging what some have called the ‘‘scenic aesthetic.’’

Third, attention to ecological quality can be influenced by the perceived aesthetic value of landscapes. For example, a predominant concern with scenic quality led to important advances in understanding and managing public wildlands in America, but this context is only one domain of landscape change. Early policy attention to wildlands prompted parallel inquiry into more obviously human-dominated settings, like cities, agricultural lands, and the European cultural and historic landscapes that have been intensively managed for millennia. The need to protect and maintain ecological health, diversity, and ecosystem services in all types of landscapes is now more widely accepted. But understanding how people perceive and experience the beauty of all landscapes is central to achieving public support of, and compliance with, ecologically motivated landscape change. This becomes especially relevant when human aesthetic preferences and ecological goals are not aligned—when what is seen as beautiful is deemed to be ecologically unhealthy or what is

deemed to be ecologically healthy is seen as undistinguished or ugly.

The disjuncture between aesthetics and ecology

Ecological concepts such as biodiversity, ecological health, and ecosystem services were heard of little, if at all, when aesthetics first began to affect landscape management policy. These ecological concerns have now become legal drivers for many aspects of landscape change, in areas ranging from water quality protection to agricultural subsidies. Educational campaigns have helped to raise public awareness and spur action. In some situations, ecological arguments are supplanting aesthetic ones as justification for protecting the non-commodity values of landscapes. But while ecological knowledge can help foster an intellectual understanding of new management policies, such knowledge may not translate into aesthetic appreciation of ecologically beneficial landscapes.

This disjuncture between aesthetic experiences and ecological functions is at the heart of what we refer to here as the aesthetics–ecology debate. Humans cannot directly sense ecological quality, though there may be a tendency, based on evolutionary processes and cultural expectations, to assume that good ecological quality is associated with good aesthetic quality. In some cases aesthetic and ecological values will be positively correlated, but there is no guarantee this will always be true. What is aesthetically pleasing may or may not reflect ecosystem health. Neatly tended countryside and metropolitan landscapes may be perceived as beautiful, but the deep green of fields or lawns sometimes signals poor ecosystem health. Conversely, ecologically healthy landscapes may not be aesthetically pleasing. Landscapes such as wetlands and prairies may be perceived as unattractive; people may not directly recognize their biological diversity. Similarly, landscape management practices that effectively conserve water quality, protect soils or provide other important ecosystem services may not be seen as aesthetically pleasing. Yet, importantly, for all landscape types, people tend to interpret their aesthetic experience of landscape as providing information about its ecological quality.

To address this conundrum, some environmental designers, philosophers, and social scientists have advocated expanding the scope of landscape aesthetics to explicitly incorporate ideas about ecological processes. This ''ecological aesthetic'' is motivated by the idea that ecological processes may not conform to the visual qualities associated with a pleasurable landscape appearance, and that this disjuncture can encourage ecologically damaging anthropogenic landscape change. An ecological aesthetic is, by definition, normative in that it asserts that it is desirable for humans to take aesthetic pleasure from landscapes that embody beneficial ecological functions. In this way, aesthetic experiences can promote and sustain healthier ecosystems, and thus indirectly promote human health and welfare.

Those of us writing this paper all agree that a complementary relationship between aesthetic pleasure and ecological health in the landscape is desirable. Indeed, an ecological aesthetic may be seen as a forward projection of the beneficial relationship between landscape preference and ecology theorized by some to have been established through natural selection over human evolutionary history. What is controversial is whether, in cases where landscape aesthetic preferences are found to conflict with ecological goals, aesthetic preferences can (as a practical matter) and should (as an ethical matter) be changed. This problem has different implications and possibly different resolutions in different landscape contexts—a topic we explore later in this paper. An important related question is whether ecologically beneficial landscapes can and should be designed to appeal to aesthetic preferences. We return to this key idea—that an ecological aesthetic should be advocated as a normative aesthetic—in detail at the end of this paper where we discuss the ethical implications of interventions to achieve a closer alignment between aesthetics and ecology.

Toward a conceptual model of landscape aesthetics and ecology

Although we come to this topic of research from different disciplinary backgrounds and experiences, we all find that environment-behavior models developed in environmental psychology provide a useful starting point for describing the relationship between landscape aesthetics and ecology. Environment and

behavior are often described as transactional and contextual; transactional in that humans and the environment help to define and transform each other by their mutual interactions over time; contextual in that human behavior is shaped by the qualities of particular places and situations. Change is an important outcome of person-landscape and person–person-landscape transactions, and changes that occur within a given context and scale affect other scales of both socio–cultural and ecological systems.

In Fig. 1 we build upon these ideas in a conceptual model that attempts to make explicit the relationship between aesthetics and ecology. As with most environment-behavior models, we portray humans and the environment as discrete but interacting sets. What distinguishes our model from others is its attention to the scale of landscape patterns that constitute what humans perceive as their surroundings. This is the critical perceptible realm where aesthetic experience occurs and where intentional actions toward landscapes can directly or indirectly affect ecological functions. Significantly, this perceptible realm provides the most active intentional contact between environmental and human phenomena—where the process of perception leading to action most directly links human systems with ecosystems. We nest the critical scale of the perceptible realm within multiple scales of environmental and human phenomena in order to illustrate its influence upon phenomena at other, less directly perceived scales. In the sections below, we describe the perceptible realm and how it derives from and affects the broader system of human-environment transactions.

Landscape patterns and ecological processes

Landscape patterns are perceptible instantiations of interrelated, interdependent, environmental phenomena. Spatial compositions of landform, water, vegetation, and human artifacts—singly or in combination—provide some ecological information at a scale that is readily perceived by people. Perception of larger patterns such as forests or wildlife populations, and of smaller features such as flowers or butterflies, also provides some information about ecological systems. Beyond this perceptible realm exists a broader range of environmental phenomena that function from sub-microscopic to global scales and over instantaneous to geological time periods. But because these phenomena are outside of the ‘‘human scale’’ they are less likely to evoke our concern and action. Yet ecological integrity and human well-being depend upon elements and interrelationships across the full spectrum of environmental scales.

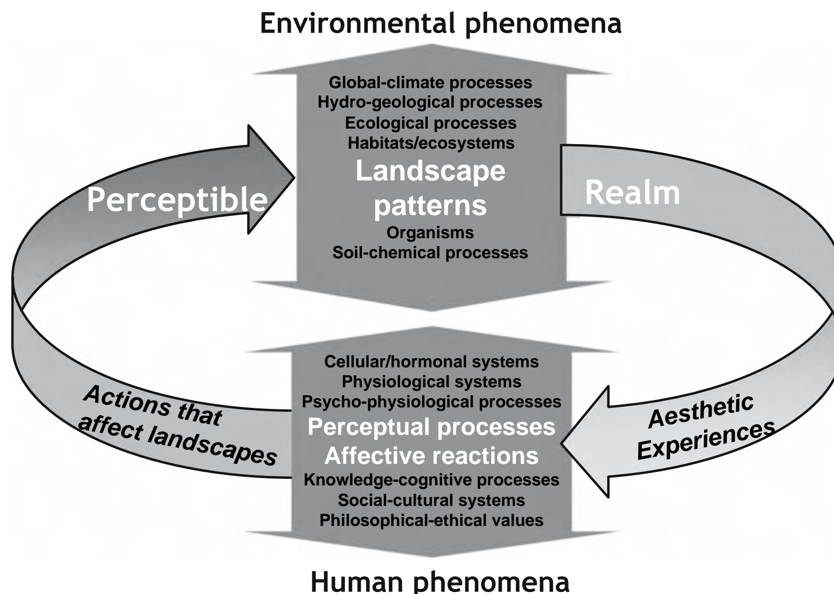

Fig. 1 Model of human–environmental interactions in the landscape

Maintaining the integrity of ecological processes and their capacity to provide ecosystem services is essential to human welfare and the raison d'etre of our conceptual model. While landscapes and ecosystems affect people in countless ways, our model describes how human actions, based on landscape perception, can affect ecological functions at scales that may not be immediately perceived. Long-term or global effects, for example, are often unintentional and unanticipated. Because essential ecological phenomena operate outside of the perceptible realm, landscape planning, design, and management that create functional links between beneficial ecological phenomena and aesthetically pleasing landscapes are key to the cultural sustainability of vital ecosystem functions.

Landscape perception and the role of knowledge in aesthetic experience

Landscape aesthetic experiences are relatively direct perceptual experiences of certain environmental phenomena. While predominantly acquired through sight, landscape aesthetic experiences can be facilitated and moderated by other sensory inputs. Aesthetic experiences are fundamentally triggered by affective (emotion-based) processes, which are shaped by evolved biochemical, physiological, and psychological capacities and predispositions. The complexity of human perceptual response also suggests that knowledge and cognitive processes can change perceptions. Learning to recognize habitats, for example, could influence people's intentions for landscape change. The ecological value of a landscape might, in and of itself, give pleasure to a person who knows how to recognize relevant ecological phenomena. This recognition may occur separately from or along with the feeling of pleasure that is understood as aesthetic experience. Whether the pleasure that derives from recognizing ecological value ''counts'' as an aesthetic experience is at the heart of the aesthetics–ecology controversy. Some of us would argue that pleasure in recognizing ecological value should be distinguished from landscape aesthetic pleasure. A similar argument is that societal and cultural systems or philosophical and ethical values that can affect how people are attracted to or repelled by landscape experiences should not be considered components of aesthetic experiences. These issues hinge on controversial philosophical questions that underlie the idea of an ecological aesthetic, and we do not attempt to resolve them in this essay.

Since our conceptual model aims to show how aesthetics affects ecological processes and their capacity to provide ecosystem services, we adopted an inclusive definition of landscape aesthetic experience as *a feeling of pleasure attributable to directly perceivable characteristics of spatially and/or temporally arrayed landscape patterns*. Even within this broad definition, we continue to differ among ourselves on which characteristics of landscape are considered directly perceivable and on how extensive, immediate, and direct a role cognitive processes and acquired value systems play in landscape aesthetic experiences. We especially disagree about how and the extent to which knowledge of the ecological significance of landscape patterns enters into aesthetic experience.

Aesthetic experience as a driver of action and change

The actions that occur within the perceptible realm are in many ways the most important element of the model in Fig. 1 because actions demonstrate the potential for aesthetics to motivate and direct landscape change. For example, while human aesthetic response to landscape is often thought of as passive, such as looking at lake scenery from behind the windshield of a moving automobile, perception even at this level can have an action component: from the overt expression of preferences (''Isn't it beautiful!'') to the ancillary consumption of resources to make a trip or choose a route for aesthetic pleasure. Such preferences may lead to behavioral choices (''Let's stop here and have a picnic.'') and actions that result in small/short-term (''Throw those hot barbeque coals in the lake so we don't start a fire.'') or large/long-term (''Why don't we buy land and build a cottage here for holidays and our retirement?'') changes to a site. As individual preferences, choices, and actions are aggregated over broader social and societal levels, their potential to change landscapes, regions, ecosystems, and other environmental phenomena can be profound. In US, for example, the ''amenity migration'' of people moving to live in scenic landscapes has been identified as one of the largest contemporary drivers of landscape change.

Societal actions are further played out through political and other influences on programs, management practices, and policies. Across Europe, agri-environmental measures, payments, and regulations aimed at protecting ecological and cultural heritage interests are resulting in major changes to wildlife habitats and visual landscape character. These more abstract forms of action institutionalize behavior and may speed or slow individual action to alter change at local-to-global scales.

The interactive nature of our model suggests that not only can aesthetic experiences lead to changes in the landscape, but also that landscape changes can affect aesthetic experiences, such as when a hurricane or clearcut devastates a cherished landscape. As landscape patterns change, people's aesthetic experiences of places change as well, ultimately affecting their actions (e.g., choices of where to build or where to object to logging). In this way, the action component of our conceptual model describes a recursive cycle in which change can alter the trajectory of both human perception/action and ecological processes. An important implication of this cycling is that how people perceive and experience change can lead to responses that may make relationships between aesthetic experience and ecological benefits more complementary or more divergent.

Finally, this interactive aspect of our model implies that human reactions to landscape also can change humans. Aesthetic experiences may produce direct physiological and psychological benefits through stress reduction as well as indirect health benefits through physical activity motivated by the desire for aesthetic experience through such activities as hiking or gardening. Landscapes also may change people as they learn from observing and interacting with landscapes—for example, as farmers or foresters learn about the underlying ecological processes that produce crops and lumber. Similarly, enhanced environmental knowledge might change people's response to the landscape, whether through or separate from their aesthetic experiences. The aesthetics–ecology relationship thus has implications not only for ecological well-being but also for human well-being.

Effects of landscape and situational context

Our model suggests how the aesthetic experience of landscapes may drive actions and changes to people and the landscape, but our discussion has not yet addressed how the specific landscape type and the situation in which the experience occurs may affect aesthetic experiences. Different landscape types have particular perceptible characteristics that evoke related human perceptions and expectations. As we considered scholarship and research in landscape aesthetics over the past 35 years, we were struck by how consistently specific landscape types were found to evoke different aesthetic responses, but how for the most part these very fundamental differences have been only implicit in the literature. This lack of attention may stem from the fact that many studies consider only a single landscape type and a single type of situational encounter, leaving context implicit for that study. Reviewing conclusions across these studies, including our own varied work in wildland, rural, and urban landscapes, we believe that context must be more explicitly addressed in order to advance landscape perception research and theory-building, particularly related to the aesthetics–ecology relationship and its effect on landscape change. Our own research experiences in America and northern Europe only begin to limn the aesthetic distinctions that may be attributable to context.

Figure 2 is a schematic of how both landscape context and situational context can influence aesthetic experience. The center of the figure derives from Fig. 1—landscape patterns within the perceptible realm elicit aesthetic experiences. The ''landscape context'' box shows that visible patterns of the landscape signal its type, and different landscape types may elicit attention to different patterns. The ''situational context'' box indicates how social/cultural and personal factors affecting the observer/respondent constitute a situation that also affects that

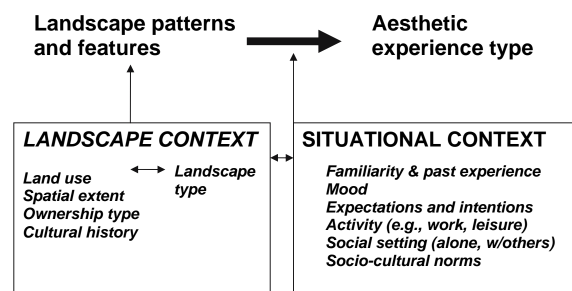

Fig. 2 Context component to model of human–environmental interactions in the landscape

person's landscape experience. Situational context might evoke different landscape aesthetic experiences even in the same person under varied circumstances. For example, a person may have different aesthetic perceptions about a landscape while recreating than while working in the same place. Familiarity, mood, and other personal, social, and cultural factors may also work to alter the situational context and affect how the landscape is perceived.

Landscape contexts and situational contexts interact, as when land uses identify landscape types, and signal and constrain observer intentions and the salience of attendant social norms and personal expectations. In the other direction, the observer's intentions may emphasize particular social norms and personal expectations, affecting what features of the landscape and setting are most salient, what is perceived as appropriate or attractive, and what actions are most likely.

In the remainder of this section we further identify contextual characteristics of different landscape types, and describe how landscape types signal and constrain human situational contexts, and potentially modify aesthetic responses.

Contextual characteristics of landscape types

Contextual characteristics such as land ownership, land use, cultural history, and spatial extent vary together to create perceptible landscape types. Different personal expectations, cultural norms for landscape appearance, as well as different types of experiences, tend to be elicited by these different landscape types. For example, publicly owned landscapes of large extent that are perceived as wildlands or wilderness are likely to be the settings for leisure activities, and evoke experiences that most people associate with scenic beauty. In contrast, privately owned landscapes of large extent that are dedicated to agriculture evoke personal expectations and cultural norms of people working in harmony with nature, and an experience type that is related to human care. In Europe, private landscapes of large extent may elicit a type of experience influenced by expectations and norms that are more directly related to historic traditions of a nation or region, with strong cultural attachments to perceivable landscape characteristics that are associated with those traditions. For example, in areas with small-scale ownership patterns, small fields and tended trees with hedgerow or walled boundaries give rise to an experience guided by expectations of carefully tended agriculture or forestland consistent with the cultural character of a region.

These contextual effects are important because they may evoke different types of experiences raising different theoretical and applied problems regarding the aesthetics–ecology relationship. Explicitly examining these differences helped us see how our conceptual model (Fig. 1) could be generalized to widely differing landscape types. Further investigation of contextual differences among landscape experiences could help to build landscape perception theory that more usefully addresses complex aesthetics–ecological relationships. While an experience associated with natural scenic beauty remains dominant for American public lands of large extent that are encountered in the context of recreation, a scenic aesthetic may not adequately describe the experience of private lands or public lands of smaller extent that bring pleasure to everyday life. These other types of landscape experience include, but are not limited to: care, attachment, and cultural identity. One approach to the aesthetics–ecology controversy might be to posit different types of aesthetic experiences distinguished by different landscape and situational contexts. It follows from our conceptual model that these different aesthetic experience types could have different implications for actions that affect ecological function.

Landscape types modify aesthetic experiences

In the following sections we introduce and briefly discuss four broad landscape contexts. It should be noted that while we as a group agreed that different landscape and situational contexts can modify people's landscape experiences and actions, we did not reach consensus on whether the pleasure that derives from recognizing the ecological, ethical, cultural or societal value of a landscape ''counts'' as an aesthetic experience. This issue affects judgments about what interventions might be most effective or appropriate in what circumstances, such as when aesthetic experiences and ecological benefits should be made more complementary by educating observers or by landscape design, or when known ecological benefits should be pursued regardless of

aesthetic consequences. For example, if knowledge and experience can induce a change in aesthetic type, a scenically unattractive but ecologically beneficial constructed wetland could begin to elicit a more positive ecological aesthetic when those who live nearby become better acquainted with the habitat and hydrologic functions it performs. Alternatively, the wetland could initially be designed to fulfill those valuable habitat and hydrologic functions in a landscape pattern that has immediately positive aesthetic experiences, separate from knowledge of those functions. Or, the protection of the unscenic but ecologically beneficial wetland could be justified on the basis of its scientifically substantiated ecological merits, regardless of its admitted aesthetic shortcomings. We agreed that different strategies for achieving ecologically beneficial landscapes may be appropriate for different landscape types, perhaps building upon different aesthetic types, and we allude to some of our agreements and differences in the sections below, but we leave much of this topic open to future discussion and research.

Wildland landscapes: scenic versus ecological aesthetics?

The aesthetic experience most often associated with wildland landscapes encountered in the context of recreational pursuits has typically emphasized natural scenic beauty or what some have called a scenic aesthetic. Landscape perception studies conducted in this context have generally shown a strong, positive correlation between perceived scenic beauty and perceived naturalness. We acknowledge that naturalness is an ambiguous and contested term, and that most if not all ''wild'' landscapes are in fact significantly influenced by human activity. Yet despite the slipperiness of this concept, there is a preponderance of evidence suggesting that for many wildlands, perceived naturalness maps closely with more objectively quantified indicators of ecological quality. In wildlands, landscape patterns that are perceived as natural are often also perceived as scenically beautiful and thus scenically beautiful landscapes may often be of high-ecological quality. In most wildland contexts, this convergence may be accepted as a happy coincidence. Landscape patterns that evoke positive aesthetic experiences, and thus induce protective and promoting actions, are also patterns resulting from healthy ecosystems and ecological processes.

Counterexamples of this mutually beneficial relationship in wildlands are noteworthy and can be problematic for landscape management. These counterexamples include landscapes that may be extremely important ecologically but are not scenically attractive, and landscapes that are highly scenic but are less valuable or even destructive ecologically. An often cited example of the first type is the wetland landscape, especially bogs or swamps. Counterexamples of the second type are more difficult to find in wildland situations, but some have argued that efforts to protect scenic mountaintops can divert attention from less attractive but more ecologically significant lands at lower elevations. Conflicts of the first type might be resolved by landscape designs that increase scenic values while preserving ecologically important functions. Alternatively, education campaigns and guided experiences might be used to encourage an ecological aesthetic that better aligns with ecological goals, but accomplishing substantial changes in aesthetic responses is likely to be very challenging in natural (naturalistic) wildlands that are usually experienced in the context of short-term leisure visits.

Agricultural landscapes: an aesthetic of care and the effect of knowledge

Relative to the aesthetics–ecology debate, American agricultural landscapes epitomize an aesthetic of care in which displays of order and stewardship are perceived as being in harmony with nature, even though ecological benefits may not be consistent with that perception. Care is an aesthetic that, unlike the scenic aesthetic, depends on perceptible cues of continuous human presence. It invites human engagement in changing and maintaining landscapes, and this engagement is perceived as benevolent. Reflecting situational expectations different from the scenic aesthetic, landscape features that are cues to care are read not only as pleasing patterns and colors, but as social gestures of neighborly consideration. Particular features that elicit an aesthetic of care vary with landscape type and region. In Midwestern American agricultural landscapes, straight rows of crops, uniformly green fields free of weeds, and freshly painted farm buildings connote care. As we discuss below, in many European agricultural landscapes, features

associated with good care are more dependent on long cultural traditions, and in metropolitan landscapes, closely cropped lawns and vibrant beds of annual flowers are among the features that connote care. In any of these settings, some noticeable ecological impacts like visible erosion and sediment-laden streams may be seen as scenically ugly, but many features that look well-cared-for may actually be ecologically damaging. In these contexts, aligning aesthetics with ecology can be a matter of designing ecologically beneficial plans that also clearly display care.

Agricultural landscapes also exemplify the effect that situational context has on aesthetic experience. Farmers who are regularly engaged in working the land often have sophisticated knowledge of the ecological processes that affect agriculture, as well as nuanced perceptions of landscape features that are salient to the success of agricultural enterprises. On the other hand, people who only travel through agricultural landscapes may have little knowledge of these processes or enterprises. While both groups expect agricultural landscapes to look well-cared-for, each group may notice different landscape features. For visitors, care might be filtered through a pastoral type of aesthetic based on a romantic notion of agrarian life, while for farmers and others who live in this landscape, care may be reflected through best management practices in which commodity production is a foundation of care. However, both the pastoral features appreciated by visitors and production features that farmers are more likely to appreciate sometimes undermine ecological function. Policy and planning can help align these features to better support ecological health.

European cultural landscapes: the aesthetics of attachment and identity

For most of Europe, the rural landscape is shaped by an ancient history of farming and forestry. Traditional land uses have given rise to a variety of distinctive field systems and settlement patterns that are often prized by residents and tourists as attractive landscapes as well as being valuable for biodiversity. These distinctive patterns are termed here as ‘‘cultural landscapes.’’ They also contribute to place attachment and local identity for the people who live and work there, and there is widespread support for their maintenance as an essential part of European cultural and natural heritage.

The way landscapes are perceived and interpreted by different cultures has led to different landscape patterns, and these patterns can be identified and mapped as historical landscapes. At the landscape level, patterns such as landform are important since they have been integrated into local perceptions and belief systems. At the site level, the focus has been more on the properties of material culture and social systems that describe the use of space.

Perspectives embedded in the concept of cultural landscapes demonstrate the complexity of the aesthetics–ecology debate and bring the situational context dimension further into the fore. Cultural features from more recent eras can visually dominate and often replace cultural or natural features that were important to earlier societies. Pre-historic monuments may have had a more striking impact on the landscape of the past than they do today, where they compete with remains from historic and contemporary times. The explicit layering of culture and history in European landscapes gives rise to such questions as: given personal expectations and socio-cultural norms, what is the authentic landscape? Which time period should be given precedence? Whose expectations count? The situational context of active farmers may lead to different landscape patterns than those preferred in the situational context of those who enjoy walking across cultural landscapes. Related to the aesthetic of care discussed above and more importantly to the broader issue of aesthetic–ecological conflicts, what happens when expectations and norms incorrectly assume that the historic cultural landscape was one where humans lived in harmony with nature? For example, intensively managed historic landscapes of northern Europe have been associated with an aesthetic tied to national or regional identity and given precedence for protection, but management for this may have detrimental ecological impacts. This is difficult because historic landscapes, now used to show how well some European cultures cared for the land in the past, were in fact horribly overexploited and unlikely to be sustainable. The cultural landscape aesthetic often contests for space and choice of management regimes with legitimate attempts to manage land for both ecological and scenic aesthetics.

Metropolitan landscapes: juxtaposing a variety of aesthetic responses

Metropolitan landscapes embody perhaps the greatest variety of aesthetic experience types. Metropolitan areas include private lands such as residential and business land uses as well as public open spaces such as parks and conservancy areas. They range in extent and location from very small plazas and yards in the center city to large conservation areas at the urban fringe. These landscapes are highly dominated by human intent, though they often include intentionally natural areas or abandoned sites that can look quite wild. Finally, their cultural character reflects the diversity of the groups that maintain or have an interest in the landscape, and may cater to ethnic preferences as well as class, user, and interest group preferences.

This diversity of contexts invites a variety of types of aesthetic experiences–ranging from a scenic aesthetic to an aesthetic of care to explicit, normative ecological aesthetics, to other aesthetic experience types based on differing situational contexts. These might include formal, postmodern, vernacular, kitsch, or other types that may be supportive of, compatible with, or detrimental to ecological health. This diversity of experience types in some ways makes metropolitan landscapes a microcosm of issues that play out across wildland, agricultural, and European cultural landscapes, though often with their own unique interpretation. For example, in contrast to the emphasis on naturalness in the scenic aesthetic of wildlands, in urban settings well-designed human artifacts within parks and the backdrop of the city itself are often seen as adding to rather than detracting from the scenic beauty of the landscape.

Another important difference is that in metropolitan areas, adjacencies between different landscape types can be very abrupt and may confront people with rapid contextual shifts. For example, in traversing a large park such as Lincoln Park in Chicago or Golden Gate Park in San Francisco, one can encounter formal garden spaces with vivid colors, forms and textures; naturalistic areas crafted by master landscape architects to provide scenic aesthetic experiences that emulate those found in nature; memorial groves and other designed sites that have high-symbolic value for some stakeholder groups; and sprawling natural areas that serve important ecological roles. Incompatibility among landscape types may not be a significant issue when they are juxtaposed across a park landscape, but conflicts can heighten when stakeholders with different situational contexts disagree in the type of aesthetic experience they think is appropriate for a specific place. Negotiating these differing viewpoints can be challenging, and experiences dealt with in urban contexts may offer lessons for addressing differing community and cultural expectations in other landscape contexts.

Aligning landscape aesthetics and ecology: prospects and precautions for intervention

Context is very important to the aesthetics–ecology debate, and we need to learn more about how it affects aesthetic experiences. Expectations about the perception of landscape will change across cultures and landscape types. While we leave open the question of what landscape experiences are purely aesthetic or what experiences are amalgamations of other response dimensions, we do agree that a key societal pathway to addressing ecological goals is through aesthetic experiences. As a final explication of our model, we discuss the use of design and knowledge interventions in aligning aesthetic experiences and ecological goals.

Interventions through design

For some settings like publicly owned wildlands, aesthetic experiences and ecological goals are often in close alignment with each other—what looks good to people and provides valued aesthetic experiences also sustains ecological functions and processes. But in other settings, aesthetic preferences may promote landscape change that undermines ecological goals. In these cases, landscape design and related planning, policy, and management activities may be used to intervene to bring aesthetic and ecological goals into closer alignment. Intentional landscape change through design is a powerful way to achieve this alignment. With reference to Fig. 1, design interventions are human actions that can change perceptible landscape patterns to build a closer correspondence between what is perceived and the valued functions of environmental phenomena outside the perceptible realm.

Much has been written about using design to help achieve ecological goals, but our model stresses that design that aims to meet ecological goals should also strive to deliver positive aesthetic experiences, consistent with public aesthetic expectations for a particular landscape context. Landscapes that produce important ecological benefits are unlikely to last in human dominated landscapes if they are undistinguished or aesthetically unattractive. Appropriate design, planning, policy, and management can create aesthetically attractive landscapes, achieving ecologically beneficial landscapes that are also culturally sustainable.

For example, designers of a formal garden in an urban park might select colorful flowering plants that convey an aesthetic of care and also provide nectar for insects and birds, contribute to native biodiversity, minimize inputs of water and fertilizer, and do not have invasive tendencies. Policies that affect agricultural landscape patterns might incorporate apparent characteristics that signal to farmers and the broader public that conservation set-asides are intentional acts of good stewardship. In landscapes of enduring cultural traditions, like the rural landscapes in much of Europe, field shapes and borders might emulate a favored historic period yet employ best management practices that minimize ecological damage to the land. For ecologically important but unscenic wildland areas such as wetlands or prairies, mown borders, gateway plantings, and carefully placed boardwalks can convey care, and foster more positive aesthetic experiences.

Interventions through knowledge

A second way to bring aesthetic and ecological goals into closer alignment is by enhancing people's knowledge. In contrast to design interventions that affect landscape patterns, knowledge interventions aim at the human component in Fig. 1 and attempt to change the perceptual, affective, or cognitive processes that mediate landscape aesthetic experience. This type of intervention might give people knowledge and experiences promoting greater aesthetic appreciation by calling attention to forms of stewardship that may not be readily apparent, or that may even be interpreted as a lack of care. For example, by learning about the important ecological functions of bogs and swamps, and perhaps by gaining experience and appreciation of some of their ecological features, people might come to have more positive experiences in them, or at least be willing to accept their ecological benefits as a fair trade for their aesthetic shortcomings. Knowledge interventions can also aim at teaching people about the negative impacts of some environmental conditions or practices so that they might be less likely to engage in them. For example, by learning about the invasive tendencies of some visually attractive plants, people might come to see them as undesirable and refrain from planting them in residential gardens where they could escape into the wild.

While research in public health, nutrition, safety, and some aspects of pro-environmental behavior (e.g., energy conservation, recycling, and antilittering) suggests that knowledge alone is insufficient for changing attitudes or behaviors, aesthetic theory in the arts and philosophy has long held that knowledge does affect aesthetic appreciation. Knowledge interventions relevant to landscape aesthetics come in many forms, from information provided by agencies and through the media, to on-site signage, guided and self-guided tours, and more extended experiential activities such as involvement in ecological restoration programs. The efficacy of knowledge interventions in different landscape and situational contexts is a subject worthy of further research effort.

Ethical implications of a normative aesthetic

Policy, planning, design, management, and education are all inherently normative activities—introducing changes judged to be improvements. While our conceptual model of aesthetic–ecological relationships is descriptive rather than normative, the model does suggest a mechanism for achieving normative outcomes. A key outcome is to align ecological goals with aesthetic experiences to achieve culturally and ecologically sustainable landscapes. We agree on the desirability of fostering a complementary relationship between ecology and aesthetics in order to sustain such goals as human and ecological well-being. However, our model could as easily be used in a very different way: the same mechanism that can be used to achieve desirable outcomes could be used to promote landscape change that fosters positive aesthetic experiences to the detriment of ecological goals. Thus, the way in which our model creates a

framework for normative interventions clarifies its ethical implications.

Some scientists and scholars may feel this application of the model overreaches the traditional role of research by prescribing what *should be* rather than only describing *what is* the relationship between humans and the landscape. Some of us who share in writing this paper feel that on both practical and ethical grounds it is more effective and appropriate to approach aesthetics–ecology conflicts by explicitly distinguishing between aesthetic and ecological goals. By treating conflicts directly through a tradeoff or negotiation process, anthropocentric/aesthetic and biocentric/ecological values can each be acknowledged and advocated on their own terms. Yet others of us think that if scholarship in landscape perception is to maintain its relevance for guiding design, planning, and management of the landscape, we have a responsibility to suggest positive pathways to change. By incorporating actions that affect landscape change explicitly into our model, we suggest how society might choose to achieve beneficial outcomes. We see our model as a useful means to explore how and under what conditions various interventions might achieve different outcomes, how interventions operate in various landscape contexts, and to what extent they can be used to bring different types of ecological phenomena into the perceptible realm.

Those who accept that design interventions might be useful in aligning aesthetic–ecological relationships might find attempts to change perceptions by knowledge interventions less acceptable. In particular, there is considerable apprehension among us about the ethics and effectiveness of using persuasive information to alter environmental perceptions and behavior, especially when these interventions emphasize fear or threatening messages. Some are concerned about the ambiguity and uncertainty of environmental knowledge itself. The dynamic character of scientific knowledge raises the question of whether we should intervene to protect ecological health if we are not certain that our ecological knowledge is true. While consensus does not yet exist in many relevant areas of ecological science, and science is always subject to future revision, the precautionary principle would lead us to act in defense of ecological goals as we understand them and to monitor the effects of our actions. Even when we are relatively confident about our scientific knowledge, landscape changes implied by that knowledge may be incompatible with public environmental values. For example, in the management of urban green spaces there are many options for improving ecological health and sustainability. Judging that the aesthetic experience of a restored prairie landscape that provides native biodiversity is superior to the aesthetic experience of a mature non-native forest that filters air pollutants and moderates the urban heat island seems arbitrary, and attempts to persuade with knowledge that do not admit the complexity of the relationship between ecological functions and human/social well-being can be ethically questionable.

While the topic of persuasive communication often acts as an ethical speed bump cautioning us against hasty knowledge interventions, similar warnings have been waged against design interventions. One of the most commonly cited examples in this respect is screening or other means of hiding land management practices such as timber clearcutting that many people would find aesthetically offensive. Some have questioned the ethics and efficacy of using these same types of techniques to hide the visual effects of practices such as prescribed burning aimed at improving ecological sustainability. In design as well as knowledge interventions, openness to public discourse, a clear ethical purpose, and acknowledgment that we might be wrong must guide decisions for what and how interventions are made.

Conclusions

Because human impacts on ecological processes have undermined numerous essential and beneficial ecosystem services, from adequate clean water supplies to landscape beauty, we need strategies for making decisions that bring human values and ecological goals into better alignment. Related to landscape change, we suggest that landscape patterns that elicit aesthetic responses of immediate pleasure or displeasure are an important starting point for formulating actions to affect landscape change. While certainly not all aesthetic pleasure from landscapes is a response to ecologically beneficial landscape patterns, we do argue that future landscape patterns, human experiences, and actions can be devised to

create landscapes of all types that are ecologically beneficial and simultaneously elicit aesthetic pleasure. Landscape planning, design, and management that address the aesthetics of future landscape patterns, then, can be powerful ways to protect and enhance ecological goals.

Working together on this collaborative paper has forced us to sort through our various disciplinary perspectives, experiences, and differences to arrive at some common understandings about what ecology has to do with landscape aesthetics, and to more sharply delimit areas for future inquiry. Our conceptual model of aesthetic–ecological relationships is indeed a work in progress, and we invite others to critique and expand upon what we have explored here.

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Selected references for further reading

1. Daniel TC (2001a) Whither scenic beauty? Visual landscape quality assessment in the 21st century. Landsc Urban Plann 54:267–281
2. Daniel TC (2001b) Aesthetic preferences and ecological sustainability. In: Sheppard SRJ, Harshaw HW (eds) Forests and landscapes: linking ecology, sustainability and aesthetics. CABI Publishing, Oxon, pp 15–30
3. Fry G, Sarlov-Herlin I (1997) The ecological and amenity functions of woodland edges in the agricultural landscape; a basis for design and management. Landsc Urban Plann 37:45–55
4. Gobster PH (1995) Aldo Leopold's ecological esthetic: integrating esthetic and biodiversity values. J For 93:6–10
5. Gobster PH (1999) An ecological aesthetic for forest landscape management. Landsc J 18:54–64
6. Gobster PH (2001a) Foreword. In: Sheppard SRJ, Harshaw HW (eds) Forests and landscapes: linking ecology, sustainability and aesthetics. CABI Publishing, Oxon, pp 21–28
7. Gobster PH (2001b) Visions of nature: conflict and compatibility in urban park restoration. Landscape Urban Plann 56:35–51
8. Gobster PH, Nassauer JI, Daniel TC (2005) Landscape aesthetics: what's ecology got to do with it? In: Lange E, Miller D (eds) Proceedings of our shared landscape: integrating ecological, socio-economic and aesthetic aspects in landscape planning and management. Ascona, Switzerland, May 2–May 6, 2005. Swiss Federal Institute of Technology, Zürich, pp 42–44
9. Hill, D., Daniel, TC (in press) Foundations for an ecological aesthetic: can information alter landscape preferences? Soc Nat Res
10. Nassauer JI (1992) The appearance of ecological systems as a matter of policy. Landsc Ecol 6:239–250
11. Nassauer JI (1993) Ecological function and the perception of suburban residential landscapes. In: Gobster PH (ed) Managing urban and high use recreation settings, Gen Tech Rep NC-163, USDA Forest Service North Central For Exp Stn, St. Paul, pp 55–60
12. Nassauer JI (1995a) Messy ecosystems, orderly frames. Landsc J 14:161–170
13. Nassauer JI (1995b) Culture and changing landscape structure. Landsc Ecol 10:229–237
14. Nassauer JI (1997) Cultural sustainability: aligning aesthetics and ecology. In: Nassauer JI (ed) Placing nature: culture and landscape ecology. Island Press, Washington, DC, pp 65–83
15. Ode ÅK, Fry G (2002) Visual aspects in urban woodland management. Urban For Urban Greening 1:15–24
16. Palang H, Fry G (eds) (2003) Landscape interfaces: cultural heritage in changing landscapes. Landscape Series, vol 1. Kluwer Academic Publishers, Dordrecht
17. Parsons R, Daniel TC (2002) Good looking: in defense of scenic landscape aesthetics. Landsc Urban Plann 60:43–56
18. Tveit M, Ode Å, Fry G (2006) Key concepts in a framework for analysing visual landscape character. Landsc Res 31:229–255