Landscape as medium and method for synthesis in urban ecological design

Joan Iverson Nassauer*

School of Natural Resources and Environment, University of Michigan, Ann Arbor, MI 48103, USA

Abstract

“Landscape” refers both to a conceptual field that examines how humans affect geographic space and to real places, and the word has both analytical and experiential implications. Pairing the analytical and the experiential enables landscape to be a catalyst for synthesis in science and for insight in urban ecological design. Emphasizing that science is fundamental to ecological design, this essay broadly interprets urban ecological design to include intentional change of landscapes in cities, their megaregions, and resource hinterlands. The essay offers two laws and two related principles for employing landscape as a medium and a method for urban ecological design. The laws observe that landscapes integrate environmental processes and that landscapes are visible. Two related principles explain how these inherent characteristics can be used to effect sustain ability by using landscape as a medium for synthesis and in a method that invites creative invention.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

More than 25 years ago Jackson (1984) described landscape as the field where humans and nature joust for time. Jackson's insight grew out of his study of vernacular landscapes, which he identified as the product of “local custom, pragmatic adaptation to circumstances, and unpredictable mobility” (p. xii). By characterizing the landscape as “where we speed up or retard or divert the cosmic program and impose our own” and calling for a “new ordering of time” (p. 157), he underscored his claim that humans make all landscapes - not just the places that we immediately recognize as designed. More importantly, he pointed the way toward a new kind of making, one in which humans anticipate the social and environmental implications of our incessant attempts to adjust nature and adjust to nature. We now admit that we have remade nature, irremediably and ominously. However, Jackson concluded with the promise of “a new kind of history” (p. 157) that affects not only nature, but ourselves. In this essay, I describe how landscape can be the medium as well as the method for design that aims toward that new kind of history.

As defined by Jackson, landscape refers to both a conceptual field that examines how humans affect geographic space, and to literal settings: real places. I follow Jackson in claiming both the analytical and experiential implications of the word, and this essay describes how it is the pairing of the experiential and the analytical in landscape that enables it to be a catalyst for synthesis in science and for insight in urban ecological design.

Urban ecological design is the subject of this essay because it epitomizes the inherent contradictions and potentials of landscapes made by people. Ecological is the pivotal term in the phrase. The struggle to understand nature adequately to intelligently intervene, since we inevitably will intervene, underpins Jackson's declaration that “…the new ordering of time should affect not only nature, it should affect ourselves” (p. 157). This essay rests on the belief that science is fundamental to intelligent intervention, and ecological refers broadly to the socio-environmental sciences that can provide knowledge to inform action. The term design is used to mean “intentional landscape change” (Nassauer & Opdam, 2008, p. 636) and encompasses change affected by design professions like engineering, landscape architecture, and planning; change affected
by real estate development or natural resource management; and most importantly, change that stems from the “local custom, pragmatic adaptation to circumstances, and unpredictable mobility” (Jackson, 1984, p. xii) of people living their lives. Urban is used here to refer not only to cities but to their megaregions which are tightly intermeshed in infrastructure, trade, and travel patterns, as well as their hinterlands that feed the global supply chain (Dewar & Epstein, 2007). By this definition, in the century when the human population has become predominantly urban, all landscapes can be considered urban to the degree that they are managed to provide ecosystem services. While ecosystems in cities obviously have been radically changed for human purposes, agriculture, forestry, mining, and transportation landscapes are arguably equally urban, even when they appear to be countryside (Cronon, 1992).

Since the establishment of this journal, landscape planning has evolved from addressing rural landscapes (Weddle, 1974), to encompassing urban design and planning (Rodiek, 1992; Sprin, 1986) and doing so in the context of landscape ecology (Rodiek, 1995). Its current scope recognizes that understanding and managing landscape change to achieve and protect ecosystem services requires not only science but ecological design, which aims to synthetically achieve ecological, social, and economic goals (Nassauer, Wang, & Dayrell, 2009; Palmer et al., 2004). Cities, metropolitan areas, megaregions, and the urban support landscapes of agriculture, forestry, mining, and transportation all are the legitimate objects of urban ecological design in support of “a new kind of history.”

Perhaps because landscape does have both analytical and experiential connotations, it is a word used by many different disciplines, which have given it different specific, sometimes contradictory, meanings. The resonance and adaptability of the word landscape also makes it vulnerable to misuse. Spare parts are discarded when it is butchered for consumption, cutting land from scope. But even left intact, particular uses of the word can trivialize its more complete meaning. The ecological connotations of landscape are trivialized when landscape ecology is employed as only an implicit metaphor. Its esthetic connotations are trivialized when landscape aesthetic experiences are identified with vaguely defined spiritual values or compartmentalized as only a part of outdoor recreation. When images of landscapes as seen by people in everyday life are considered to be mere illustrations, the power of human experience to motivate landscape change is grossly underestimated. And in vernacular speech, landscape is often trivialized as a verb, meaning to act on the landscape by construction or maintenance. Jackson defines “vernacular landscapes” very differently, to include all the spaces at all scales that lie between obviously designed places, which Jackson dubbed “political landscapes.” Vernacular landscapes constitute the global matrix, embodying a complex array of human intentions that are resilient even where politics and planning fail. And understanding vernacular landscapes in this broad sense suggests how landscape can be a medium and method for synthesis—among different inhabitants, disciplines, and forms of practice. All landscapes (whether concepts about geographic space or literal places) are visible spatial entities, and this simple characteristic is the basis for a powerfully practical analytical and synthetic device for bringing ecological insight to urban design.

Landscape is a visible and noticeable artifact of often unnoticed and sometimes invisible natural and societal processes. Because landscapes are visible, landscape can bring different people into a common experience of environmental systems. Across all scales of environmental phenomena, the scale at which landscape patterns are perceived by humans, the “perceptible realm,” is decisive for landscape change (Fig. 1) (Gobster, Nassauer, Daniel, & Fry, 2007). This landscape scale links everyday experience with other environmental phenomena that are not directly perceived, from global atmospheric processes to submicroscopic processes of soil chemistry. The perceptible realm is where humans imagine, negotiate, and decide about design, intentional landscape change.

Ecological design of vernacular landscapes calls for innovation, applied invention, a prerequisite for the “new kind of history” that Jackson foretold. Rather than attempting to return to a more natural order, mimicking nature, or compromising between human desires and the limits of nature, ecological design invites the invention and realization of new, resilient landscapes that visibly embody societal values, thoughtfully incorporate our best knowledge of environmental processes, and are adaptable to surprising change. To achieve this, ecological design must employ ecology not...
merely as a metaphor (Pickett, Cadenasso, & Grove, 2004), but as an analytical engine that propels designers to work with dynamic environmental and human phenomena, anticipate surprises, and formulate synthetic normative approaches to intentional landscape change. It must grow from knowledge that integrates science and practice to produce landscapes that synthesize apparently distinct societal and environmental functions (Carpenter et al., 2008; Hill, 2009; Palmer et al., 2005) and anticipate the future (Meinke et al., 2006).

Ecological design should focus on vernacular landscapes because places that do not bear the stamp of professional designers occupy the largest part of the terrestrial planet, including a growing proportion of megaregions. For example, suburban and exurban landscapes (often summarized under the pejorative label sprawl) are the fastest growing land use in America. Squatter cities are the predominant type defining many sprawling cities in the developing world. Agricultural landscapes, which occupy more than 40% of the European Union and more than 30% of the contiguous American states, are arguably the largest urban land use, since the functional ecosystems of cities extend to agricultural watersheds that provide potable water and other ecosystem services, and the supply chains of urban food processing and consumption begin in agricultural landscapes. Such vernacular landscapes are designed in the sense of being intentionally changed, often by people who are pragmatically using what they know to make a living, to take care of what they own, or to manage the quality of life in their communities. These landscapes are only indirectly affected by formal design decisions; they are not part of Jackson’s “political landscape.” However, professional design and science can affect vernacular landscapes if they employ knowledge of “local custom, pragmatic adaption to circumstances, and unpredictable mobility” as valuable information for science and practice.

For cities to be resilient socio-environmental systems in the midst of global change, landscape change that is managed by professionals should achieve vernacular status. This is a formidable goal. Even integrative science that describes functional characteristics of healthy urban ecosystems (e.g., Braunman, Daily, Duarte, & Mooney, 2007; Pickett et al., 2001) describes ecosystem services in ways that may seem irrelevant to people who make vernacular landscapes (Peters, 2010). Making human-dominated landscapes resilient requires translating science into a vernacular. Landscape is a medium and method for this translation.

2. Two landscape laws and two principles

To show how landscape can be used for synthesis science and ecological design, I offer two laws of landscape function and two related landscape principles. The two laws state the obvious: that landscapes integrate environmental processes and that landscapes are visible. The two principles explain how landscape characteristics can be used to effect sustainability: The Landscape Medium principle demonstrates that the process of designing a shared landscape can synthesize disparate perceptions of a landscape and its functions. The Landscape Method principle pragmatically employs the imaginative artifice of design to produce potential innovations that anticipate the future.

2.1. Landscapes and integration of environmental processes

- Landscape Law 1: integration of environmental processes. Different environmental processes operate in and through the same landscape, and each landscape inherently integrates these processes.

Landscapes inherently integrate different processes, indicators, and design goals (Dramstad & Fjellstad, 2011; Palmer et al., 2005; Swanwick, 2009). From the standpoint of human experience, Termorshuizen and Opdam (2009) see such a strong relationship between landscapes and ecosystem services that they recommend adopting the characterization “landscape services.” They argue that this could make knowledge about ecosystem services relevant at more local scales, where people make concrete decisions about landscape change. This law suggests that the common sense of 19th century naturalists and geographers who found scientific insight by field investigation in the landscape is relevant for addressing local and global environmental challenges in the 21st century. 21st century science is in search of a way to integrate methods and conclusions from diverse specialized sciences, and a focus on landscapes is one approach.

Because they inherently integrate the effects of fragmented analyses and decisions, landscapes can confront society with “unintended effects,” consequences of human actions that do not anticipate synthetic properties. Transportation systems, economic development policy, housing technology and policy, agricultural technology and policy, water infrastructure systems, construction techniques, and even ecological restoration efforts are all replete with such unintended effects. For example, U.S. federal policy promotes the use of “smart growth” techniques including distributed stormwater management systems (a.k.a., green infrastructure) on urban brownfield sites through the U.S. Green Building Council’s “LEED-ND” (Leadership in Energy and Environmental Design for Neighborhood Development) system (U.S. Environmental Protection Agency, 2010). However, green infrastructure systems typically enhance connectivity between surface and groundwater, and brownfield sites often have contaminated groundwater that is not remediated as part of the redevelopment process. Consequently, brownfield redevelopment that is not attentive to the synthetic properties of green infrastructure with contaminated groundwater could unintentionally cause the migration of contaminants to surface ecosystems. In contrast, design and planning processes that recognize how landscapes integrate environmental processes can identify advantageous synergies. In another example related to green infrastructure, the City of New York recognized that maintenance of distributed stormwater systems was essential to sustainability, and found that rights-of-way that are already maintained by the city (as part of the transportation system) would provide an armature to ensure adequate maintenance of green infrastructure (PlaNYC, 2008). The Landscape Law of Integration of Environmental Processes contributes to finding beneficial synergies and avoiding unintended effects of landscape change.

A corollary of this law is that: Landscapes function at nested scales. This corollary is well-known and thoroughly examined as part of landscape ecology (e.g., Allen & Hoekstra, 1987), and it should be equally well-known by anyone determining the boundaries of landscapes to be considered in urban ecological design. Allen and Hoekstra’s (1992) recommendation to always think up one scale and down one scale from the function of central interest remains a good rule for experimenting with the relationship between environmental processes and landscapes at different scales. For example, green infrastructure must be designed as a response to its location within a functional watershed, but also with attention to subtleties of surface slope and texture of the landscape surface at scales so fine as to demand that some final decision be made in the field, at 1’ = 1’ scale (Hill, 2009; Walsh et al., 2005). A key challenge for ecological design is to make the hierarchies of ecological processes (e.g., watersheds, materials life cycles, habitats) integral to the multiple governance hierarchies (e.g., federal, state, counties, watershed districts, school districts, municipalities) that affect ecological systems (Innes, Booher, & Di Vittorio, 2010).
2.2. Visible landscapes and common experience

- **Landscape Law 2: Common experience of visible characteristics.** Landscapes are visible in everyday experience and can be made visible in spatial representations. This makes it possible for different people to have the same experience of visible characteristics of a given landscape.

  This law emphasizes that because landscapes can be seen, different people can point to characteristics that they notice and discuss the different meanings those characteristics convey. What the characteristics mean and how they are valued depends on many aspects of context, and the complexity of landscape meaning and value has been richly explored (e.g., Spiri, 1998; Treib, 1995). However, this law establishes that with reference to visible characteristics, different meanings and values of can be described and compared, making synthesis possible.

  Landscapes are visible evidence of the integral natural and cultural processes that produce and change dynamic environments. For some scientists or other knowledgeable viewers, landscape appearance may be directly linked to environmental or cultural processes that are not immediately apparent to most people. For most people, however, the link between what landscapes mean and how they look is self-evident. It is part of everyday life. Landscape pattern is what people notice and change as they remake the environment to suit their needs; it defines a scale at which people intentionally intervene to change landscapes, a scale of vernacular design. Paying attention to what people notice about the landscape and what it means to them in everyday life will help scientists, designers, and policy-makers reach synthetic conclusions that are useful in affecting change (Nassauer, 1992; Termorshuizen & Opdam, 2009).

  Examining and designing a single, shared landscape engages groups with different languages and cultures (design and science, science and society, policymakers and local stakeholders) in grappling with the same object (Nassauer & Corry, 2004). While we might “see” the landscape through different disciplinary or experiential frameworks, we can point to the same locations or relevant characteristics in a landscape or in a spatial representation of the landscape, and describe what we see there. Used in this way, landscape functions as a boundary object as Star (2010) defined it: a material or organizational structure that allows different people to work together without having achieved consensus but rather cooperating by iteratively “tacking back and forth” between perspectives that refer to properties of the boundary object and that are more or less well-understood by different participants (Star, 2010).

  The visibility of landscape and its faithfulness of representation make it possible for different people to refer to what they see as they iteratively tack back and forth, literally or conceptually pointing to different characteristics of the landscape, and progressing toward having a common experience and a common basis for deciding about landscape change. This potential has been widely demonstrated (e.g., Bohnet & Smith, 2007; Hulse, Branscomb, & Payne, 2004; Lewis & Sheppard, 2006; Sheppard, 2005). In an urban example from my own work, all neighborhood residents were familiar with the small two-block area (approximately 20 acres or 8 ha) of Maplewood, MN, USA, where my team designed rainwater gardens in 1995–1996. The small size of the project area and neighbors’ familiarity with it made it possible for designers and residents to share a visible landscape, pointing to particular locations and characteristics that everyone could see, until we reached a common conception of what the landscape was and could be (Nassauer, 1997). If landscape representations offer apparently realistic visual experiences, representation can advance synthesis by making novel but relevant landscapes immediately comprehensible as well.

  A second example, which explored potential ecosystem services of exurban landscapes, we examined landscape innovations that hadn’t yet been constructed and were somewhat unfamiliar to the homeowners who might adopt them. Faithfulness of representation was important to help people see these novel landscape types (Fig. 2), and we aimed for photorealistic representations that accurately simulated the appearance of the future landscapes (Nassauer et al., 2009).

  Following from these two landscape laws, are two principles stating that landscape can be used as a medium for synthesis and a method to promote innovation. These principles articulate Jackson’s assertion that landscapes are “always artificial, always synthetic.” Both the landscape medium principle and the landscape method principle employ design, intentional landscape change. From Jackson’s perspective, design is both a shared artifact of human interaction with the environment and the making of a new kind of history. Design has inherent potential to produce innovations, applied inventions, and, consequently, designs can be treated as experiments, hypotheses about interactions between human intentions and ecological processes (Nassauer, 1999; Pickett et al., 2004). This is important because it demonstrates how the landscape medium and method can bring innovation into the analytical framework of science, acting as a catalyst for communication between science and practice (Nassauer & Opdam, 2008). The Landscape Medium principle demonstrates that because landscape can be a boundary object shared by different experts and stakeholders, it is a medium by which they can synthesize disparate perceptions of the landscape and its functions and move toward a common conception for design. The Landscape Method principle uses the landscape medium, but it employs the imaginative potential of design to invent alternative future landscapes, and it focuses on advancing innovation by comparing and assessing these different alternatives for a particular place or for a particular type of place.

2.3. The landscape medium for synthesis

- **Landscape Principle 1. The landscape medium.** Because landscapes are visible and inherently integrative, landscape can be a medium that synthesizes diverse environmental functions and human perspectives. A design process that uses landscape to engage people with diverse perspectives in manipulating this shared medium can promote synthesis and advance synthesis science.

  Any landscape is simultaneously seen and valued in many different ways. As a geographic entity with specific location and extent, a single landscape simultaneously embodies numerous biogeochemical and ecological processes, is a home to many species – including humans, may produce materials or market goods, and is the subject of laws and legal inquiries, capital valuations and related financial transactions, study by scientists of many disciplines, study by scholars of the humanities, inspiration for artists, and manipulation by designers and builders of many disciplines. In fact, as Meinig (1979) famously observed, there are (at least) ten ways to view the same landscape – as nature, habitat, artifact, system, problem, wealth, ideology, history, place, and aesthetic. Meinig asserted that:

> . . . even though we gather together and look in the same direction at the same instant, we will not – we cannot – see the same landscape. We may certainly agree that we will see many of the same elements – houses, roads, trees, hills – in terms of such denotations as number, form, dimension, and color, but such facts take on meaning only through association; they must be fitted together according to some coherent body of ideas. Thus we confront the central problem: any landscape is composed not only of what lies before our eyes but what lies within our heads. (Meinig, 1979, pp. 33–34)

  ...
However, this principle asserts that by being attached to the same reference object, a landscape, different views can be exchanged, and that a design process can move that exchange toward synthesis in relationship to some question or problem.

Sciences, the design professions, and vernacular landscape change operate almost independently, describing and changing the same landscape in ways that may be only incidentally related, inadequately understood, or contradictory – and sometimes destructive. In metropolitan areas, development typically undermines habitat values, reduces water quality, and increases per capita emissions of greenhouse gases. The ecosystem services of a landscape may or may not be immediately apparent because many ecological processes are not visible to the naked eye or cannot be interpreted by those who are not knowledgeable about what they can see (Hein, Vankoppen, Degroot, & Vanierland, 2006; Nassauer, 1992). The landscape medium principle employs the landscape as a medium to align what is visible and may have immediately apparent value for some, with what is invisible or not widely understood, the ecosystem services supported by a landscape (Nassauer, 1997).

While different disciplines conceptualize the meaning and value of a landscape in different ways, and often different members of a community disagree about proposed landscape changes, this principle emphasizes that landscape is a medium that facilitates synthesis. Establishing the grain, extent, and boundaries of a landscape can be contentious, depending upon the values and functions of interest: for example, watersheds at different scales in a hierarchy, or political boundaries compared with watersheds. But once the landscape of interest has been agreed upon, people with very different purposes have a basis for discussing the same landscape, even though their immediate specific conceptions, interests, and experiences may differ. If a design process approaches the landscape as a synthetic medium, scientists and stakeholders who may perceive different functions and services when they see a landscape, can experiment with manipulating the landscape as a common material. To manipulate this common material together,
they must address gaps and contradictions among their distinct perspectives.

Some key hallmarks of a transdisciplinary (Fry, 2001) design process are elaborated below. These are: inclusion of diverse conceptions, development of a shared reference or boundary object (a landscape), design by iteration, breadth of conception, and specificity and accessibility of the design product. The resulting transdisciplinary landscapes are synthetic products of diverse perspectives.

Include diverse disciplines or stakeholders to design a single landscape together. Since only one landscape pattern can be imposed on a given landscape at a particular time, the differences, incomplete understandings, misunderstandings, and synergies among diverse disciplines’ or diverse stakeholders’ conceptions and values can emerge and be rectified in a landscape design process. Whether the design of the landscape is merely selecting the location and boundaries of a place of interest, establishing the relevant characteristics of a real place, or establishing the relevant characteristics of landscape type more conceptual than real, having diverse participants agree on a single pattern forces each to consider how the functions of interest to them can be rectified with other functions that they would not have otherwise considered (Berkes, 2009).

Develop a shared reference or boundary object, a common landscape, represented by a shared data set. How diverse landscape conceptions are rectified depends on the overarching purpose of the design: how the landscape must function in the context of a particular research, policy, planning, or construction project, and how it inherently does function in the context of resident communities and socio-environmental processes that may not be explicitly addressed in the initial definition of a project. In a particular project, shared landscape data might serve to support models of many different environmental functions and models of different economic and cultural values (e.g., Mahmoud et al., 2009). It might help policy makers, developers, or the ultimate inhabitants of a place anticipate or affect landscape change (Hulse et al., 2004). When a common landscape is employed as a boundary object between science and practice, it can promote collaboration between these realms (Fig. 3).

Designing landscapes together across diverse participants is not only a means of engagement, it is a means of mutual learning and rectification of differences, at least within the frame of the selected landscape (Albert, Zimmermann, Kneillllg, & von Haaren, 2012). In some cases where community visioning is a critical element of landscape change, literal scale models of the local landscape – large enough so that local people can use their own hands to experiment future alternatives – may be the appropriate medium (e.g., Bohnet, 2010).

Once a landscape is designed (selected, constructed, or represented in shared field experiences, images, and data sets), perhaps the most direct way that the landscape medium integrates disparate conceptions of landscape is by presenting different disciplines, professions, and stakeholders with the same landscape representations and shared data sets, the same image or map of a specific place. Landscapes can be represented by precise data that support different assessments by different groups of the same landscape (Hulse et al., 2004; Nassauer & Corry, 2004). Not all data will be shared, but a foundation of shared data helps to promote synthesis, ensure meaningful integrated assessments and adaptive management of a landscape, and set up the potential use of the landscape method to generate alternative futures, as described in Principle 2. High resolution spatial data in fine classification schemes for land cover/land use, soils, relief, and surface and groundwater data are typical fundamentals to represent the shared landscape in ecological design processes. For example, as part of the Baltimore Ecosystem Study, Zhou, Troy, and Grove (2008) employed 1 m resolution land cover data to examine the relationship between lawn appearance and lawn fertilization practices by individual households across two small urban watersheds. Similarly, our team employed 1 m data representing 24 classes of land cover in our integrated assessment of alternative futures for two small Corn Belt agricultural watersheds (Nassauer, Santelmann, & Scavia, 2007; Santelmann et al., 2001).

While different investigations query and select from a single data set in different ways and augment it with more specialized data in different experiments or assessments, the data set in its entirety inherently represents a shared conception of the landscape. This is a starting point for noticing potential conflicts and contradictions, for finding synergies, and for conducting an integrated assessment of different alternatives for future landscape change (Scavia & Nassauer, 2007).

Design a common landscape iteratively. The landscape medium invites iterative redesign, as participants critically examine resulting landscape patterns and compositions and “tack back and forth” sharing their different perspectives on what they see in the field, in maps, or in other images. Reviewing alternatives as landscape representations, different disciplines or stakeholder groups occupy a meeting ground for identifying their differences and integrating their knowledge. Errors, omissions, and ideas for innovation can emerge even before a formal assessment or design of landscape alternatives (Fig. 4). The design process elicits participants’ responses to place-specific designs, whether these designs are only proposals or fully constructed and inhabited places, and these responses are the basis for a group discussion, negotiation, and learning. This learning can take the form of revising rules of thumb for pattern design based on place specific response alone, new policy ideas, or new socio-environmental research questions (Fig. 3).

Initiate the design process with relevant criteria for possible landscape functions. The emergent common landscape may embody multiple ecosystem services and multiple societal values that might not otherwise intentionally occur in the same place, or that might otherwise be at odds with each other in a single landscape. This emergent common landscape will be accessible to integrated assessment of its environmental and societal functions if it was conceptualized with an awareness of those functions, at a scale that is relevant to the science, policy, or design questions at hand (Doering, Kling, Nassauer, & Scavia, 2007; Termorshuizen & Opdam, 2009).
Complete the design process with an accessible, replicable, clearly specified landscape description at the relevant scale. If the synthetic landscape medium is described in ways that are useful to both science and society (Fig. 3), it supports translation between the two realms. The landscape description should be sufficient to enable integrated assessment that includes any relevant environmental and societal functions (Scavia & Nassauer, 2007) and to establish a baseline for adaptive management; it should be sufficiently accessible to be salient to society; sufficiently clear and replicable to be credible in science; and sufficiently balanced and informed to be legitimate in both science and society (White et al., 2010; Cash et al., 2003).

The landscape medium can contribute urban ecological design knowledge to science and make science knowledge applicable to urban ecological design. By explicitly promoting synthesis, the landscape medium broadens scientific conceptions of landscape structure and function (McAlpine et al., 2010). Especially in cities, where virtually every place functions as part of many different social milieus and environmental systems, the landscape method invites science to engage local landscape knowledge and the societal values that often propel urban landscape change. It also complements known advantages of ecosystem management and place-based studies by bringing specific characteristics of landscapes and the design process into play.

The products can be landscapes that are generalizable patterns, applicable to many different places of a given type, or designs that are specific to a place (Fig. 3). The key to making design useful in this way is to use design of generalizable patterns to link scientific knowledge of environmental or societal processes with design proposals to change specific places. Generalizable pattern rules explicitly make conceptual connections between the necessary simplifications of science and the infinite complexity of local societal and environmental characteristics in particular places. Those connections go two ways: allowing science knowledge to affect local landscape change and allowing local knowledge to inform future pattern rules and science questions. In this way, the landscape medium can powerfully complement adaptive management as a response to landscape change.

2.4. The landscape method and invention

• Principle 2. The landscape method. Because landscape representations can be manipulated as a shared medium, they invite invention. They can be employed to imagine and represent alternative future landscapes: creative design products that embody novel possibilities, respond to uncertainty, anticipate risk, and promote innovation.

The landscape method takes the landscape medium one step further to anticipate the future. It employs design process to discover multiple synthetic design products: landscape inventions, which can engage the sciences, design and policy disciplines, and stakeholders in generating and comparing alternative future landscapes. This method invites creative, imaginative transdisciplinary experimentation with different possibilities for intentional change toward alternative future landscapes (Nassauer & Corry, 2004; Stein, et al., 2003; White et al., 2010). The alternatives are based on hypothetical circumstances, often termed alternative scenarios, that help to anticipate challenges to society and ecosystem services and lead to adaptive innovations (Barton & Haslett, 2007).

Alternative future landscapes are a particular method for employing alternative scenarios. While alternative scenario approaches are familiar to economists and landscape ecologists (e.g., Ahern, 1999) and in the wake of the Millennium Assessment have been increasingly employed to anticipate change in socio-environmental systems (Carpenter & Folke, 2006), the alternative future landscape approach has specific advantages for urban ecological design because it employs the landscape medium and method. It always represents alternative futures as landscapes in, spatially explicit representations based on shared data, as discussed in Principle 1. The representations might be models, maps, or images that demonstrate the implications of the alternative scenarios in a landscape. Such representations are not mere illustrations, nor are they only quantitative outcomes. Rather, they are representations of integrated processes at a selected relevant landscape scale.
The landscape method is fundamentally creative (Ford & Gioia, 2000; Gilson & Shalley, 2004; Lyle, 1985). It allows transdisciplinary teams of scientists, policy-makers, and stakeholders to be imaginative, speculative, or didactic in their assumptions about landscape change, design or policy as they iterate through the design process (Fig. 4) several times, creating a related series of design products, alternative landscape futures. Furthermore, it is a proven means of engaging stakeholders in affecting landscape change (Mahmoud et al., 2009; Potschin, Klug, & Haines-Young, 2010; Shearer et al., 2006).

Like other types of alternative scenarios, alternative future landscapes require an adequately complete and precise description of a baseline or present situation, a number of alternative future scenarios, and possible contextual circumstances (e.g., plausible future policies or possible changes in technologies or global environmental phenomena) that could connect the baseline with alternative future scenarios (Schoonboom, 1995). Determination of whether an alternative future is plausible should account for societal relevance and significance for ecosystem services rather than only calculated probabilities of change from the present to some future state. Using the landscape medium, selected landscape characteristics vary among alternatives based on broader scenario assumptions and goals. Landscape characteristics (location, configuration, composition, and management) are selected because they are hypothesized to exhibit relevant characteristics of ecological, economic, or cultural processes. Like other creative processes, the landscape method succeeds best when participants have been fully engaged in developing initial assumptions and goals for the array of scenarios so that these are understood by all as a starting point for generating alternative landscapes. The method is also creative in the breadth and divergence of landscape conceptions that it promotes: participants should be prepared to welcome ideas that are not part of their discipline or their own experience. Ideas that are novel and might initially seem unlikely should be incorporated as alternatives are generated. Importantly, the landscape method is flexibly iterative (Fig. 4), allowing alternatives to adjust and novel ideas to be edited as they are compared with other alternatives in the context of project goals.

Selecting characteristics of each alternative future landscape opens the way for different groups to describe what natural and human processes should be represented in the landscape futures (e.g., Albert et al., 2012; Hulse et al., 2004). Aspects of process that may appear to be accounted for in one alternative may be absent in others. Aiming to take a precautionary stance toward protecting ecosystem services, some would argue that selecting relevant ecosystem services is first and last a matter of expert judgment by scientists who understand the environmental processes in play. On the other hand, Termorshuizen and Opdam (2009) suggest that what they term landscape services should be determined in a community process of selecting ecological functions that the community values. Using the landscape method, different alternatives can reflect different concerns and values, and observation and assessment of landscape alternatives can suggest common ground. Given a certain set of ecosystem services that exist or are desired in a landscape, there are many possible landscape patterns that could embody those services, and the determinative difference may be in which landscape patterns the community values – regardless of whether community members understand their ecosystem services.

Each alternative landscape is a design product represented by a shared data set that can be used for measuring or modeling relevant environmental and societal functions. This enables alternatives to be compared in an integrated assessment, as described in Principle 1. It also supports adaptive management, complementing institutional interventions by giving decision makers and stakeholders shared visible experimental objects, alternative landscapes that they can iteratively co-create and compare. Experimentation with different alternative landscapes allows the design process to incorporate uncertainty, acknowledging that there may be many different ways to synthesize diverse perspectives and inviting landscape innovation in response to imaginative, normative, and surprising possible futures (Liu et al., 2007; Walker, Holling, Carpenter, & Kinzig, 2004).

3. Conclusions

The integrity and visibility of landscapes may be so commonplace that their inherent potential to prompt synthetic discovery has been ignored or trivialized. J.B. Jackson’s description of the vernacular landscape “where we speed up or retard or divert the cosmic program and impose our own”… with the promise of “a new kind of history” jolts us out of the trivial. If we think more closely about the landscape and are willing to learn from landscape ecology and landscape design, we may find an approach to urban ecological design that invites imagination and promotes innovation at the same time as it is firmly grounded in scientific inquiry. The landscape laws and principles I have offered here are intended to show that landscape is a powerful conceptual device for synthetic thinking across disciplines in the sciences, design, policy, and practice and for collaboration among experts and stakeholders. It can link creativity to analysis and scientific knowledge of process with place-specific design, leading to more broadly anticipatory inquiry in science and more intelligent design. A medium and a method that lead participants to see and manipulate the same landscape characteristics can bring experts in different disciplines and stakeholders with different experiences to understand the landscape as part of a system that incorporates many different natural and human processes, seen or unseen. Looking at extensive regions or specific sites through the landscape medium can focus the perspectives of disparate disciplines on the same object, a landscape pattern seen by all. While different viewers are experts in different processes, they are united in paying attention to that pattern. Anticipating the future through the landscape method marries science to creativity, nurturing innovation and effective adaptation to changing environmental phenomena. Not all answers lie in the landscape, but, if we use landscapes as a medium and a method for synthesis in urban ecological design, we will be able to test a new kind of history by the way it looks to all of us.

Acknowledgments

Work on this essay was supported by funds from the National Socio-Environmental Synthesis Center, a Center funded by NSF (Grant #DBI-1052875) and the University of Maryland. The essay will appear in a forthcoming Springer Press book: Resilience in Urban Ecology and Design (Pickett, Cadenasso, & McGrath). It benefited greatly from the thoughtfully critical review of Steward Pickett, Mary Cadenasso, Joshua Newell, Paul Gobster and Wei-Ning Xiang. I sincerely thank them.

References


