

Landscape Metaphors, Ecological Imperatives, and Architectural Design

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ARCHITECTURAL DESIGN, METAPHOR AND THE LANDSCAPE

"In architecture, tools involve both conception and construction." –Alberto Perez-Gomez ¹

In the description of the ACSA 2009 session "How Long Can You Tread Water," Professor Sandy Stannard asks, "Are we improving our relationship with nature, or settling for the status quo?" ² Indication of the status and *quality* of this relationship may be found in the divergent ways that architects characterize their efforts and the motivations that underlie them. One common means for architects to provide meaningful grounding for complex design undertakings is *metaphor*. ³ Metaphors have the capacity to abet the process of communication in architectural design, serving as a conceptual vehicle by which architecture is imagined and made material, and appear especially invaluable when the designer confronts novel situations and strives to share unfamiliar ideas with other members of the design team, consultants, clients and the public.

The art historian Henri Focillon suggests, "There is no meaning without displacement of meaning, without metaphor." ⁴ Our patterns of articulation and our habits of behavior inscribe themselves upon one another. As these sediment over time, they can become dissonant relative to the dynamically evolving conditions a design culture experiences. In such instances, metaphors can help designers displace old meanings, generate new patterns of enunciation, and bridge ideas formerly un-

related. Metaphors can assist in formulating problems afresh, allowing designers to solve them with greater sensitivity, intensity and effectiveness.

A preliminary survey of formative ideas inspiring renowned contemporary architects reveals a curious and promising phenomenon, a profound transformation in the manner architects conceive their work. Reflective of a larger cultural paradigm shift from human centeredness to human *situatedness*, historically prevalent body- and technology-based metaphors are giving way to landscape-oriented metaphors as primary conceptual organizing tools in architectural design. Rather than a building as a corpus, as contained, the building finds itself in and, with greater frequency, *as* milieu itself. We wonder if this current proliferation of landscape metaphors indicates an effort on the part of the architectural profession to address, through urgent and often romantic poetic imagery, the degradation of natural systems and the effacing of singular ecologies that characterize current development practices.

The goal of this essay is to provide a preliminary explanation as to the proliferation and diversity of landscape metaphors in use today, and relate this to the question of our relationship to nature that is at the heart of this session and our work. Why are landscape metaphors so important to so many contemporary architects, and how do they direct design inquiry? In order to make sense of this phenomenon, we attempt a preliminary taxonomy of the numerous landscape metaphors we

have documented, speculate as to what might drive the use of particular metaphorical “types,” and consider the architectural implications of working with these. Most critically given the focus of this ASCA session, we ask whether the deployment of certain metaphorical types (or their hybrids) are more likely to result in projects that are truly sustainable and ecologically responsive, and how the designer’s poetic imaginary evolves in response to increased environmental knowledge and sophistication. With a goal towards environmental sensitivity and resourcefulness, it would seem inherently advantageous that architects look beyond buildings to the landscape in deriving conceptual organizational strategies. However, as we will attempt to show, certain types of landscape metaphor better prompt and reflect nuanced and attuned readings of the landscape, and encourage the kinds of collaborative inquiry that enable “deeply green” architectural innovation to occur.

LANDSCAPE AS A COMPELLING AND DIVERSE SOURCE OF METAPHORICAL INSPIRATION

The use of landscape as inspiration and analog for architecture is as old as architecture itself. What is striking today, however, is the popularity of landscape metaphors, an avoidance of claims of their universality such as characterizes the postmodern condition, and the tremendous diversity of interpretations and intentions by which architects appropriate the landscape. A brief survey of architects’ motivations begins to suggest some reasons for this. David Miller of the Miller/Hull Partnership in Seattle finds landscape-focused projects provide more meaningful conceptual opportunities when compared with object-focused projects, that richness is more inherent to dynamic relationships than individual things.⁵ In a similar manner, Vincent James of VJAA in Minneapolis notes that much of the firm’s design process focuses on “orchestrating and filtering temporal phenomenon” and asserts “architects need to think about the temporal field as much as they think about the form or appearance of the buildings themselves.”⁶ Ken Radtkey, principal of Blackbird Architects in Santa Barbara, “sought the definitions of landscape and architecture, and found little essential separation between the two. Definitions of landscape center around vistas and viewing spaces... perhaps the notion of garden. These occupy the heart of architecture in my work.”⁷ For David Cook, partner with Behnisch

Architekten in Stuttgart, the landscape is a recurring source for (metaphorical) inspiration as

“it is infinitely variable and non-static; is ever-changing, responding to local conditions, ebbs and flows of the seasons, cycles of nature. The landscape serves to stimulate all of the senses. Numerous buildings, in contrast, are rather stagnant. Reference to the landscape also offers us a degree of freedom, as we are obviously all rather reluctant to acknowledge too many buildings as sources of inspiration!”⁸

Contemporary interest in lightness of construction, architectures of uniquely dynamic contextual response, and the need for adeptness in responding to evolving conditions (environmental, economic, demographic, other) might also help to explain the preponderance of landscape metaphors. Renzo Piano writes of “a spirit of adventure” and a “light way of using method.”⁹ Vincent James describes numerous projects as emerging from lively processes of unfolding, and as subject to certain “rules or laws,” whether meteorological, geological, biological, ecological or hydrological in nature.¹⁰ Landscape-based metaphors offer opportunities to extend the reach of an architectural endeavor far beyond its physical borders, both literally and figuratively. In some instances, this might mean a design is imagined to “fuse with the landscape,” as with Steven Holl Architects’ Nelson-Atkins Museum Addition in Kansas City.¹¹ In other cases, the local topography may be extended by the architecture or replaced by an evocative, topographic structure, as with the continuous park-like landscape of Foreign Office Architect’s Yokohama Port Terminal.

Evocative, tangible landscape metaphors may assist in the creation of a shared, fluid vision of a project as the design team travels along an iterative path of architectural innovation, and over what may be an extended period of time. David Cook persuasively interrelates metaphor, landscape and the design process in this regard, suggesting, “Metaphors are particularly important on large projects where we need to have shared long-term goals and where the architecture may be something which is to a large extent still in flux.”¹² Like many contemporaries and architects before him, Cook also notes that “the quality of the realized building is more often than not dependent upon the strength of the original idea, [and while] I think most metaphors tend to be a little diffuse at the commencement of a project, they then become more defined as

the project progresses.”¹³ We will have more to say about a metaphor’s role over a project’s progression later in this essay.

A PRELIMINARY TAXONOMY OF LANDSCAPE METAPHORS IN CONTEMPORARY ARCHITECTURE

Examining a limited cross-section of contemporary projects from around the world, it seems plausible to arrange landscape metaphors in four basic categories or types—two that emphasize building organization and that are *emulative* in nature (where buildings assume the qualities of the landscape) and two that focus on the manner in which buildings *interact with* their surroundings (where buildings acknowledge and support the landscape and healthy landscape processes)(see Figure 1 at the end of this essay). A *formally emulative* (FE) landscape metaphor would seem to be employed primarily as a generator of architectural form, as with Mecanoo’s Isala College in Silvolde, The Netherlands, where the building “must be elongated...with a gentle curve—as if to follow the bend in the river.”

¹⁴ A *dynamically emulative* (DE) approach utilizes a landscape feature or environmental phenomenon to inform metaphorically the manner in which a building behaves/performs, such as the integration of sun shading and light distributing devices on the roof of Renzo Piano’s Menil Collection in Houston that were “immediately christened a ‘leaf.’”¹⁵ Similarly, Behnisch Architekten conceptualized the Plenarsaal in the Bundestag in Bonn as gathering under a tree in a meadow, and this informed the design of light-diffusing skylight assemblies. Given all poetic approaches or landscape metaphor types we have identified, dynamically emulative metaphors seem closest to *biomimicry*, where nature is looked to as a design model and valued for its graceful resourcefulness, elimination of the concept of waste, and simple appearance often belying tremendous physical sophistication.¹⁶

With respect to interactive types, *generically interactive* (GI) landscape metaphors offer quite generalized descriptions of landscape and consequently engage building and landscape using a very broad brush. Will Alsop’s Cardiff Barrage, where an “enormous inland freshwater lake [replaces] what are now tidal mud flats by creating a dramatic man-made barrier,” provides an example, one that seems to devalue a potentially important (and specific)

ecosystem type.¹⁷ The “green backbones” that help to organize Mecanoo’s Ringsvaartplasbuurt Oost housing project provide another example of the use of a generically interactive landscape metaphor. In this instance, we are not insinuating insensitivity to context on the part of the designer(s); only that such a metaphor could be deployed on almost any site, regardless of context, and it therefore has generic qualities.¹⁸ In contrast to a generically interactive metaphor, a metaphor that depends upon an understanding of ecological and climatic subtleties of a given place to engage a building with the landscape can be termed *specifically interactive* (SI). For its winning design for Beirut University, Vincent James Associate Architects contradicted conventional passive solar orientation to take advantage of the Lebanese coastal microclimate (and cooling afternoon sea breezes). The firm also defied competition parameters by divided the building mass into several smaller pieces, which allowed it to create a pattern of “horizontal migration” through shaded outdoor plazas and “landscape drifts.” It is one example of how a context-specific response can inform a building’s rich engagement with its surroundings and inhabitants.¹⁹

We celebrate the proliferation of landscape metaphors in contemporary architecture, and hypothesize that *dynamically emulative* and *specifically interactive* landscape metaphors in particular, or hybrids and/or combinations of these, will lead us more directly down a path of deeply green design thinking. As for the former, we refer to David Cook’s statement of the “infinitely variable and non-static” attributes of the landscape as informing design, rather than the landscape’s capacity to invoke quiet contemplation, or to elicit abstracted geometric patterns. Built landscapes emulating those found in nature might be event-laden, dynamic yet supportive, and characterized by coherent complexity and luminous, ambient and thermal richness. Such variability can be achieved with great material and energy efficiency, as with that which designers emulate. Adaptive spaces, if also supportive, are likely to be memorable and appreciated, and therefore sustained.

Yet it is not sufficient that we make architectural spaces, buildings and cities into built topographies, trees and rain. An exclusive focus on the emulation of natural forms combined with the current pace and scale of development might lead to a future

of near total artificial environments that recall to a greater or lesser extent a former time of natural variety and diversity, a world we once shared with “specialist” species and their unique ecological settings. In addition to taking cues from the natural environment in designing buildings, designers are urgently called upon to create architectures that poetically and specifically engage, celebrate, protect and when necessary reestablish those singular natural systems and habitats we encounter in our work. Ken Radtkey of Blackbird Architects suggests, “spatial, visual, physical, and more complex environmental connections may resensitize us to our world.”²⁰ And the “secret” he shares “is simply to use and benefit from every bit of nature, culture, light, air, water, soil and context available in a situation.”²¹

NOTES ON THE LANDSCAPE METAPHOR TAXONOMY

The taxonomy described above is not definitive. Our approach is that of episodic insight, where individual designs are organized in types only to project kaleidoscopically upon our understanding. These proto-types provide a step in what Bruno Latour describes as the “slow work of representation;” that is, a continual testing of propositions and proposals as a means of arriving at helpful, shared descriptions of the nature of collective associations of humans and nonhumans.²² The taxonomy serves as a vehicle for identifying characteristics that certain landscape metaphors share, and how the choice of one landscape metaphor seems to privilege particular facets of complex design undertakings (and their context) over others.

All landscape metaphors tend to elicit form even if formal qualities are not the primary “driver” behind choice of metaphor. Many emphasize constructional relationships between a building and its site, some attempting to deconstruct “the dichotomy of building and locale” and others attempting to “stitch” a building back into an idealized milieu.²³ Others begin with simple transparency between indoor and outside spaces—a spatial relationship that harkens back to the Roman atrium house and before. Such “metaphors of continuity” often encourage the creation of desirable microclimatic conditions via natural ventilation, direct solar gain or other passive design strategies, making them both dynamically emulative and specifically interactive in nature. Still

other metaphors suggest concern with how building configurations might support larger ecological goals such as landscape permeability and wildlife corridor connectivity.

In many cases hybridizations and proliferations of metaphors occur, especially as the design team sees opportunities over the course of project development for both establishing profound connections to a site and more resourceful climate conditioning strategies. Will Bruder and Partners’ Burton Barr Central Library in Phoenix offers an example of a project that utilizes more than one category of metaphor, and is especially compelling both for its spatial richness and stellar environmental performance. Conceptualized as a ‘crystal canyon,’ the Library’s three-story atrium and adjacent public spaces are sandwiched between shade providing, thickened spatial elements (‘canyon walls’) to the east and west (an instance of a DE metaphor). The Teflon fabric ‘sails’ on the north façade of the library provide shade in the early morning and late afternoon in the summer, protecting the collection and also creating dramatic patterns of light and shade, offering a passive solution suited to the building type and its hot, arid setting. In addition, the ‘candlelight’ column caps ‘catch’ direct sunlight that penetrates the skylights during the summer solstice (examples of SI metaphors).

Hybrid landscape metaphors may speak in part to the shortcomings of our taxonomy, to any attempt to gather and organize a complex array of entities and phenomenon under the term “landscape.” But they also demonstrate how designers may utilize multiple metaphors in one project, or one metaphor in multiple ways, and therefore illustrate the very positive, multifaceted nature of metaphor itself. Metaphors as “condensers” of meaning offer a multiplicity of possibilities, what George Lakoff and Mark Johnson would consider a series of “entailments” or logical corollaries.²⁴ Even if there exists one favored intention behind the use of a particular landscape metaphor, numerous benefits may be derived. Moreover, it is precisely the *variability and pliability* of the landscape as metaphorical source, even when referring to highly specific environmental contexts, that would seem to help a linguistic community—a design team—work on a project over an extended period of time. A project undergoes changes and phases, and the successful metaphor “adapts” to evolving conditions and

“grows” in complexity, as with aspects of the landscape itself.²⁵ With the dynamics of the design process in mind, it is worth tracing the life of metaphor in a recent and compelling project, Renzo Piano’s California Academy of Sciences in San Francisco, as a means to inquire more deeply as to the relationship between initial (metaphorical) conceptualization and the “realities” of engaging pressing environmental issues in architecture.

CONCEPTUAL EVOLUTION IN RENZO PIANO’S CALIFORNIA ACADEMY OF SCIENCES

Frank Alameda, Director of Biology for the California Academy of Sciences (CAS) in San Francisco, describes the interview with Renzo Piano that led to Piano’s commission for a new facility to be built on the former CAS site at Golden Gate Park (note: the project was completed in 2008).²⁶ Piano did not offer a conceptual design proposal during the interview, as did several of his competitors. Instead, Piano spent considerable time on the site during the interview process and produced a section sketch of an undulating, “living” or green roofscape that mimics the surrounding hills of San Francisco, with the expressed intention of recreating the “bucolic Golden Gate Park site.”²⁷ This is an instance of a hybrid *formally emulative/ dynamically emulative* landscape metaphor in play, with the green roofs intended to help reduce the urban heat island effect and help moderate temperature extremes within the building, and most importantly for Piano, to act as frames or a parasol for human activity and expression that are clearly derived from local topography.

Paul Kephart of Rana Creek Living Architecture was hired to design and install the living roof. Kephart’s interest is “moving beyond evocation” and in creating projects that “take on the function of demonstrating ecological contribution.”²⁸ He recognized the tremendous opportunity that undulating roofs presented, given how different portions of the roof would assume different aspects and orientations. There are north facing, wet, shady, eddylike patches and south facing, dry sunny spots. There are relatively steeply slopping portions of roof and relatively flat portions. Microtopographic and climatic variation would enable a level of ecological diversity dramatically greater than the “extensive” type moss sedum roofs that have become the commonplace application. Plant species were chosen for CAS so the roofs become stopovers for migra-

tory birds flying up and down the Pacific flyway. Other plant species were introduced that support (threatened) invertebrate pollinators. Additionally and with other Kephart projects, living roofs become nurseries that propagate threatened or endangered native grasses and wildflowers, such that the buildings he helps realize contribute demonstrably to broader ecological function.

ECOLOGY AND THE DEATH (AND REBIRTH) OF METAPHOR

Due to unique project circumstances, most notably the involvement of Paul Kephart as well as Frank Alameda, the conception of the CAS evolved as far as its relationship with the surrounding environment from one motivated primarily by emulation of landscape form to one that emulates *and* interacts with the landscape in highly intentional, functionally specific and dynamically evolving manner. The question that this happy trajectory raises relative to our interest in metaphor is whether in future Piano projects—and those influenced by the “lessons” of CAS—there will be an attempt to engage ecology (and ecologists) with immediacy during the conceptual stages of design, and what impact this may have on choice of metaphor and of representation, on predispositions and working methods. With the trajectory of the California Academy of Sciences in mind, how might more rigorous ecological engagement by interdisciplinary teams of designers and scientists influence the poetic potency of a landscape metaphor in the creation of “living architectures”? Could it be that attentiveness to highly singular conditions in making ecologically supportive architectures point to the *inadequacy* of more abstract metaphorical conceptualizations that so commonly influence the generation of form and are thought to represent the architectural imagination at its finest? Is it accurate as Jean-Joseph Goux suggests that “the concept abolishes the concrete signifying body, effaces singular sensation by means of signifying exchange”?²⁹

We see a healthier relationship between environmental knowledge and poetic opportunity, that intensified ecological engagement has the potential to inspire the generation of new metaphorical constructs, ones that promote imaginative space making *and* the provision of habitat, diverse green networks, encounters with nonhumans, *life*. Ecological considerations do not require that the designer abolish metaphors; rather they highlight their pro-

visional character in architectural design, where interplay exists between what unfolds (events) and how this forces a reevaluation or evolution of a concept in the act of making. It is a coevolution. Augmented aesthetic expression accompanies enhanced (scientific) understanding of the behavior of ecological systems, and a consideration of how these relate to human endeavor and meaning.

This ultimately has to do with the fluidity of language, particularly as it relates to our evolving understandings of the world and our relationship to it. The field of architecture is *expressing* renewed interest in the landscape and in landscape processes. For example, architects aware of dispersal corridors and landscape permeability, relatively new ecological concepts, will be more likely to build these into descriptions of their design intentions, to seek collaborators who are knowledgeable and passionate about natural systems, and to configure architectural entities that facilitate unique, contextually dependent interactions. Architects are transported to a new domain, and are invited to envision further possibilities of architectures that both emulate and support working ecologies. Metaphor serves more than an associational role, more than what Perez-Gomez describes as “the electrified void between two terms that are brought together but kept apart.”³⁰ Rather metaphorical thinking enables imaginative extension into entirely new realms, where terms are both brought together and *brought to light*.

It deserves mention that in efforts to make projects that address ecology effectively and that help “improve our relationship with nature,” architects must recognize the inherent predisposition toward metaphor in ecology, a lack of certitude or sedimentation of the very domain they seek to emulate and support. Clements in the 1940s considered ecological systems to be relatively stable (although certainly dynamic); today environmental scientists focus more on “intermediate regimes of disturbance” and consider ecological systems to be fundamentally open-ended.³¹ Tomorrow ecologists may work with other metaphors they deem more apt. Given this situation, the efforts of designers can be viewed as both conceptualizing architecture in a more ecologically oriented way (and tracking the implications of this thinking on what is built) and opportunistically thinking about ecological systems as an important, sufficiently interpretable part of the

palette out of which we construct and reconstruct the world. Architectures and ecologies become co-creative, overlapping and enmeshed. Ultimately, in this lyrical and pragmatic way, where according to Wayne Booth a “good” metaphor can provide a basis of shared action by helping build a proper ethos, we stitch humans into the fabric of natural systems and natural systems back into the fabric of the contemporary city.³²

While in today’s design culture we equate advances in sustainability, built ecology and landscape health with LEED and like performance measures (ironically and unfortunately a narrowing of terms seems to parallel the burgeoning popularity of green architecture), we believe an equally important, and certainly more originative, means to address this topic is through what the environmental philosopher Bryan Norton would describe as “linguistic activism.”³³ Successful landscape metaphors are linguistic acts par excellence, invoking environmental qualities and goals of design undertakings, sensitizing architects to their work and to the world, and prompting a manner of thought that seeks in environmental settings solutions to architectural problems, and in architectural configurations solutions to environmental problems. Through such processes of association and invention, metaphors transport us to new conceptual and ecological domains. There, new habitats, and habits, await us.

ENDNOTES

1. Perez-Gomez, Alberto. *Built Upon Love: Architectural Longing After Ethics and Aesthetics* (Cambridge, MA: MIT Press, 2006) 98.
2. Session description from “The Value of Design: Design is at the Core of What We Teach and Practice” Call For Papers for the 97th ACSA Annual Meeting, Portland Oregon, March 26-29, 2009
3. For an overview of the influence of metaphor on the environmental receptivity of the architect, see Brook Muller’s “Metaphor, Ethos and Environmentally Responsive Design,” in the *Getting Real: Proceedings of the American Collegiate Schools of Architecture Annual Conference*, Salt Lake City, UT, 2006
4. Focillon, Henri. *The Life of Forms in Art*, Charles B. Hogan and George Kubler, trans. (New York: Zone Books, 1992) 26.
5. A paraphrasing of David Miller’s comments during a lecture sponsored by the Department of Architecture at the University of Oregon, May 7, 2007.

6. James, Vincent and Yoos, Jennifer. *VJAA* (Princeton: Princeton Architectural Press, 2006) 67.
7. Personal correspondence from Ken Radtkey to authors, July 27, 2007.
8. Personal correspondence from David Cook to authors, July 18, 2007.
9. Piano, Renzo. *Logbook* (Milan: Moncelli Press, 1997), 246.
10. James, Vincent and Yoos, Jennifer. *VJAA* (Princeton: Princeton Architectural Press, 2006) 67.
11. "Lanterns of Light," *Metropolis*, March 2007: 101.
12. Personal correspondence from David Cook to authors, July 18, 2007.
13. Personal correspondence from David Cook to authors, July 18, 2007.
14. Houben, Francine and Mecanoo Architects. *Composition, Contrast, Complexity* (Amsterdam: Birkhauser, 2001) 91-94.
15. Piano, Renzo. *Logbook* (Milan: Moncelli Press, 1997) 80.
16. See Janine Benyus' *Biomimicry: Innovation Inspired by Nature* (New York: Harper Collins, 1997)
17. Steele, James. *Architecture in Process* (Princeton: Academy Editions Press, 1994)
18. Houben, Francine and Mecanoo Architects. *Composition, Contrast, Complexity*. 51-54.
19. James, Vincent and Yoos, Jennifer. *VJAA* (Princeton: Princeton Architectural Press, 2006)
20. Personal correspondence from Ken Radtkey to authors, July 27, 2007.
21. Personal correspondence from Ken Radtkey to authors, July 27, 2007.
22. Latour, Bruno, *Politics of Nature: How to Bring the Sciences into Democracy*, Catherine Porter, trans. (Cambridge, MA: Harvard Press, 2004) 71.
23. James, Vincent and Yoos, Jennifer. *VJAA* (Princeton: Princeton Architectural Press, 2006)
24. See George Lakoff and Mark Johnson's *Metaphors We Live By* (Chicago: University of Chicago Press, 1980)
25. Here, the critic may wonder whether this concern over choice and implications of metaphor (at worst) divert us from our 'true' task, the physical, social and economic realities of the conditions surrounding a project, or (at best) serve as a (somewhat) useful tool, not to be confused with primary architectural matters. In response, and as we have alluded, we see value in recognizing the inverse, and argue that descriptions of what approaches the 'truth' of an architectural undertaking inevitably rely on metaphorical or paradigmatic enframement (understanding metaphor here in the broad sense of conceptual categorization). In this sense, a metaphor is both a tool along the lines of Perez-Gomez' quote that instantiated this essay and is indicative of a *metametaphorical frame* in which the designer makes certain claims as to what is primary and in which the designer is disposed to use certain tools over others.
26. The description comes from a conversation with Frank Alameda during a visit to the CAS construction site during a studio field trip on January 19, 2008
27. "San Francisco's New Academy of Arts and Sciences," *Metropolis*, September 2006.
28. The quote comes from a conversation with ecodesigner Paul Kephart during a visit to his studio "Rana Creek Living Architecture" in Carmel Valley, California, on January 18, 2008
29. Goux, Jean-Joseph. *Symbolic Economies: After Marx and Freud*, Jennifer Curtiss Gage, Trans. (Ithaca, NY: Cornell University Press, 1990 (1973)) 105.
30. Perez-Gomez. *Built Upon Love: Architectural Longing After Ethics and Aesthetics*. 36.
31. For a consideration of Frederic Edward Clements' view of ecological communities as stable and "tightly interdependent," see Michael G. Barbour's "Ecological Fragmentation in the Fifties," in *Uncommon Ground: Rethinking the Human Place in Nature*, William Cronon, ed. (New York: W.W. Norton & Company, 1995). For a consideration of the benefits of intermediate levels of disturbance on ecological systems, see H. Ronald Pulliam and Bart R. Johnson's essay, "Ecology's New Paradigm: What Does It Offer Designers and Planners," in *Ecology and Design: Frameworks for Learning*, Bart R. Johnson and Kristina Hill, Eds. (Washington, D.C.: Island Press, 2002), pp. 51-84. For a consideration of ecosystems as open or "sympoietic" systems, see Beth Dempster, "Boundarylessness: Introducing a Systems Heuristic for Conceptualizing Complexity," in *Nature's Edge: Boundary Explorations in Ecological Theory and Practice*, Charles S. Brown and Ted Toadvine, Eds. (Albany, NY: State University of New York Press, 2007)
32. See Wayne C. Booth's essay "Metaphor as Rhetoric: The Problem of Evaluation" in *On Metaphor*, Sacks, Sheldon, ed. (Chicago: University of Chicago Press, 1978) 47-70.
33. See Bryan Norton's *Sustainability: A Philosophy of Adaptive Ecosystem Management* (Chicago: University of Chicago Press, 2005)