A FRAMEWORK FOR UNDERSTANDING THE CONCERNS OF ECOLOGICAL DESIGNERS

Mark DeKay
Department of Architecture
School of Architecture and Allied Arts
University of Oregon

ABSTRACT

This paper creates a theoretical framework of analysis for understanding the concerns and methods of ecological designers. Various definitions of ecological design are reviewed to show its basis in natural ecological systems, either as analog or as context, and its purpose as creating sustainability. Ecological design methods are categorized as conceptual, factual, or integrative. The characteristics and definitions of these methods are explained and several practitioners and theorists classified. Lyle’s concept of ecosystematic order is used to show the basis of methods in either a building architecture or a landscape architecture perspective. A matrix is generated and applied to a representative of each category, showing the concerns of each in terms of the integration of human and natural ecosystem structure, function, and location.

1. INTRODUCTION

Ecological design as a field of knowledge is broad and difficult to define. In the past two decades, many proposals have been suggested for the restructuring of cities and the sensitive design of buildings with a concern for ecology. Only recently has an interdisciplinary ecological design movement become identifiable, entering public and professional awareness. Ecological design is still in a stage of searching and definition, perhaps because it has ceased to be wholly identified with counter-culture and is now seen more as a professional responsibility, just as environmentalism as a whole has moved from activism to a mainstream force.

While there seems to be an emerging consensus of schematic ecological design strategies, there are two identifiable areas of divergence between ecological designers. Divergences are evident in the field in both methodological approaches and in the specific manifestations of common strategies.

For example, at the urban scale, there is almost a consensus among proponents that the ecological city should be a higher density, mixed use, pedestrian-oriented city which increases urban agriculture, biomass, and wildlife habitat, while reducing auto infrastructure. Perhaps because ecological design is a discipline in its infancy, there are significant differences in the proposals of its practitioners and theorists, such as the building and housing types proposed, degree of intervention and replacement of existing urban fabric, increments of development considered, process of transformation, and degree to which the current development, regulatory and public works context is addressed.

This paper will focus, however, on the methodological differences between ecological designers, particularly at the urban scale. It seeks to answer, in the broadest sense, the questions:

- “What is ecological design?”
- “How can a designer understand in a holistic way the wide range of ideas and methods linking design and ecology?”

2. DEFINITIONS OF ECOLOGICAL DESIGN

The term ecological design is often used interchangeably with sustainable design. I would like to offer the suggestion that ecological design is a process of moving toward and creating the state or condition of sustainability as an ideal. Sustainability can be conceived of as the ability or condition of a (natural) system to sustain itself as a whole functioning system over long periods of (ecological) time. Ecological design is a point of view, a paradigm, and a process. Since it involves designing ecosystems, it is also a product.

2.1 John Todd

John Todd defines ecological design as, “Design of human settlements that incorporate principles inherent in the natural world in order to sustain human populations over a long span of time” (25, p. 1). He suggests using our understanding of ecology to design human systems such that sustainability in these systems and in their larger contextual natural systems is assured. Taken out of context, the above statement may appear anthropocentric in its value, but the rest of the book clearly argues for the value of other species, systems, and the planet as a whole.

2.2 Ian McHarg

Perhaps the most statuesque figure of ecological thought in design is Ian McHarg, considered by many as the originator of ecological planning. McHarg defines ecological planning as the determination and selection of alternative futures in order to achieve a “synoptic fitness-health” of system to environment by matching human activities to their “interacting physio-biicultural systems” (16, p. 112-3). Jusuck Koh has described ecological design as “a transformation of Ian McHarg’s ecological approach to planning.” (11, p.76).

Human ecology is defined by McHarg as “the study of the interaction of organisms (including humanity), and the environment (including humanity among other organisms)” (16, pp. 109-10). The concept of synoptic fitness is the ordering of human activity within environments that provide “the largest amount of needs.” This human activity must, as a corollary, be ordered and “fit” to its environment in such a way as to “import and employ the least amount of energy and time to modify the environment and itself.”

For McHarg, the advocacy of human ecological planning is a maturation from his earlier theory of ecological planning,
Ecological design is the ordering of the built and native environment occupied by humans, structured as a human ecology analogous to and employing the principles of nature. Natural systems thus minimize local and global environmental impacts, in order to continue maintenance and health of natural systems at all scales, including their human and non-human components.

A shorter, more manageable definition might be: interventions, based on principles of natural systems, to create sustainability.

3. METHODS AND CONCERNS OF ECOLOGICAL DESIGNERS

It is easy to think of ecological design in simply linear terms, separating the city from an idealized nature and reducing design to either the minimization of environmental externalities or the minimization of site impacts. This is the view of the mechanistic conservationist, not of the ecologist, and results in the conservation versus development polemic. Each of the definitions above clearly places ecological design of the built environment within its local and global ecological systems.

The conscious ecological designer is aware of both the underlying contextual ecological systems in which design intervenes, and of the fact that human culture itself is an ecological system, however misaligned with natural principle it may be.

During the last century in the U.S., there have been recurring, if not consistent, attempts by designers and planners to act in alignment with their best understanding of what would produce an ecologically balanced region, city, landscape, neighborhood, or building. This is a rich, diverse, interdisciplinary history, and forming an image of the whole field is difficult.

3.1 Conceptual, Factual, and Integrative Methods

As a way to understand how proponents of ecological design explain the organization of human activity in relation to both ecological theory and natural landscapes, one can make a distinction between methods which emphasize analogs from ecological systems and methods which emphasize appropriate action in relation to a specific landscape and its contextual range of systems. These seem to be the two rather distinct but interrelated methodological constructs underlying the work of most ecological designers.

The first group, I term conceptual ecological methods and the second group, the factual ecological methods. A third category can be added to the analytical framework, integrative ecological methods, which employ both conceptual and factual methods of design. No designer, of course, is entirely factual or entirely conceptual, and these distinctions are certainly abstractions.

Conceptual Methods

In general, the conceptual methods tend to focus on the design of human ecosystems based on ecological principles, but in an idealized form, abstract from the specifics of a particular site. Location is not a critical factor. They tend to be more internally focused and often address abiotic processes or forces, such as climatic forces of sun and wind, and structure settlement pattern to increase resource efficiency, but seldom respond directly to the spatial pattern and process of particular local ecosystems. In addition, conceptual methods tend to view the city more as a unit isolated from regional considerations and tend to view cities from more of a building architectural perspective.
Fig. 1. Methods of Ecological Design

Conceptual methods derive from a principle-driven model, drawing on systems theory. While engineered solutions are possible, these methods depend more on setting into play universal archetypal patterns and operational rules. Principle, as the mechanism organizing facts, is the starting point for these methods. Their illusion is that their map is sufficient to represent the territory; that lower order facts will always follow higher order rules. It is the myth of both scientist and cleric.

**Factual Methods**

Factual methods tend to be more externally focused and focus on the location of particular human uses in the landscape based on responses to the spatial pattern, distribution, location, and process of ecosystems and regions, but rarely address the organization of human activity as an ecosystem. Location is the critical factor for this group. Specific facts about a particular ecosystem and generalizable facts about a class of ecosystems are used as design generators. This group tends to see the city as integrated with its landscape and region, and espouses more of a landscape architectural perspective.

Factual methods derive from an information-driven model based in the natural sciences and integrated by ecology. Information, especially about the spatial distinctions of landscape characteristics is the starting point for these methods. Their illusion is that, given enough information, a problem will solve itself. It is the myth of the engineer, the economist and the technocrat.

**Values and Design Process**

One primary difference between factual and conceptual methods is in their model of design process. Although both sets of methods begin like most design with visions and programming decisions, factual methods tend to move from the specific to the general and conceptual methods, from the general to the specific. A factual process is based in understanding through some appropriate model the pertinent information, about a specific place or class of places, that limits and suggests more general possibilities and plans. On the other hand, a conceptual process often begins with generalized principles and concepts, at a more universal level, and proceeds to develop and refine a design as the specification of the generalized pattern.

Values are addressed by each class in different ways, related to their methods. Conceptual methods are addressed in the definition of principles and in the assessment of the design's degree of alignment to the principle. Factual methods include values in selecting the important facts to consider, in designing the analysis model. Both include values in the creative synthetic leap to design product. Both are also subject to the potential for mistaking relatively value-free technique for value-full method. However, neither approach must be limited in this way.

**Summary of Methods**

Figure 1 summarizes this framework; it includes a categorical assessment of several ecological designers and theorists. While the application of these concepts as an analytic framework is inherently reductionistic, the methods used for their identification were more holistic than analytical. Particular projects were not analyzed for each figure. Rather, the distinctions covered in this paper arise from a contemplative reading of the body of ecological design literature at large in an attempt to find patterns that would make ecological design comprehensible. The purpose of distinction is not to classify and focus on differences, but to synthetically understand ecological design as a field of inquiry through examining the relationships of individual players to a construct of the whole. If ecological design as a professional and academic field is considered as a system, then it exists and gains its identity from the totality of multiple simultaneous views and expressions of its elusive and ultimately ineffable ideal. Thus differences in point of view are valuable, not necessarily divisive. Furthermore these differences often represent the rapid evolution of ecological design theory and the awkwardness that accompanies transformation.

3.2 **Ecosystem Order**

Human activity and natural systems interact all the time; human systems can be designed in ways sensitive to the natural systems that they influence. Natural or native systems are able to manage themselves, but human systems require design and constant management. At a deeper level, humans systems and their local contextual natural systems can be designed as a single interacting system. In either case, the order of the ecosystem must be understood if appropriate action is to be taken. Lyle conceptualizes three interrelated components of ecosystems order: structure, function, and location (15).

Structure and function are the statics and dynamics, the form and process of ecosystems. Structure refers to the biotic and abiotic elements of a landscape and their relationships to each other. Structure includes the number, type, distribution, and relations of the system's plants, animals, microorganisms, soils, minerals, etc. Function refers to the flows of energy, materials, and information within a system and between it and other adjacent systems. Each ecosystem has a particular set of functions associated with a characteristic form.

Structure and function, form and process, are interrelated, but they are also intertwined with location. Location refers to the
spatial distribution of particular structure/function symbiotes within a particular place, including its physical, biological, cultural, and political aspects. In design, the link between processes and their location is usually made using a suitability model to find the 'best' place in the landscape to place a particular activity. Ecological design must, in appropriate locations, fit the structure and function of human activity, designed itself along ecological principles, with the structure and function of natural activity, which is the context for human habitation.

3.3 Concerns of Ecological Designers

Lyle’s concept of the order of ecosystems (structure, function, and location) can be helpful in forming a basis for the conceptual interaction of human and natural systems. Considering both human and ‘natural’ ecosystems by placing them on different axes of an interaction matrix, Figure 2 is generated. This can be a useful tool when used to understand in a coarse way the differences between the concerns addressed by differing urban ecological designers and theorists.

The horizontal axis is defined by considering only the structure, function, and location of a natural system. Without human activity; their combination represents the ideal untouched and unoccupied natural landscape, or wilderness.

Conceptual methods (discussed above) begin on the vertical axis with human concerns, while factual methods begin on the horizontal axis with natural concerns. This indicates a difference in the orientation or basis of the two groups of methods.

3.4 Application of the Framework

To illustrate how this framework can aid us in understanding the differences and similarities in ecological design theory, it is applied to a familiar representative of each group of ecological design methods: conceptual (Van der Ryn), factual (McHarg) and integrative (Lyle). Figure 3 shows a darkened circle if the designer significantly considers the interaction represented by a particular cell, and no circle if the interaction is not significantly considered.

Although Sim Van der Ryn’s current attention is focused on moving beyond the concept of dense mixed use settlement patterns to deeper integrative reflective theoretical positions, his most familiar proposals are summarized in the book Sustainable Communities (27). These projects, for the most part, are concerned with the internal processes of the restructured city as an ecosystem – in proposals such as the Marin Solar Village. Reinhabitation proposals for existing suburban and urban environments focus primarily on regenerating a more traditional pedestrian oriented urban pattern modeled on the Medieval village. In some cases there is emphasis on local natural process, but much more emphasis is given to energy conservation and climatic response.

The most familiar understanding of Ian McHarg’s work is the methodologically focused work presented in Design With Nature (17). More contemporary theory and practice move closer toward integrative methods, but still have their basis in landscape analysis methodology, with a focus on matching human structure to natural location based on the fitness of that structure to the natural characteristics of the site. In projects such as planning for Woodlands, Texas (9; 15), there is an emphasis on minimizing impact of human occupation to the existing wildlife habitat and ecological integrity, especially of the hydrological system. The project shows little interest, however, in considering external ecological impacts, such as those associated with high energy use of decentralized organizations. Settlements pattern, as a function of internal human system ecological integrity seems less important.

John Lyle offers a theoretical basis for an integrative

Fig. 2. Concerns Ecological Urban Designers

The vertical axis in the matrix is defined by a design which considers only human ecosystem, structure, function, and location would be an idealized human system, intended to be applied universally without concern for its location in a natural context. It would be the extreme city-as-a-diagram. A specific natural context is simplified to ‘nature’ or ‘the country.’

Fig. 3. Application of Framework to Three Ecological Designers

Van der Ryn

Lyle

McHarg
methodology, culminating in the information—intensive predictive approach of modeling the structural and functional implications of human actions in the landscape (12). The Institute for Regenerative Studies project at California Polytechnic State University, Pomona (10; 12) is a good example. We are still yet to see a thorough integrative study of an urban design project; most integrative projects are in suburban or "compromise" zones. The question remains unresolved as to whether or not the city can be designed in true integrative fashion, retain some semblance of health in its local ecosystems, and not dramatically retard ecological succession within its entire area.

4. CONCLUSIONS

Designers and planners are looking for ways to increase the sustainability of their cities but have few tools, and there is a dearth of information about how to form the most basic concept of a vision for an ecological city. What is and is not ecological design needs to be clarified, along with appropriate, replicable methods for achieving its goals.

Ecological design has been presented in this paper as a process of moving toward and creating the state and condition of sustainability as an ideal. Ecological design is primarily a way of deigning, a consciousness—a point of view, a paradigm, and a process. Generically, design is the ordering of the built and native environment occupied by humans. To create ecological sustainability it must be structured as a human ecology analogous to and employing the principles of mature natural systems. Mature systems offer stability, whereas pioneering systems offer productivity.

Minimizing local and global environmental impact is an effect, not a primary purpose of ecological design. Focusing on linear cause and effect relationships can be misleading if the elements are not considered in a systems perspective. The maintenance and health of natural systems at all scales, including their human and non-human components is its greater goal.

The methodological distinctions identified can be useful for understanding the differences between the methods of ecological urban designers and theorists. Ecological design can be seen as the synthesis of two polarities: conceptual and factual methods. Conceptual methods tend to focus on the internalized design of human ecosystems based on ecological principles, but in an idealized form, abstract from the specifics of a particular site. Factual methods tend to focus on the location of particular human uses in the landscape based on responses to the spatial pattern, distribution, location, and process of ecosystems and regions, but rarely address the organization of human activity as an ecosystem.

Lyle's concept of the order of ecosystems (structure, function, and location) can be helpful in forming a basis for the conceptual interaction of human and natural systems. The matrix framework presented can aid designers in understanding the differences and similarities in the concerns of ecological designers and theories and can help to a synthetically understanding the whole of ecological design as a field of inquiry. In a crude and abstract way, it represents the holistic vision of ecological design's mission.

5. REFERENCES


