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Introducing landscape ecology

Comments of the editor

Frank B. Golley
Institute of Ecology, University of Georgia, Athens, GA 30602, USA

Our new journal has been developed by SPB Academic Publishing cooperating with the International Association of Landscape Ecology (IALE), which is affiliated with the International Association for Ecology (INTECOL). IALE membership includes landscape designers, architects, and planners, as well as soil scientists, geographers, modellers, biogeographers, and those biologists who call themselves ecologists. The journal is intended to be the official voice of IALE and to represent these various disciplines' interests and research on the landscape. Landscape sets the scale and orientation of the journal. Ecology indicates its breadth and wholistic approach.

A central task of the editor and editorial board is to set the boundaries of the subject matter contained in the journal. These boundaries will be fuzzy, like those in nature, and will shift with time.

In this introductory comment, I want to repeat some of the ideas presented at the second meeting of the USA chapter of IALE, at Charlottesville, Virginia, USA on March 11, 1987. The comments seem as relevant at the birth of a new journal as at the close of a meeting of a newly organized landscape ecology society. My comments were divided into three parts: first, general, philosophical matters; second, space and time; and third, human interactions with the landscape.

General matters

Let me begin by restating the obvious. All studies involve three levels of attention: the object of interest, the components and functions within that object which explain its behavior, and the larger system of which the object is a part and which establishes its significance. Frequently studies deal with one or two levels and are, therefore, incomplete. If such incompleteness becomes routine, then it can act negatively on the development of a subject.

Let me give an example. Ecosystem science emerged in the world through the activities of the IBP and great projects were carried out with general success. These projects provided fine descriptions of system behavior at the level of watershed, forest, and field, and explained some of the processes underlying those behaviors. In my opinion, they were less successful in organizing ecology or in solving environmental problems. I believe, one reason for this lack of success was that ecosystem studies did not fit clearly into a larger schema and, therefore, it was difficult to fully explain the significance of a specific ecosystem study. Unfortunately, these ecosystem studies lacked an understanding of landscapes. Until the rediscovery of landscape ecology, ecosystem scientists struggled with the integration problem unsuccessfully. Now ecosystem scientists are developing a sound comparative basis for their studies within the framework of landscape ecology.

The enthusiasm of ecosystem scientists indicates one of several directions for the development of

landscape ecology (Naveh and Lieberman 1984). We are interested in ecosystem functions at a landscape scale. These functions include flows of water, of chemical elements, and of energy. We are also interested in the structural arrangements of the biota and the physical environments which control these functions.

In comparison to biotic communities, landscapes appear to have relatively simple structures, and but little, if any, replication. Hence, the statistical procedures which have been developed for the study of agricultural plots and for laboratory experiments may not be appropriate for use in the study of landscapes. This structural character of landscapes and its relationship to standard statistical procedures may create difficulty in our communication with biological and social scientists who place high value on replication and tests of difference. We need to grapple with the problem of certainty in the study of landscapes.

Space and time

Landscape is a spatial concept, and clearly landscape ecology has a particular interest in space. In this way, it is fundamentally different from other types of ecological studies in which space is only one, usually not very significant, element among many. It seems to me that there have developed two different approaches for the analysis of space and for presenting the findings to decision-makers. First, we may look into nature, study the patterns that we see there, and describe these patterns as patches, corridors and so forth. Foreman and Godron (1986) have provided us with an excellent portrayal of the power of this procedure. For our description, we need not depend only on field level measurements but may expand the scope with remote sensing data from airplanes and satellites. Remember, the term 'landscape ecology' was coined by Carl Troll (1939) to describe his study of aerial photographs.

The second approach can be characterized by the work of Milan Ruzicka (Ruzicka and Miklos 1982) of Czechoslovakia. This approach is driven by a question. For example, where might a steel mill be placed in a certain region? The resources required by a project, the impacts of a project on the environment and other landscape requirements are identified. The study involves the search for patterns among various landscape properties in order to identify areas were there is a convergence of positive factors, where there are minimum negative factors and so forth. The resulting landscape analysis is presented on maps which define the landscape in terms of units for a particular project. Each project might result in the identification of different landscape units. Thus, the units are not necessarily visible to an observer of the natural landscape. The decision-maker is given the location of units with high value, low value, and neutral value for the project, and the constraints of economics, politics, or what ever controls decisions in that situation are applied to select a specific location from among the set of solutions.

Clearly, these two approaches lead to very different outcomes. Both approaches have value and will be useful for different applications.

The focus on space creates another special characteristic of landscape ecology, the diversity of individual viewpoints. The landscape may be viewed in a pictorial or cartographic form, as numerical data, or in models. The models may be words, even poetry if we think of Gary Snyder (1970), or any other representation of our perception. Since landscape usually is presented at large spatial scales and involves many individual bits of information, it lends itself to remote sensing and to computer analysis and synthesis. Mathematical modelling will be a central part of landscape ecology. This means that the field of landscape ecology will contain people who view the landscape as a landscape artist, as well as those who think in terms of fractals. If we can retain our good humor, as our President, Isaak Zonneveld (1982) encourages us to do, then we have the advantage of truely reaching across barriers toward solutions to human problems.

Space is such a dominant concern in landscape ecology it tends to overshadow our interest in time as the other parameter which structures analysis. It seems to me that time is especially difficult to incorporate into our studies of landscapes. This is because we are operating with geological time, biological time, and human history. Here, landscape ecology may intersect with environmental history.

Hybrid systems

Neef (1982), in his paper at the first Landscape Ecology Congress at Veldhoven, The Netherlands, introduced the concept of hybrid landscape systems. In this case, the term 'hybrid' means the mixture of natural components derived from the original landscapes and new components introduced by man, all manipulated by human activity. These are the actual systems in which we live, and they open to us a very important collection of questions. Here biological entities from a variety of sources are mixed up with those selected by evolution for the site and then are impacted again and again by a variety of human actions, including burning, cutting, polluting, protecting and so forth. The trajectories of change of these systems, called ecological succession, are notoriously difficult to predict, let alone explain. Indeed, some ecologists assert that it is not possible to predict the pathway of succession. We also need to erase from our minds the concept of a pristine world in static equilibrium, and recognize that biological changes and human interactions have been an ongoing process. We need to determine how these hybrid systems change over time, how they will respond to further impacts, and what is their future.

These matters are especially important to the environmental designer and landscape architect because the designed landscape, for example the garden, is frequently thought of as a transition between the built environment and the natural environment. If the natural environment is itself not a pristine baseline but is a different form of garden, a mistreated garden to be sure, then the tension between man-made and natural is lost. This shifts the problem from designing with nature to designing according to canons of beauty and utility based on our understanding of ecology (Howett 1987). The challenge is to create landscapes which are beautiful, as well as productive of goods and services required by humans and natural creatures and to contribute to a system of values where landscapes can be assessed and protected for their intrinsic qualities and not only their economic worth.

Conclusion

Landscape Ecology is being launched at an important time in the history of the biosphere. In 1987, we face widespread deterioration and destruction of the Earth's landscapes and waterscapes, with direct impacts on humankind (Brown *et al.* 1987). It is clear that human beings have not managed their populations, cultures, or landscapes well. Indeed, we frequently seem ignorant of the interactions between human decisions in economic and social spheres and the land, water, and air upon which we depend for life. Our scale of focus has been too small and our attention span too short to grasp the biospheric web in which we exist. It is crucial that landscape ecologists develop ways to convincingly express our understanding of the biosphere and then effectively apply this understanding to problem solving. The task of correcting biospheric disorder is a universal activity, requiring information and insight from all. We intend that *Landscape Ecology* have this broad objective and that it be relevant to the problems that face mankind at the end of the twentieth century.

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