Landscape Ecol (2007) 22:1445–1446
DOI 10.1007/s10980-007-9169-4

EDITORIAL

Deconstructing and reassembling the landscape system

Paul Opdam

Published online: 23 October 2007

To me, landscape ecology aims at understanding the functioning of the landscape system, which includes human beings. Most landscapes are used by humans and changed by humans, often on purpose to improve values and benefits of landscape services for economic, ecological or social reasons. It follows that a variety of scientific disciplines are united in the domain of landscape ecology. If it is the objective of landscape ecology to understand this system, how has landscape ecology been doing since the establishment of the International Association for Landscape Ecology 25 years ago? Has it proven possible to study such complex spatially heterogeneous systems? Are landscape ecologists capable of advising the decision makers of the world how to adjust and develop landscapes for a sustainable future?

Since the early beginnings, a main discourse in landscape ecology has been the controversy between the holistic and the reductionistic approach. Some scholars advocated studying the landscape machinery as a whole; others argued that the working of the landscape machinery could only be understood by deconstructing the machine and studying the mechanisms of its parts. I think that it is important to understand the working of the machine through its parts, because we need to be able to predict what happens if some parts are replaced by others, or to say where the machinery can best be improved. The whole landscape system is so complex, so variable and so extensive in its dimensions that it simply cannot be studied by describing and comparing its characteristics in space and time. Description is important, of course, to capture the spatial patterns. Thanks to the revolution in information technology, geographic information systems (GIS), and a wealth of spatial indices, landscape ecology surely has laid a firm basis of descriptive pattern studies. But to make predictions on its response to change, we have to know the mechanisms that produce those patterns. Hierarchy theory has taught us that landscapes are built of a cascade of nested subsystems, that all contribute to its functioning. For example, biodiversity is composed of an enormous variety of interacting species, responding to patterns at different spatial scales, and responsible for a range of functions in the ecosystem. Any prediction on the response of landscapes to land use change or natural disturbances requires understanding of the mechanisms organizing such hierarchical systems. And that is why many landscape ecologists are focusing on the working of parts of the landscape, rather than the whole system. During the past 25 years, landscape ecology witnessed a wealth of carefully done, detailed, analytical, mechanistic, mono-disciplinary research, seeking to understand the working of a small piece of the complex system.

P. Opdam (✉)
Department of Land Use Planning and Alterra,
Wageningen University, Wageningen, The Netherlands
e-mail: Paul.Opdam@wur.nl

However, given the mission of landscape ecology, this type of research will bring us nowhere. If science is more than keeping smart and curious people at work and happy, if science is also beneficial to human society, then scientific knowledge needs to help people in shaping a better world. Although the reductionistic approach might be a necessary route to understanding the parts of the system, it certainly is no more than an obligatory detour to our final goal. With Naveh (2007), Wu and Hobbs (2007) and many others, I think that now landscape ecology is ready for reassembling the machine and put the parts together again. We need to generate a strong movement of integration of knowledge of the detailed mechanisms, and find out how they fit together and work together in a more complex system, under a variety of conditions, and in a variety of places. Integration is putting information on the structure and function of the parts into a higher hierarchical level of the landscape system; integration is about proposing generalities pertaining to the behavior of the parts, while neglecting the differences between them. For knowledge on biodiversity and landscapes, for example, we need to assemble the variety of species into functional response groups based on similarities in responses of species to landscape patterns change. Integration is to follow the road back to holism.

This is an important step to a landscape science able to facilitate decisions based on principles of sustainable management of our landscapes. But it is not enough. Landscapes are changed by humans, to create added values. All too often such decisions are driven by short-term economic and social goals, neglecting the fact that landscapes are the template for a series of landscape services that are a condition for human life and welfare. Understanding the functioning of the landscape space for delivering ecosystem and landscape services is a prerequisite for regional planning and land use change decisions. But, because it is not the scientist who makes these decisions, the scientific information needs to be brought into the world of the actors in policy, planning, design and management. Landscape ecology has not been very successful in transferring information in a form that generates knowledge in the heads of those actors (see for example, Termorshuizen et al. 2007). The lack of knowledge transfer from science to society is a growing concern in other parts of science as well, and expressed again at the World Congress on Landscape Ecology in Wageningen in July 2007. Cash et al. (2003) have shown that effective knowledge transfer is based on three pillars: credibility, saliency and legitimacy. The crux of their message is that these three prerequisites can only be optimized if scientists and practitioners work together in applying generic scientific knowledge in the specific context of a region (so called transdisciplinary research). At the Wageningen conference, several symposia were devoted to this notion. One of the challenges is to generalize the findings of applying knowledge in a series of cases, and find out how scientific knowledge should be structured and made available for application, how different decision making processes require different types of knowledge, and how scientific knowledge affects decision processes. Asking such questions is taking position at the forefront of science, since it requires a true interdisciplinary approach, but at the same time it enforces the credibility of landscape science in the eyes of society.

References

Cash DW, Clark WC, Alcock F, Dickson NM, Eckley N, Guston DH, Jager J, Mitchell RB (2003) Knowledge systems for sustainable development. PNAS 100:8086–8091

Naveh Z (2007) Transdiciplinary challenges in landscape ecology and restoration ecology—an anthology. Springer, Dordrecht, The Netherlands

Termorshuizen J, Opdam P, van den Brink A (2007) Incorporating ecological sustainability in landscape planning. Landsc Urban Plan 79:374–384

Wu J, Hobbs R (2007) Landscape ecology: the-state-of-the-science. In: Wu J, Hobbs R (eds) Key topics in landscape ecology. Cambridge University Press, Cambridge, pp 271–287