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Review: Proportion in the Labyrinth?
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Source: *Ecology*, Vol. 64, No. 5 (Oct., 1983), p. 1324
Published by: Wiley
Stable URL: http://www.jstor.org/stable/1937848
Accessed: 26-06-2016 10:23 UTC

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Ecology, 64(5), 1983, p. 1324
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Proportion in the Labyrinth?

Allen, T. F. H., and Thomas B. Starr. 1982. **Hierarchy: perspectives for ecological complexity.** The University of Chicago Press, Chicago, Illinois. xvi + 310 p. $27.50.

This important and stimulating book raises a number of very pertinent ecological questions. With its publication, and with the recent publication of a number of other works in related disciplines, I note a growing dissatisfaction with the reductionist approach to ecology. As the authors indicate, this book is very much part of the tradition of Margalef and others in that it stresses the complexity of ecological systems and the ways in which such complexity may be treated. The starting point of the book is that ecological systems are complex, information carrying systems and must be treated as such.

The book begins with an introduction that discusses the classification of ecological systems as middle number systems: systems with too many parts to be modelled successfully by sets of differential equations and too few parts to be treated by the biological equivalents of statistical gas laws. Allen and Starr use Koestler's idea of a hierarchy of holons to introduce their discussion of such systems. It would perhaps have been better if the authors had explained the history of such ideas in more detail. There is scant reference to von Bertalanffy who introduced many of these concepts in the 1940s and who was one of the founders of the movement concerned with a General Systems Theory. There is some reference to the work of D'Arcy Thompson, but a better history of the concepts of scales and hierarchies would allow most readers to place this book in its proper context more easily.

A second section of three chapters discusses the definitions of the Janus-faced holon, of decomposability, of scales and filters, and of the problems associated with the human scale of perception. I am sure that, for most readers, Koestler and von Bertalanffy are required reading for a full appreciation of this section. In parts, I did not find the prose style of this book very easy; granted these are not easy concepts to convey in words, but I had to reread the basic sources before the full meaning of the text became clear.

A third section deals with the evolution of increasing complexity in biological systems. Here, the ideas of preadaptation and information transfer through time are stressed. At this point the authors echo some other recent books in the area of information theory and computing. The idea of the monkey typing pool with editors at different levels seems to crop up in a number of places. The flow of information through time implies a level of selection complementary to the Darwinian model of selection. The chapter on functional and structural boundaries raises a number of points including the parallelism between holons and computer subroutines. Information is passed into and out of a subroutine in the form of a small number of key signals; the same may happen across holon boundaries. This chapter also makes a very important point in a footnote; this is a point which should have been made at some length, and one which would then have given the book a sharper focus. The authors identify the difference between equilibrium and non-equilibrium ecology as a difference in scale. For me this was one of the more important ideas raised in the book. It is clearly possible to reconcile many of the current arguments about emergent properties and community structures by reference to the scale of observation. It was a pity that this point was not made more clearly and at length. In this and other ways this book could have become a guide to a number of important ecological debates. The ideas are there but need to be sought out. The last chapter of the third section also deals indirectly with the equilibrium vs. non-equilibrium debate in the form of a discussion about scaling strategies.

The last section of the book is composed of six chapters which discuss the application of hierarchical ideas to a number of ecological examples. Chapters deal with scale in community ecology, modelling, diversity and connectedness, scale in phytoplankton communities, and agricultural examples. Once again some very important points are made but some golden opportunities are missed. The differences between the views of Clements and Gleason are identified as differences in scale but the extrapolation to such ideas as Connell's "intermediate disturbance" hypothesis and non-equilibrium theories of community structure are not made. Allen and Starr make good use of multivariate statistics to show how pattern and process are organised at a number of levels and make some telling points about the roles of disturbance, competition, and of resource utilisation. In a last chapter the authors discuss the role of scale as an investigative tool and make some interesting suggestions about different ways of observing hierarchical behaviour.

Allen and Starr note at the beginning of the book that aquatic ecology has played an important role in the development of ecological theory over the years, but fail to mention the empirical studies of Rigler and Vollenweider. Such work is tantamount to the study of ecosystems as large number systems, as the results obtained are like statistical gas laws. The fact that these approaches work in planktonic systems is probably because the organisms (phytoplankton) are so small that basin scale averages for such parameters as chlorophyll and total phosphorus become high level averages of a very large number of individuals, species, and processes. Thus, limnologists have been doing some of the research at a variety of scales that the authors favour.

This book is a stimulating introduction to the problems of working with complex ecological systems. The terminology and the concepts may be novel to some but the book concludes with a good glossary. The authors note that much of what is said in this book has been said before but not in one unified structure. It is easy to review a book with good hindsight; all credit to the authors for making an original statement and making it with humor and some striking examples. Any book that makes a point by referring to the Superbowl as seen from the inside of the football grabs my attention! I assume that with the feedback from the first edition, the authors will integrate a wider viewpoint into the second edition and will integrate these ideas into the context of some current ecological debates. That could produce a classic.

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