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Biol 862.02
12/13/5
Bibliography (Microcosms)

My initial research on the use of microcosms to learn about larger ecological phenomena lead me gradually to the study of articles dealing with the subject of scale. There is a plethora of experiments that used model systems, most concluding that their data is relevant, although must be extrapolated with caution. This bibliography represents the more scale-associated articles, as it seemed most relevant to the discussion concerning use of microcosms in understanding wide ranging ecological phenomenon.

Bell, T., Neill, W.E. and Schluter, D. (2003) The effect of temporal scale on the outcome of trophic cascade experiments. Oceologica 134:578-586

Review of results of published trophic cascade experiments in order to test the prediction that the outcome of freshwater trophic cascade experiments is intricately tied to the duration of the experiment. The authors acknowledge that small-scale studies are vital to gaining an understanding of ecological concepts and that close attention must be paid to temporal and spatial scale in experimental design. Ultimately, they conclude that short-term studies in trophic cascade theory are adequate for predicting long-term patterns.

Boyle, T.P. and Fairchild, J.F. (1997) The role of mesocosm studies in ecological risk analysis. Ecological Applications 7:1099-1102

Authors express concern that "the large picture" is generally overlooked in the realm of ecotoxicology stating that mesocosm studies have not been related to broader, applied ecological questions in resource management, something they deem important to develop. Provided in conclusion is a list of recommendations for consideration such that basic and applied ecology could be linked more credibly.

DeMelo, R., et al (1992) Biomanipulation: Hit or Myth? Limnol. Oceanogr. 37:192-207

A retrospective look at the theory and practice born of a novel idea in 1984. Challenging the tendency for advocates/scientists and land managers to better understand and investigate nascent trends before accepting and acting as they're "definitive dogma". This review gives a holistic look at the results of a moment in time. Interesting to look back at an era past and examine and contrast the results of mulitple experiments using a seemingly antiquated idea – the biomanipulation theory.

Drake, J.A. (1989) Community-assembly mechanics and the structure of an experimental species ensemble. The American Naturalist 137:1-26

This paper demonstrates an early attempt to understand "unifying principles" and mechanics that drive ecosystems to alternative states through manipulations of

laboratory systems. Exploring the understanding of historical effects and invasions as well as the concept of community assembly trajectories.

Gardner, R.H., W.M. Kemp, V.S. Kennedy and J.E. Petersen, editors (2001). *Scaling Relations in Experimental Ecology*. Columbia University Press, NY, NY, USA.

Some of the leading scientists doing microcosm work (that are extremely interested in the concept of scale) worked to compile this text Therefore, it provides one of the most comprehensive back rounds and lists of insights concerning issues surrounding the use of small-scale experiments that I've seen. They address issues such as "soft extrapolation" and a need for a "science of scale".

Jessup, M.J. et al (in press) Big questions, small worlds: microbial model systems in ecology. *TRENDS* in Ecology and Evolution (www.stanford.edu/~bohannan/Media/Jessupetal04%20copy.pdf)

Authors are advocating that findings of microbial model systems (generally used as tools to investigate genetic and physiological questions) are adequate tools to address ecological issues. One of their arguments is that local interactions lead to patterns at large spatial scale. They are fairly convincing and make some good points in favor of the use of simplistic systems. Authors address criticisms of microbial model systems, but don't say anything revolutionary.

Kennedy, V.S. and Kemp, W.M. (2001) Scale-Dependent Relations governing Extrapolation from Mesocosm to Nature in Coastal Ecosystems. http://www.hpl.umces.edu/meerc/projects.html

This is a short essay on MEERC's approach to answering the question of scale in ecological experiments. They discuss the need for (and their attempt at) attaining principles that can help to match "the scales of the observations to the scales of the question".

Lawton, J.H. (1996) The Ecotron facility at Silwood Park: The value of "big bottle" experiments. Ecology 77:665-669

This is a simple compilation of the ins and outs of the Ecotron Facility by one of its own. It is an introduction to the methodologies and ideals of the scientists at the facility as well as a brief description of current research. In addition, the author discusses what he believes one can and cannot learn from such science. A must read for anyone interested in what happens at an institute performing "big bottle" research.

Petersen, J.E., et al. Multiscale Experiments in Coastal Ecology: Improving Realism and Advancing Theory. BioScience 53:1181-1197

This article, by far, gives the best synthesis of the topic of scale and the approaches taken to understand dynamics involved in applying findings from mesocosm studies to the larger picture. Much time is taken to evaluate approaches and decipher implications from the multi-scale work done at the MEERC. The article compiles historic uses and current trends in the use of small-scale controlled experiments used to better understand the larger picture. Their view of the current applications and methodologies

in laboratory studies relating to larger real-life ecosystem issues drives their synthetic ecosystem work.

Schneider, D.C. (2001) The Rise of the concept of Scale in Ecology. BioScience 51:545-553

This is an article for all the mathematicians in the class. Asking the question: can "scaling" become a unifying concept in ecology, not just a subject for discussion? Nicely synthesized with a ton of information. Schneider is well versed on the history and concerns associated with scale in ecology and he provides a discussion on power laws and their potential relevance in helping to understand habitat structure.

Woodruf, L.L. (1912) Observations on the origin and sequence of the protozoan fauna of hay infusions. Journal of Experimental Zoology 12:205-264

An early "bottle" approach exploring succession in hay infusions.

Wynn, G. and Paradise, C.J. (2001) Effects of microcosm scaling and food resource on growth and survival of larval *Culex pipiens*. Ecology 1:3

Nothing new in this paper; just another paper confirming what already generally accepted, not providing any real answer to the issue of scale, just an experiment to demonstrate the issue exists. Unique in that sense, I suppose, because most papers uncovering issues of scale were experiments where that wasn't the goal. Aim of research is to demonstrate that the size of experimental enclosures will directly affect growth and survival of mosquitos – when resource levels were scarce. Conclusion of research seems to be what they hypothesized: choice of scale in experimental design will affect the outcome of the experiment.