

# Philosophical Foundations for the Practices of Ecology 1st (first) Edition by Reiners, William A., L

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## 100 years of ecology: what are our concepts and are they useful?

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**Abstract.** On the occasion of the Ecological Society of America's centennial, we sought to learn which ecological concepts members value in terms of their utility. This required defining "concept," and selecting concepts from current ecology textbooks that might arguably belong to a normative set. All ESA members were invited to participate in an online survey in October 2014 in which they rated 70, randomly selected concepts (out of a total set of 131) in terms of utility. Alternative to rating, respondents could mark the concept as unfamiliar. Respondents were also able to list concepts that were important to them that were not encountered in the survey. Fifteen percent (1324) of the ESA membership participated in the survey. Of these, 89% were addressed in North America, 62% were male, 77% held Ph.D. degrees, 67% were involved in academia through employment or as students, and about one-half of the total were divided between community and ecosystem ecology domains of interest. The 10 highest ranked concepts (in descending order) for utility were scales (small, local, regional, global, etc.), ecosystem, habitat, species, disturbance/perturbation, organism, population, community, competition, and species life history. The 10 lowest ranked concepts (in descending order) for utility were Lotka-Volterra predator-prey/competition models, Allee effect, nutrient spiraling, character displacement, doubling time, climax, Hardy-Weinberg equation, red queen hypothesis, chemotroph/chemoautotrophy, and mimicry. Respondents entered 2960 terms not encountered in the survey. After parsing for concepts missed due to the survey's random presentation process, for semantic redundancy and for terms deemed non-concepts, 119 candidate concepts emerged. Many of these deserve consideration for inclusion in a normative set and introduction in textbooks. This research provides a well-considered definition of "concept," a basis for defining a normative set of concepts expected to be known to all ecologists, and a measure of familiarity but, more importantly, a measure of usage by contemporary ecologists who were members of ESA. These results help us to understand ourselves and our science, to better teach ecology, to explore the extent and intellectual structure of the collective ecological community, and to further explore the extent and intellectual structure of the principal concepts by which ecologists pursue their work.

**Key words:** concept utility; conceptual thematic categories; ecological concept; Ecological Society of America; ecology textbooks; heuristic toolkit; intellectual framework; membership survey; normative concept set; scales and scaling; science education.

### INTRODUCTION

As the world's largest ecological society, the Ecological Society of America (ESA), reached its 100th year, members paused to consider the nature of the discipline at this point in its history (Turner 2015). A fundamental aspect of any discipline is the conceptual framework by which it organizes its exploration of how nature works. The term "concept" is informally used to refer to abstract ideas developed over the history of the discipline although there is neither common agreement on the definition of concept nor on which terms might be considered concepts. That a term is vague does not mean that it is vacuous or that its use is inadvisable. Vague terms include

science, ecology, experiment, sustainability, and health, for example. We (authors) sense that the meaning and usage of concepts will always be variable within ecology, and that it probably never will be clear how or when ecologists incorporate the extraordinary variety of concepts into the practices of ecology. Nevertheless, we have attempted to determine which concepts introduced at a basic and, therefore, widespread level are considered useful and hence, valuable to ecologists at the ESA's Centennial year.

Many ecologists overlook or take for granted the importance of concepts to their practices. Their work may seem only to involve the application of detailed knowledge, ability to find new information, and skills to solve particular problems. We contend, however, that the "stuff" with which ecologists address problems includes concepts, even if only as mental blueprints or hazy metaphors in the heuristic toolkits by which they think,

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background in the fundamentals of science philosophy. using physics as the ideal (Gasper , Reiners and Lockwood ).  
breadth of training in the first case and the individual's mathematical.Philosophical Foundations for the Practices of  
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Press.assumption that theoretical ecological models (TEMs) can guide deci- sion- making At the same time, leading  
ecologists and philosophers continue to .. with TEM-based analyses.<sup>3</sup> First, with such analyses, they try to answer  
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