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Energy Systems Language as a Tool for Ecological Modeling and Valuation

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As the main subject of international talks during the 1990s, 'sustainable development' has affected much of the world in its endeavor toward a better and prosperous world. Ecosystem-based management has been emphasized as one of the key principles in realizing sustainable development. Sound management of ecosystems which are the very basis of our socioeconomic well-being is ever more important in an age of diminishing resources. This calls for a more holistic approach in analyzing, predicting, and evaluating the current human interventions on ecosystems to assist in formulating better policy alternatives in ecosystem management. Models have been used as simplified pictures of the real world to help people understand complex systems around them, test hypotheses about the systems, and solve problems they are facing. They can be in the form of verbal language, physical models, or mathematical representation. This paper introduces an energy systems language which introduced by Howard T. Odum in 1967 as a methodology for converting verbal descriptions of systems of any kind into system network diagrams. Energy systems language uses a set of symbols that have special meanings and mathematical relationships of components and processes of systems, for modeling of all kinds of systems of interest. As a top-down modeling tool, the energy systems language shows systems organization graphically while keeping important energy constraints and systems kinetics so that anyone with a little understanding of the symbols and their meanings can grasp network organizations of systems and their properties easily. Diagrams of the energy systems language can help researchers identify and organize knowledge of main components and processes of a system under consideration which are most relevant to the problem they are trying to solve. In most other modeling conventions, true pictures of nature-energy constraints and network organization are hidden behind ambiguous verbal languages, complex differential equations, or long computer programs. When drawn in an appropriate way, energy systems diagrams show energetics and kinetics at the same time in a holistic way. Energy systems diagrams provide an easy way of writing computer simulation programs based on the pre-defined mathematical relationships among symbols to investigate the systems dynamics. This paper introduces cases in which the energy systems language was applied for modeling and valuation of ecological systems.