

Structural Human Ecology: New Essays in Risk, Energy, and Sustainability

Edited by Thomas Dietz and Andrew Jorgenson

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Eugene Rosa was a pioneering researcher who spent much of his career establishing links between the social sciences and the ecological and biophysical disciplines. *Structural Human Ecology* collects papers from a conference held at Washington State University celebrating Rosa's life and body of work. The text follows in Rosa's footsteps with its focus on intersections of human and non-human processes that help us unpack environmental risks both complex and lacking in precedent.

In the preface, Paul Ehrlich highlights Rosa's profound contributions to the early days of human ecology research. Ehrlich recounts the ways that Rosa and his collaborators expanded upon existing bodies of work, such as the IPAT model, which framed environmental [I]mpacts as the product of [P]opulation processes enacted under varying levels of A[ffluence] and [T]echnology. Rosa and others built upon this formulation to produce the stochastic, iterated or STIRPAT model that (as Ehrlich recounts) "has been used to measure such things as the impacts of growing populations and expanding consumption on environmental variables, and [to refute] a variety of claims that those impacts will be handily reduced by economic factors and technological innovation." Rosa was also a key actor in the Millennium Alliance for Humanity and the Biosphere and, for both his leadership and resoundingly prescient work in many of the most pressing problems of modernity, is dearly missed.

In the introductory chapter, Thomas Dietz and Andrew Jorgenson give a brief account of human ecology's development as a field. Beginning with its early days in the Chicago School, human ecology distinguished itself from sociology with its concern for the biophysical environment and concepts such as spatial patterning and succession more commonly found in the ecological and evolutionary sciences.

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Although Dietz and Jorgenson acknowledge human ecology as a heterogeneous field whose actors are sometimes only loosely connected, they nonetheless identify three core themes by which its academic community may be characterized. The first is a concern with metatheory, or how problems may be known and identified, particularly when (as is the case with modern environmental issues) such problems are often novel in character, broad and complex in scope, and difficult or impossible to reliably replicate. The second core theme of *Structural Human Ecology* concerns attention to risk and uncertainty—concepts which are inherently difficult to model or predict in systems of human–environmental exchange. The third and final core theme of the book is an expanding repository of macrocomparative research on human–environment impacts that has only truly become available in recent decades. Although Dietz and Jorgenson note that no overarching paradigm dominates or defines *Structural Human Ecology*, they cite Rosa for three points that are inescapable in the field: context matters, theory must be disciplined by data, and progress requires careful thought about concepts and premises. The rest of this chapter outlines the subsequent sections of the book, which are organized around the three core themes above: metatheory, risk analysis, and quantitative analysis of impact drivers. The closing section of the chapter focuses on fertile directions for future research.

The first section of the book contains essays by Thomas Dietz and Richard York on issues of metatheory. A common thread between these essays is Rosa's seminal paper "Metatheoretical Foundations for Post-Normal Risk" (Rosa, 1998). "Meta" (as both Dietz and York refer to the paper) concerns both the ontology and epistemology of risk analysis. The paper outlined what later became known as Rosa's HERO framework: [H]ierarchical [E]pistemology applied to a [R]ealist [O]ntology. The framework endorses approaching uncertain or unclear problems from the view that some objective reality does exist, but that we must approach such problems with full acknowledgment of the profound informational and social constraints to our understanding.

York discusses the nature of risk in areas of uncertainty and "post-normal" science (Funtowicz & Ravetz, 1992). He delineates between risks found in simple systems such as those of engineering, and those that are found in more complex social, ecological, and human–natural systems. The former he likens to the models of classical physics, wherein measurement error is a well-known and predictable presence. The latter, York argues, contains levels of both measurement and specification error that are difficult to account for. Such roadblocks may be attributed in large part to the singularity and magnitude of anthropogenic environmental impacts found in late modernity. As contemporary issues of global climate change, resource consumption, and pollution are precisely the subjects with which *Structural Human Ecology* concerns itself, researchers are compelled to use great care in defining the boundaries of their knowledge.

In the next chapter, Thomas Dietz elaborates on issues of ostensibility and repeatability and extends them from the scientific enterprise to questions of value. Dietz tells us that, in addition to values perpetually influencing science, environmental science must grapple with assessment of facts whose value to society is almost entirely uncertain. The phenomena studied by human ecologists may be singular in history (low repeatability), and values related to novel phenomena may be difficult to identify (low ostensibility). The involvement of the market further fractures the field between production (re: growth-oriented) science and impact science, which studies the consequences of the former. Dietz's chapter (channeling Rosa) highlights the growing conflict between these subfields and lays out steps to reconnect science with public discourse.

The second major section of the book focuses on risk as it relates to emergent technologies and the scope of human impacts on the natural environment. The section opens with a chapter by Renn et al. on climate engineering, the theory and practice of altering the environment to limit the scope and rapidity of climate change. As anthropogenic impacts increase in magnitude, the call for large-scale solutions intensifies. Renn et al. provide input on fostering integrated public–scientific dialogue on such solutions.

The next chapter contains a discussion by Roger Kaspersen on the intersection of emerging technology with three types of uncertainty: aleatory uncertainty, model-parameter uncertainty, and deep uncertainty. In each of these types, further data and research are progressively less likely to be helpful. Kaspersen advises strategies of adaptive management and resilience building for bridging the gap between uncertainty and decision-making. However, the author notes that these strategies are not quick fixes, and elaborates a series of dilemmas that impede their implementation.

The final chapter of this section, written by Paul Stern, discusses public perception of recent high-risk technologies such as nuclear power, radioactive waste management, and DNA manipulation. Summarizing a considerable body of research, he asserts that while scientific analysis focuses on the probability of certain outcomes, public discourse tends to center on the nature of potential consequences (rather than the likelihood of actually encountering them). From these conclusions, Stern lays out a set of design principles for managing new technologies.

The third section of the book explores the body of macrocomparative work on human–environment interactions, including the stresses and well-being of both parties. This body of work owes considerable thanks to Rosa's role in developing the STIRPAT model. The section opens with a chapter by Allan Mazur on the relationships between energy consumption and human quality of life. Although

energy availability does raise standard of living, the relationship decouples at higher levels of consumption. Mazur concludes with a discussion of what drives increasing levels of energy consumption.

Andrew Jorgenson authors the next chapter, wherein he applies the STIRPAT framework to both previous and new analyses on the relationships between population, affluence, and environmental stress. Jorgenson's work supports previous literature (e.g., Burns et al., 1997; Inglehart, 1995; Kidd & Lee, 1997) findings that population, urbanization, and affluence levels all predict environmental stress (in this case as greenhouse gas emissions). However, Jorgenson highlights both regional and over-time variability in these relationships.

The following chapter, written by Sandra Marquart-Pyatt, looks at the ways that structural human ecology may operate across multiple levels of social organization to address complex relationships. Both social levels (households, communities, nation states) and ecological levels (ecosystems, landscapes, biomes) add nuance to the human–environment relationship, and yet the available data seldom transcend these levels. Marquart-Pyatt utilizes an approach advocated by Rosa that involves using comparable data from diverse regions to help integrate macro- and micro-level effects. Keeping with the section's theme, Marquart-Pyatt links this approach with the STIRPAT model to produce a functional research paradigm.

The concluding chapter of *Structural Human Ecology* is also written by Dietz. He summarizes and reinforces the lessons that are Gene Rosa's legacy. He recites tenets about the importance of context, the need to approach knowledge production cautiously, and the dialectical nature of theory and data and the relationship of both to public discourse. Rosa's body of work exemplified a truly integrative approach to tackling complex problems. Equally important, he provided (and continues to provide) an exemplary model for aspiring human ecology scholars.

Structural Human Ecology does justice to both the life and work of Gene Rosa and to the titular discipline which serves as his legacy. It integrates a diverse body of scholarship that will provide a facile framework for tackling human–ecological problems we have only begun to properly frame and understand. Students and scholars of environmental sociology, of human ecology, and of the broader social sciences will wish to reference this text frequently as they seek to develop firm grasps of their respective fields.

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