

## HUMAN ECOLOGY

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### Summary

It is generally agreed that Ernst Haeckel first used the term ecology in 1866. It was then used by other biological scientists to designate a science that deals with the interrelationships between organisms and their surroundings. The ecological perspective originated in the natural sciences (botany and zoology) during the late nineteenth century in order to study plants and animals by reference to what Darwin called “the web of life.” Early in the twentieth century social scientists applied ecological principles to study human behavior and community organization. The term human ecology was first used in 1921 by sociologists at the Chicago School of Sociology. From that date the main branches of ecology—animal, plant, fungi, bacteria, and human—developed and continue to be studied more or less independently of each other. This article shows that definitions and interpretations of human ecology have varied considerably, not only between the natural and social sciences, but also among academic disciplines in the social sciences including anthropology, geography, psychology, and sociology. There are other sets of interpretations that stem from worldviews of people–environment relations including the origins of the universe, the status of human beings on Earth, and ethical, moral, and political perspectives. Despite the divergence of definitions and interpretations of human ecology there have been efforts in recent decades to develop a synthetic human ecology that is explicitly integrated with general ecology. In general, these efforts have not been wholly successful because an additive approach based on disciplinary concepts and methods has usually been applied. This contribution does not advocate a monolithic model of people–environment relations. Instead it highlights the

theoretical differences between disciplinary approaches as well as their similarities and incompatibilities. It presents a conceptual framework that potentially overcomes obstacles for interdisciplinary collaboration. It recommends a pluridisciplinary method based on complex adaptive systems analysis combining objective and subjective approaches in which individual actors and social groups and institutions are attributed a crucial role.

### 1. Introduction

People–environment relations have been common to the history of art, literature, philosophy, religion, and science. Throughout human civilizations, individuals, groups, and societies have been preoccupied about the historical and ongoing relationship between the macrocosm—the cosmos, Earth—and the microcosm—the habitat and its immediate surroundings. This omnipresent concern about the relations between anthropos and cosmos illustrates that people–environment relations can be considered in terms of religious beliefs, cultural worldviews, and scientific theories and concepts in a range of disciplines and professions.

This contribution is not meant to provide an historical overview of people–environment relations. Instead it is appropriate to recall that people–environment relations are fundamental philosophical subjects. These relations involve assumptions, beliefs, ideals, and values that should not be taken for granted because they are used implicitly or explicitly by authors to formulate economic, political, religious, and scientific interpretations.

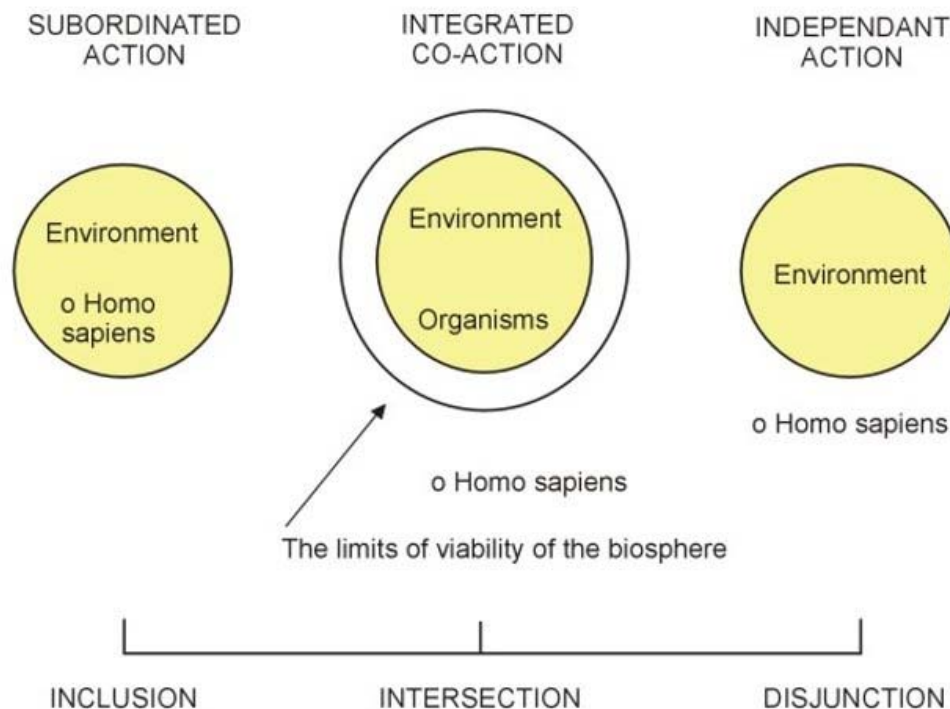


Figure 1: Three worldviews that interpret people–environment relations in terms of the status of *Homo sapiens*

At the outset, it is useful to consider the diverse, sometimes contradictory interpretations of people–environment relations in terms of two common worldviews shown in Figure 1. Inclusive interpretations, shown on the left hand side, represent those contributions of authors who use a homology between cosmos and anthropos which has been recorded in the Bible. For example, during the nineteenth century Alexander von Humboldt, a Prussian geographer, presented this interpretation in his book titled *Cosmos*. Similarly Emerson and Thoreau applied it in their contributions. This interpretation forms the conceptual foundation of the current “deep ecology” movement in North America and the political ecology of green parties in several countries. These interpretations share the worldview that the human species is indistinguishable from other biological species. All are subordinated to the conditions, laws, and processes of the Earth and the biosphere. Therefore it is plausible to use biological analogies to interpret human individuals, groups, and communities without considering the role of culture or human perception and cognition in the organization of habitats and the sustenance of human societies.

The disjunctive interpretation shown on the right hand side of Figure 1 is also recorded in biblical accounts of the Creation. It is part of the conceptual foundations and the development of biology, chemistry, and physics since the seventeenth century including the contributions of Newton and Darwin. This interpretation maintains that human beings have a unique and superior position in relation to all other organisms owing to the capacity of human culture to monitor, control, exploit, and modify constituents of the Earth. From this perspective human beings are external to and detached from the natural environment and they can act independently of it.

Each of these two contrasting interpretations of people–environment relations is an anomaly and a critique of the other. This article suggests that neither of these interpretations is satisfactory if human ecology is to apply a holistic conceptual framework. For example, those authors who adopt the disjunctive interpretation consider nature and culture at opposite poles of this axis, and they refuse to integrate human society in the biosphere. This viewpoint therefore ignores the fact that those human activities that have negative impacts on constituents of the environment can have negative consequences for human societies. In contrast, the independent action or creative behavior of an individual or a group should be inscribed within the limits of the biosphere and the specific conditions of human ecosystems.

A third interpretation is shown in the middle of Figure 1. This interpretation is founded on principles of integrated co-action. Hence, there is continual interchange between ecological, biological, and cultural components of human ecosystems. This means that one set of components will not change independently of the others. In principle, humans are totally dependent on the underlying set of biological systems and processes that operate in their own bodies, in human ecosystems and in the biosphere. This dependency is crucial to the extent that all products of culture—including the economy, institutions, and technology—are not viable unless the human society that produced them satisfies the biologically determined principles of the Earth and human life.

People–environment relations are multidimensional. The world is complex, and it should be recognized that it is not possible to observe, monitor, and explain all its components. The world is also continually changing because ecological, economic, and

other social systems are not static nor delimited by impermeable boundaries. Even in the absence of human activities, some changes to ecosystems are abrupt and unpredictable, leading to significant modifications over the long term. One can argue that the investigation of such a complex subject cannot be based on a unified theory because sets of complementary views are unavoidable.

No single discipline or perspective can understand and explain people–environment relations in a comprehensive way. Nonetheless, each disciplinary approach contributes within its specific and compartmentalized area of knowledge to this vast topic. Collaboration and coordination of contributions is necessary in order to overcome disciplinary confinement. However, the study of people–environment relations in general, and human ecology in particular, still remains divided between the social and physical sciences as well as between the theoretical and applied approaches in each of these sciences. Today the main obstacle that hinders an integrated framework is the compartmentalized disciplinary focus of scientists and professionals who do not share definitions and interpretations but adopt exclusive stances. Therefore, there is a need to replace the addition of multiple disciplinary contributions by transdisciplinary concepts and methods. A conceptual framework for the application of this method is included in this contribution.

## 2. Definitions and Interpretations

The term “ecology” derives from the ancient Greek words *oikos* and *logos* and means “science of the habitat.” It is generally agreed that this term was used first by Ernst Haeckel (1834–1919), a German zoologist, in 1866. The word ecology designates a science that deals with the interrelationships between organisms and their surroundings. Since the late nineteenth century the term “ecology” has been interpreted in numerous ways. For example, in the natural sciences, botanists and zoologists use the term “general ecology” to refer to the interrelations between animals, plants, and their immediate surroundings. The number of contributions about the science of ecology grew from the beginning of the twentieth century following some seminal publications including those by Eugene Warming (*Oecology of Plants: An Introduction to the Study of Plant Communities*, in 1909) and C. C. Adams (*Guide to the Study of Animal Ecology*, in 1913).

A distinction is often made in the biological sciences between “autecology” and “synecology”: Whereas autecology studies the interrelations between organisms of one species and its environment, synecology analyzes the interrelations between communities of biological species—animals, plants, fungi, and bacteria—in terms of their interrelations with one another and with the biotic and abiotic constituents of their environment. During the twentieth century synecology became the dominant mode of scientific study because empirical research showed that animal and plant organisms, bacteria, and fungi establish viable relationships with their environment through collective mechanisms that stem from a system of relations and networks rather than independent action.

Plant and animal ecologists maintain that the interaction between organisms and all the components of ecosystems follow principles that refer to their similarities and their

differences. A community develops from simple to more complex forms through a sequence of developmental stages known as succession. This term refers to the slow progression of changes in communities of animals and plants owing to changes in ecological and climatic conditions. The evolutionary trend is such that some species with a longer life span become dominant in a particular biotope for a certain time period which may correspond to a climax state. Climax is a dynamic equilibrium state that is determined by the limiting factors of the climate, soil, or other ecological conditions. It refers to the culmination of the evolution of animal and plant communities that corresponds to the optimal development of the biomass with respect to specific ecological conditions. By using an analogy, some contributions to people–environment studies imply that human groups and communities are natural phenomena that develop by slow progression and succession processes. This interpretation means that psychological and social characteristics of human individuals and societies are equated with biological factors, that competition between human beings is an innate biological process, and that climax is the outcome.

In contrast to general ecology, “human ecology” usually refers to the study of the dynamic interrelationships between human populations and the physical, biotic, cultural, and social characteristics of their environment and the biosphere. However, this is not the original meaning of this term, which was first used in 1921 by Robert Park and Ernest Burgess in their contribution titled *An Introduction to the Science of Sociology*. They defined human ecology as the study of the spatial and temporal organization and relations of human beings with respect to the “selective, distributive and accommodative forces of the environment.” This publication became a landmark for many other contributions that studied the spatial distribution of human populations, especially in urban areas. In addition, the application of concepts borrowed from plant and animal ecology for the study of human communities implied that human ecology was interpreted as the study of those biotic factors that influence the social organization and spatial distribution of human groups and communities. The majority of these contributions interpreted urban “space” as a surrogate for “environment.”

During the last three decades ecology has been a word *à la mode* because it has also acquired a stronger political connotation. Nonetheless this approach can be traced back at least to the mid-nineteenth century when authors such as George Perkins Marsh in North America drew attention to what they considered to be the anthropogenic causes of environmental problems. A similar approach has been increasingly used by authors from the 1960s, including Rachel Carson in *Silent Spring*, first published in 1962.

The Club of Rome, a nongovernmental organization founded in 1968, is an international “think tank” that considers the interrelations between modern industrial societies and the global environment. This group maintains that unqualified increases in gross national product (GNP) can have irreversible negative impacts on the biosphere that would ultimately lead to a global ecological crisis. Concurrently activists in other organizations and government officials in many countries, especially in Europe, have advocated a political ecology—“the green movement”—in response to publications about many kinds of environmental issues including wildlife conservation, energy consumption, and pollution by “Man the perturbator.” The authors of this interpretation use the term ecology as a synonym for “natural environment.” The growing public

perception of the seriousness of environmental problems since the 1960s has led others to use ecological knowledge for the preservation of natural resources, ecosystems, and the biosphere. In 1972, the first United Nations Conference on the Human Environment, held in Stockholm, explicitly promoted environmental protection as both a local and a global concern. This approach was challenged by those who claimed that environmental protection would restrict economic growth.

Political ecology has a strong legal and technocratic focus because environmental problems are considered pragmatically. These kinds of problems are meant to be overcome by legislation, technological efficiency, and economic measures to change the impacts of human production and consumption patterns on uses of resources and the discharge of wastes. This instrumental perspective has been complemented by an ethical one that has addressed property rights (including the rights of Nature). Property rights are social arrangements between people that define the rights, entitlements, obligations, and duties of persons, companies, or an authority (the right holder) in relation to a specific entity (e.g. a constituent of the environment such as a forest or a lake). Property rights stipulate how the right holder and other parties (non-property holders) are morally and legally required to act. They create interdependence between people and resources as well as issues of distribution and fairness. In Western countries, private claims, rights, and responsibilities regarding environmental resources often fail to meet the collective or public need for environmental protection and intergenerational equity. Consequently, state regulation is deemed necessary in many of these countries. In contrast, in former socialist countries in eastern Europe, it is sometimes recognized that state ownership of land and resources has been detrimental to these constituents of the environment. It is often argued that private property rights will assist in solving environmental problems in these countries.

Some scientists have argued that the biological and economic productivity of the world can be increased by a better understanding of ecological systems, their structure, functions, and processes. In this respect, ecological knowledge is considered to be a tool for economic development. Economists suggest that the ecological dimensions of human ecosystems comprise all “natural capital” which can be considered as stocks of renewable and nonrenewable resources. In contrast, the economic dimensions of human ecosystems include all human-made artifacts (“human capital”). This distinction between environmental and economic constituents is not straightforward. For example, all kinds of cultivated land for food production include a mixture of natural and human-made components.

Another ecological interpretation examines constraints to a viable life on Earth by applying the first and second laws of thermodynamics to the ecosystem concept. Most ecosystems are sustained as long as solar energy is supplied directly, but some (such as caves) depend on imported energy from other ecosystems. The flow of materials, the transformation of energy, and the organization of food chains and cycles are crucial to the functioning of both organisms and ecosystems as well as to how they are sustained in relation to variability and change in the environment. Both natural scientists and economists have contributed to the development of theoretical frameworks and their applications. For example input–output models have been used to measure and monitor

flows of energy, water, nutrients, and wastes either in terms of actual quantities or equivalent monetary values.

Human habitats define ecological and economic limits that circumscribe the livelihood of resident populations. In principle, the relationship between resources and human societies is mediated by information, knowledge, and values (including religious doctrine and myths). Other components that interact with the economy include human goals and ideals, technology, information and knowledge, as well as administrative, legal and political dimensions. The way that societies and groups develop and use technologies to fulfill their needs and sustain themselves is also a means for constituting and reaffirming societal goals, group and national identities, social norms, and cultural values. From this perspective, it is possible to explain why the nourishment required by an Eskimo differs significantly from that of an Australian aborigine, while that of a Tibetan farmer differs from that of a Berber of North Africa. In principle, although the vital need for nourishment is common to all human beings, the amount of energy required for survival is relative and variable between and within human societies. In principle, nutrition is mediated by a range of biological, climatic, cultural, and physiological mechanisms and rules that vary between races, across cultures, and within societies, as well as over the course of time.

Human economies explicitly involve environmental issues including thermodynamic evolution away from equilibrium. The global system and local ecosystems define ecological limits on the resident populations. Whether and how these limits are interpreted in relation to energy supply and transformations, food production and water consumption, the generation of wastes and recycling, or uses of renewable and nonrenewable resources is related to the culture of these populations. In principle, the relationship between available means and human societies is mediated by information, knowledge, and values that are used implicitly or explicitly to invent and use resources, create tools, harness energy, and develop skills. Whatever theoretical perspective is used to explore human economies, one must acknowledge that decisions are made based on choices, customs, conflicts, negotiations, and compromises. Despite the advance of scientific knowledge and new technologies, uncertainties remain and risks are omnipresent.

## **2.1 What is Human Ecology?**

Human ecology is a term that has been and still is characterized by a lack of consensus about what it means. In 1974, Bruhn presented a useful overview of the development of human ecology studies in disciplines including anthropology, geography, psychology, and sociology. He also attempted to identify whether the contributions in each of these disciplines can be the basis of an interdisciplinary approach for people–environment studies. However, he was not optimistic. He argued that social scientists in these disciplines have frequently used a biological analogy by treating human habitats as metabolisms. This analogy means that these habitats are studied in terms of their abiotic and biological components as well as flows of energy and materials. Unfortunately, anthropological dimensions including human customs, knowledge, and values, as well as communication and information, are not considered. Consequently, most of these

contributions do not provide a framework that integrate principles from both the social and natural sciences.

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### **Biographical Sketch**

**Roderick J. Lawrence** works at the Centre for Human Ecology and Environmental Sciences at the University of Geneva, Switzerland. He graduated from the University of Adelaide (Australia) with First Class Honors. He has a Masters from the University of Cambridge (England) and a Doctorate of Science from the Ecole Polytechnique Fédérale, Lausanne (Switzerland). Since 1984 he has been a consultant to the Committee for Housing, Building and Planning of the Economic Commission for Europe (Geneva), and the Urban Affairs Division of the OECD (Paris). In 1985 he was a visiting research fellow at the School of Social Sciences at the Flinders University of South Australia. In 1994 he was nominated by the World Health Organization to the Scientific Advisory Board of the European Centre for Environment and Health. In January 1997 he was nominated to the New York Academy of Science. In 1999 he was appointed chair of the Evaluation Advisory Committee of the WHO Healthy Cities Project in the WHO-EURO Region. In 1999 he was promoted to the rank of professor in the Faculty of Social and Economic Sciences. He has been the coordinator of a teaching module on Urban Development and Management in the Masters program of the European Association for Environmental Management Education (EAEME). He has also coordinated a module in the postgraduate Masters course on Town and Country Planning and Regional Development at the University of Geneva. His most recent book is *Sustaining Human Settlements: A Challenge for the New Millennium* (Newcastle, UK: Urban International Press, 2000).