Human Ecology

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of large urban places where none had existed before the era of rapid and prolonged industrial expansion. In order to meet the needs of agriculture and industry in northern China, there are plans to divert water from the Yangtze River to the Huang Ho through two major man-made canals. Water pollution is widespread within the lower course of the river as industrialization continues its virtually ceaseless expansion while demands for increased agricultural output also expands to keep pace with the growing Chinese population.

Air pollution in the industrial sector, associated with the burning of coal, contributes significantly to the environmental woes of China. The country ranks second only to the United States in the amount of carbon dioxide emitted to the atmosphere. With the Kyoto Protocol not requiring China to reduce emissions, China has been able to expand its industrial base almost at will. As the country's goal, is to develop its economic structure as quickly as possible before the ultimate reductions in working-age individuals necessary begins to fall, the Huang Ho and other areas of the environment will continue to be degraded.

SEE ALSO: Carbon Dioxide; China; Drought; Pollution, Air.

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Human Ecology

HUMAN ECOLOGY IS the study of the mutual interconnections between people and their environments at multiple scales and multiple time frames. The subject is informed by ecological and evolutionary theory in biology and by the concepts of landscape and spatial relationships in geography; but recognizes that humans have gradually achieved partial ecological and geographical dominance through their culturally given but continually changing technology and social, economic, and political arrangements. Human ecology subsumes such specialized approaches to these relationships as cultural ecology, political ecology, geography, ecological anthropology, environmental sociology, environmental economics, environmental psychology, and environmental history.

DRAWING ON HISTORY

Although the neologism "ecology" dates from the second half of the 19th century and the term *human ecology* first appeared around 1908, interest in human environment relationships goes back much farther. For example, the ancient Greeks were concerned with the impact of the environment on human health (*On Airs, Waters, and Places* was written by an anonymous author in the Hippocratic tradition). Plato speculated on the role of humans in reducing the forest cover of Greece. Such cartographers and geographers as Ptolemy and Strabo recognized spatial differentiation. Similar traditions existed in other ancient societies such as China.

Saint Francis's teachings suggested that humans could not consider themselves completely separate from and superior to nature. Chinese philosophy, poetry, and art, building on a base of shamanism, Buddhism, and Taoism, also stressed the relationship between human consciousness, society, and nature. These traditions include little in the way of systematic observation, however, or experimental testing of relationships. One important exception has been the development of agronomy, range science, and forestry based on long-term observations on soil fertility and pest management on the local scale. In societies with a written tradition, this has often resulted in a sophisticated literature; but even in societies with an oral tradition, the resulting "ethnoscience" has often been remarkably insightful. Another important exception has been the almost universal tradition of mapping surroundings using a variety of cartographic methods.

Beginning in the 15th century, European expeditions of discovery and conquest led to some of the

first field-based systematic and comparative observations of human–environment relationships at a larger scale. Observers such as Cieza de León (who accompanied the conquerors of the Inca Empire) produced detailed geographic accounts of landscapes, land use, and resource management that are still used by human ecologists documenting environmental history. Colonial authorities produced detailed reports of local resource use (such as the *relaciones geográficas* in the Spanish empire), as well as maps at a variety of scales. European advances in census taking, in both Europe and its colonies, helped John Graunt and Edmond Halley develop some of the basic analytical methods of demography by the 18th century. At the end of the 18th century, Thomas Malthus pointed out the importance of the population resource ratio and warned of the persistent danger of societies overgrowing their resource base.

BIRTH OF THEORIES

Alexander von Humboldt represents the culmination and transformation of the tradition of colonial observers of resource management. His diaries and books based on his travels through the Americas at the end of the colonial period details climate, plants, animals, population, resource management methods, and even archaeology, utilizing the most advanced instruments and collection methods of his time. Moreover, he correlated his results using maps and diagrams, generalizing about both the environmental and political conditions of resource management. He also pointed out in detail the many impacts of colonial policy on resource use. He argued for an expansion of economic freedom, recognizing the importance of state intervention, and argued for a more local level of colonial administration.

Later, 19th century travelers and scientists such as Darwin, Wallace, Bates, and da Cunha further developed ideas essential for the later development of human ecology. Darwin was inspired by Humboldt to perform detailed fieldwork in South America, and was influenced by Malthus in his development of the theory of natural selection in diverse environments to explain the diversity of species. The application of Darwin's ideas to human affairs was at first crude, but by the beginning of the 20th century was an important influence on scientific human ecology. In human ecology, the concept of adaptation did not refer to the survival and reproduction of genetically heritable traits, but rather the continual process of choosing among and refining strategies of making a living (reproducing a way of life) in a changing world. In human affairs, behavior is typically adjusted through the intervention of economic and political incentives long before stark survival is at stake.

Karl Marx asserted that the social arrangements for the harnessing of natural resources (mode of production) have a decisive impact on the rest of society. Although he gave little attention to the role of nature in conditioning human responses, some of his disciples did. Wittfogel, for example, argued that the need for irrigation in dry environments led to "oriental despotisms" in contrast to the more feudal and eventually democratic arrangements in rainier climes.

"Environmental determinism" reached its pinnacle with the works of Ellsworth Huntington at Yale. In contrast, although Ellen Churchill Semple is often considered an environmental determinist, her works on Kentucky mountain folk and on the Mediterranean are nuanced studies of environmental conditions of human life. Her book *Geography of the Mediterranean Region* still provides an excellent background for the environmental study of the area.

The French geographer Vidal de la Blache (1845–1918) is usually credited with the idea of "possibilism," that the environment presents challenges and opportunities, and possibilities for human use, but that it does not per se determine human behavior. His work emphasized the study of regional landscapes (*pays*) in terms of ways of life (*genres de vie*) developed over time; he recognized the importance of long distance as well as local processes in this development. One of his students, Lucien Febvre, went on to write *A Geographical Introduction to History* and to cofound the *Annales* school, which was to focus on the long-term interaction of environmental, demographic, economic, and other factors on the history of places. The most famous member of this school, Fernand Braudel, was influenced not only by Febvre and de la Blache, but also by Semple, in writing his detailed study of the Mediterranean world in the 16th century. More recently,

this tradition has included such figures as Immanuel Wallerstein, who has authored influential works developing "world systems theory." Although the sophistication of analysis of environmental factors has tended to weaken over time in this tradition, it still constitutes an important resource for the analysis of human ecology at regional and global scales.

Perhaps de la Blache's closest counterpart in the United States was Carl Ortwin Sauer, who (like Semple) began by studying American mountain folk. He came to focus on Latin America, where he pioneered the study of indigenous resource management and cultural landscapes. He early pointed out the destructive implications of short-term commercial agriculture. The first explicit mention of human ecology goes back to the very beginnings of the discipline of geography in the United States. In 1907 J. Paul Goode, one of the founding members of the Department of Geography at the University of Chicago, announced a course in "plant, animal, and human ecology." Goode defined human ecology as a new hybrid field for "the study of the geographic conditions of human culture" and argued for a partnership between sociologists and geographers to accomplish this goal.

Human ecology studies the mutual interconnections between people and their environments.

The theme remained important at the Chicago geography department, which not only trained Carl Sauer but also Gilbert F. White, whose 1942 doctoral dissertation, *Human Adjustment to Floods* (published in 1945), was highly influential. White argued for the importance of comprehensive adaptation to hazards rather than the deployment of narrowly defined engineering solutions. Through a long career in government and academia he influenced the development of Hazards research as an interdisciplinary subject essential for human ecology.

Parallel themes were developed around the world. For example, in Germany, Carl Troll focused his research on the detailed interaction of climate, soils, and plants at high altitudes, coining the term *landscape ecology* in 1939. He strongly influenced Karl Butzer, who built on Troll's focus on physical environment by adding the long-term analysis of demography, agricultural practices, and environmental impacts in places as diverse as ancient Egypt and colonial Mexico. Out of this work came his book *Archaeology as Human Ecology* (1982).

Sociology students at Chicago were required to take biology, geology, and geography as part of their training. By 1921, Chicago sociologists Robert E. Park and Ernest W. Burgess were arguing for the deployment of ideas from biological ecology as models for similar studies in human ecology. These scholars focused on the importance of fieldwork; some of their most enduring research results concerned the concentric geographical zonation of activities in cities.

The work of Park and his colleagues marked a high point of human ecology in the discipline of sociology; in the 1940s and 1950s sociologists tended to return to a focus on purely social explanations for social facts. In the late 1970s, sociologists William R. Catton and Riley E. Dunlap announced the revival of a "new human ecology" or environmental sociology that would be an improvement on the approach of Park, and discussions of the subject

continue in that discipline. However, by the 1950s, anthropologists had taken the lead in developing human ecology and by the mid-1970s had established the key journal in the field.

GROWING IN COMPLEXITY

Anthropologist C. Daryll Forde had found it useful to relate cultures to their habitats, and in the United States, Leslie A. White was an early proponent of the application of evolutionary ideas to the evolution of culture, centered on the technological harnessing of energy (influenced by the Marxist notion of mode of production as well as Darwin). In the 1940s, American anthropologist Julian Steward (who also was trained in biology) was faced with the task of organizing a vast amount of data in editing the Smithsonian Institution's multivolume *Handbook of South American Indians*. During this experience (and previous research with North American peoples), he became convinced that the environment played an important role in the development of societies in particular places. His writings helped create the subfield of Cultural Ecology, which he defined as "the study of the processes by which a society adapts to its environment." He called particular attention to the cultural "core," those practices most directly related to making a living in a particular place (implicitly influenced by Marx's concept of mode of production). He also argued for the importance of "multilinear evolution." By the 1960s, Cultural Ecology was a flourishing paradigm in American anthropology and archaeology.

By the 1970s, the development of human ecology had become quite complex with multiple strands. Some (especially archaeologists, anthropologists, and geographers) pursued the paradigm of cultural ecology with detailed studies of particular cultures and civilizations in environmental context. The influence of Malthus in these studies was tempered by the influential book by the Danish economic historian Ester Boserup, *The Conditions of Agricultural Growth* (1965), which persuasively argued for the ability of farmers to produce more food with increased labor inputs. Chicago-trained anthropologist John W. Bennett's *Northern Plainsmen: Adaptive Strategy and Agrarian Life* (1971) showed how different groups used the same Great Plains environment in different ways. In subsequent publications, Bennett continued to urge the study of human–environment relations in terms of process and behavior, with full attention to questions of identity and long-term change.

Other studies focused on the emergence of the human species, the origins of domestication and agriculture, the rise of cities, and on the conditions and implications of such resource management strategies as mountain agriculture, irrigation, paddy rice, and raised fields. Authors such as Robert Netting also developed broader comparative themes such as the persistence of smallholder agriculture under a variety of larger political regimes. Scholars such as Harold Brookfield (Australia) encouraged the study of the conditions of development in the global south. Many of these studies were based on a methodology combining long-term field research, ethnography, and archival research, in a context of "progressive contextualization."

After World War II, biologists such as Aldo Leopold (*Sand County Almanac*, 1949) and Rachel Carson (*Silent Spring*, 1962) had written popular books arguing for the human stewardship of nature and warning about the destruction of habitat and introduction of untested chemicals into the environment. The greatest impact on human ecology, however, came from biologists Garrett Hardin and Paul R. Ehrlich. Hardin published in his influential article on the "Tragedy of the Commons" in *Science* in 1968, while Ehrlich published *The Population Bomb* in 1968. Both works relied on Malthusian assumptions as to the unlimited propensity to breed, and the limited ability to improve food production with increased labor inputs. Hardin also assumed that human societies historically have lacked the ability to manage common lands. Their works provided a strong stimulus to research, and all three underlying assumptions have been disproved.

Researchers following the lead of Boserup have demonstrated the ability to improve crop yields through labor and capital inputs. Demographer Frank W. Notestein suggested in 1945 that societies normally reduce birth rates as the cost/benefit ratio of having children goes up, resulting in the "demographic transition," even in the absence of modern birth control methods or proscriptive government policy. Many subsequent studies have

confirmed Notestein's ideas, and research in traditional and ancient societies has shown that human fertility has seldom been uncontrolled. Finally, research has demonstrated that common lands have been effectively managed by traditional societies and that uncontrolled resource management has been rare in human history.

ECOSYSTEM CONCEPT

Of the many ideas coming from the biological sciences, the "ecosystem" concept has been especially controversial in human ecology. The majority opinion has been that it is useful to think in terms of multiple possible interconnections. The dynamic, adaptive nature of human behavior, however, coupled with the importance of policy and politics in human life and the constantly changing context of adaptation have meant that true stable homeostatic systems have seldom, if ever, emerged in human history.

Anthropologist Roy A. Rappaport in his 1968 study *Pigs for the Ancestors; Ritual in the Ecology of a New Guinea People*, argued that New Guinea society over the centuries had evolved to the point that even ritual was primarily oriented toward the regulation of relations with the environment. Anthropologist Marvin Harris popularized this and similar ideas (with strong Marxist underpinnings) in his popular books *Cows, Pigs, Wars & Witches: The Riddles of Culture* (1974), *Cannibals and Kings: The Origins of Cultures* (1978) and *Cultural Materialism: The Struggle for a Science of Culture* (1979). Most anthropologists and geographers have, however, rejected the notion that the environment has had quite the determinative power that Rappaport and Harris postulated. The notion that the environment provides a key to human history remains seductive, however, as demonstrated by the popularity of the UCLA geographer Jared Diamond's books *Guns, Germs, and Steel: The Fates of Human Societies* (1997), and *Collapse: How Societies Choose to Fail or Succeed* (2005).

POLITICAL ECOLOGY

One of the most powerful recent stimuli for the study of human ecology has been from those calling themselves "political ecologists." Influenced by such works as (Chicago-trained) Susanna Hecht and Alexander Cockburn's *Fate of the Forest* (a study of the long term influence of politics and policy on the Brazilian Amazon), and Michael Watts's *Silent Violence: Food, Famine, & Peasantry in Northern Nigeria*, political ecologists study the impact of colonial, liberal and neoliberal states and multinational corporations on resource management and environmental problems. These scholars have continued the critique of neo-Malthusianism, and have also often urged their own form of activist human ecology built around local identity politics.

There has been a great temptation to reduce human ecology to a subset of a single discipline. The term, however, still has utility in designating the social/cultural/political/environmental/geographical interface. Over time, it has become clear that fieldwork and mapping are important tools for understanding relationships at this interface. It has also become clear that since human ecology involves the interaction of otherwise unrelated systems, it has some surprising elements that do not lend themselves readily to modeling or systems approaches. Recent research suggests that human environmental problems can best be addressed by long term, place-specific research that combines multiple methodologies in a process of progressive contextualization. Furthermore, local people are the key to both understanding and solving environmental problems.

SEE ALSO: Cultural Ecology; Ecology; Historial Materialism; Marx, Karl; Political Ecology.

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