Cultural Ecology

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Cultural ecology has represented an explicit research perspective within geography since the 1960s. A Specialty Group by that name was organized within the Association of American Geographers in 1980, and its membership has trebled during the last five years, to 196 in March 1988. Cultural ecology was first categorized as a Topical Proficiency in 1987, but only 129 American geographers identify themselves under this heading. Perhaps it is still perceived more as a research perspective than as a separate subfield.

Relatively few geographers have a clear appreciation of what cultural ecologists aspire to do, and so the purpose of this chapter is explanatory and constructive, rather than critical. It represents a personal interpretation of the spirit and the logical structures of cultural ecology, as practiced by geographers in North America.[1] Academic research can rarely be organized in simple subcategories, and cultural ecology is patently in a state of ferment and rapid growth. This chapter therefore attempts to represent both the unifying themes as well as the diversity of what cultural ecologists do. A complementary view of the subfield is given by Turner (1989).

UNIFYING THREADS AND THEMES

Cultural ecology draws upon interdisciplinary roots within geography and anthropology in seeking to understand the interrelationships between people, resources, and space. It focuses upon how people live, doing what, how well, for how long, and with what environmental and social constraints. It emphasizes that human behavior has a cognitive dimension and is dependent on information flow, values, and goals. Finally, cultural ecologists recognize that actions are conceived and taken by individuals, but that such actions must be examined and approved by the community, in the light of

[1]Initially, specific responses to a set of questions were solicited from a committee consisting of W. M. Denevan, L. Grossman, P. W. Porter, B. L. Turner, and M. Watts. Their replies provided insights derived from different experiences. Successive drafts also profited with suggestions from my Texas colleagues, W. E. Doolittle, G. Knapp, and K. E. Foote.

tradition and the prevailing patterns of institutions and power, before decisions can be implemented.

These general statements are best followed by more-specific comments on how cultural ecologists formulate their problems, proceed in their analysis, and present their conclusions:

1. Society and nature are seen as intimately interconnected, bound by complex, systemic interrelationships. Within that unified framework, particular attention is given to how people manage resources via a range of strategies in regard to diet, technology, reproduction, settlement, and system maintenance. The variability of the biophysical environment in space and time is an integral component of all such discussions, as is the role of environmental constraints.
2. Cultural behavior is explicitly considered in its functional role, and with respect to material culture as well as the tangible reflections of nonmaterial culture. This is normally achieved by in-depth field studies to gain a comprehensive understanding of how energy-flows and information-flows operate, how alternative options are developed and selected, and how process and form are interrelated. Empirical detail is crucial to such research, as is the connectivity between data and conclusions.
3. Food production is a fundamental theme, especially in regard to demographic variables and sustainability. Most studies in cultural ecology are in fact directed toward rural and agricultural societies—with a Third World bias—and they generally exhibit a specific interest in understanding change.

As a corollary, it follows that cultural ecologists are concerned with the role of people and the manipulation of resources within ecosystems, rather than the delineation or simulation of such systems as a whole. Normative inferences are drawn from intensive, empirical studies. Culture is not treated as a superorganic "black box," but is increasingly presented as a processual context, amenable to analysis. Finally, cultural ecologists are interested in behavioral diversity, alternative outcomes, and feedback loops—far more than they are in causation or prediction.

CULTURAL ECOLOGY AS A NEW PARADIGM

Distant roots for cultural ecology can be sought in German efforts to integrate physical and human research in geography (Butzer 1989a), as well as in Marsh's articulation (1864) of human influences on the environment. However, these are indirect roots, not unique to cultural ecology. Two more proximal traditions are of greater interest, namely Chicago and Berkeley, representing "Midwestern" and "Western" geography (Porter 1978), and espousing different, if mainly implicit, notions of ecology.

The concept of human ecology was formulated at Chicago by J. P. Goode about 1907 (Martin 1987) and brought to wider attention by Barrows (1923). The latter presidential address proposed to shift geography from analytical to applied research, focused upon human economic adjustment to environment. Barrows' influence was directly reflected in the research of White and his students[2] on perception of, adjust-

[2]W. D. Pattison (Chicago) kindly clarified the linkages between Goode, Barrows, and White, including the evolution of the Chicago geography program during the 1920s and 1930s.

ment to, and management procedures for environmental hazards (Burton, Kates, and White 1978).

Initially representing an acultural, technocratic approach, this "hazards tradition" had little philosophical impact on the emergence of *cultural* ecology, although several concepts, such as hazard perception, proved to have considerable utility. Barrows's human ecology also contributed indirectly to the evolution of 1960s-style human geography, with its socioeconomic and Western, materialistic orientation. Somewhat ironical, and probably not unrelated, was the parallel development of another Chicago school of human ecology, directed towards urban sociology.[3] It emphasized collective life as an adaptive process, reflecting the interactions of environment, population, and organization (Hawley 1986), with a thrust that is distinctly Western and applied.

The backgrounds of these two Chicago schools explain why the "ecology" of North American human geography tends to deemphasize cultural in favor of sociological processes or behavioral psychology, generally examined in contemporary, industrialized societies. From the geographer's perspective, cultural ecology and human ecology are therefore quite different, although Clarkson (1970), Butzer (1982), and Kates (1987) suggest that the two approaches can be usefully reconciled.

The impact of Sauer's Berkeley school on cultural ecology is more obvious, but by no means unproblematical. Sauer did not explicitly espouse ecology, and some recent interpretations of his work conclude that he was a humanist at heart (see Leighly 1987). But in the context of German geographers such as Hahn, Ratzel, Meitzen, and Gradmann, Sauer (1) saw cultural landscapes as historically informative in their own right, as the product of successive cultural transformations of an original "natural" landscape; (2) recognized the dynamic role of technology and human institutions; (3) communicated with anthropologists, whose sophistication in matters of culture he appreciated; and (4) had a predilection for nonurban and non-Western societies (Sauer 1925, 1927, 1941). It is therefore not surprising that his Berkeley students, and their students in turn, were well equipped and predisposed to participate in the crystallization of cultural ecology as a viable approach in geography since the mid-1960s.

But cultural ecology was not a predictable outgrowth of the Berkeley school, with its indifference to theory and analytical specialization. Only a very few of its graduates have made the decisive shift from a preeminent concern with human impacts, landscape history, or cultural morphology to a direct study of how cultural processes affect adaptive strategies. Equally pertinent is that a majority of cultural ecologists based in North America are not linked to the Berkeley school, even though most of them share a deep appreciation for Sauer. Finally, Denevan, who directly or indirectly supervised the training of most Berkeley-influenced cultural ecologists, acknowledges the strong influence of Brookfield and the Australian school on himself and his students (Denevan, pers. com.).

Two consistent background traits of cultural ecologists in North America can be singled out: (1) considerable training in the Earth sciences or biological ecology, and (2) extensive coursework or long-term association with anthropologists. Brookfield and other early members of the Australian school shared a long interdisciplin-

[3]The pioneers of this group—R. E. Park, E. W. Burgess, and R. D. McKenzie—formulated their ideas in the same years as Barrows. Although both the Chicago sociologists and Barrows took pains to disassociate themselves from one another (W. D. Pattison, pers. com.), one must suspect some degree of initial contact.

ary association with American anthropologists such as Brown, Rappaport and Vayda in a New Guinea field project. The influence of Brookfield and his students on Denevan, Nietschmann, Turner, Waddell, Watts, and others was enhanced by faculty appointments at, or degrees from, North American universities. As for other North American cultural ecologists, Porter collaborated extensively with anthropologists in East Africa, while Butzer, Carr, and Kirkby were intimately associated with archaeological projects. Butzer additionally held an anthropology appointment at Chicago. Younger cultural ecologists who first published after 1975 are equally strongly grounded in anthropology.

This analysis shows that, while cultural ecology draws from geographical tradition, it also represents a significant break with that tradition. Both the methods and the theoretical framework—the paradigm, if you will—are different. Cultural processes have become a theme of primary attention, and the scale of analysis has shifted from extensive research on "culture areas" to intensive study of smaller social groupings, with long periods of fieldwork and emphasis on detailed observation or measurement. Primary attention is no longer devoted to the impact of people on the environment or visible features of the cultural landscape, but to food production, demography, and ecological sustainability. This quantum change represents a new set of goals that required a methodology not provided by cultural geography.

Two catalytic agents can be identified in this paradigm shift. One is the impact of the "scientific" methodology widely espoused by the social sciences since the 1960s, derived from ecological, systems, and cybernetics or information theory. The other is the application of analytical modes developed in anthropology. The first of these greatly facilitated the examination and didactic presentation of complex interrelationships and transformations. The second allowed greater understanding of sociocultural processes, switching culture from a "black box" to a set of tangible variables, amenable to direct study. These characteristics distinguish cultural ecology from cultural geography and other nature-society approaches.

COMPLEX INTERRELATIONSHIPS

Ecology, systems theory, and cybernetics or information theory were tapped more or less simultaneously by the social sciences, although with variable degrees of enthusiasm, and more often implicitly rather than explicitly. Their use had tended to accompany rather than follow programmatic statements, such as those offered by several British geographers (e.g., Stoddart 1965; Chorley 1973). Cultural ecologists have been cognizant of these conceptual frameworks, but, like many other social scientists, have been reluctant to cast their research in the terminology of other sciences. The reasons for this restraint become apparent on closer inspection.

Ecology is a biological concept, primarily concerned with energy and organisms. It deals with:

1. organic productivity,
2. the roles of different organisms with distinct econiches as they compete with other organisms of similar feeding-habits (trophic levels), and
3. the food chains (energy pathways) that link groups such as photosynthetic producers, herbivores, and carnivores at successive levels of the food chain.

Both the advantages and problems of transferring a biological paradigm to the social sciences are fairly evident. Ecology allows a structured organization of unlike variables, emphasizes function and hence interchanges between component parts, and is amenable to systematic and nondeterministic study of interrelationships within an organic whole. Much less satisfactory is that it deals with plants and animals, and offers no obvious niche for the role of culture and human cognition. Placing people at the top of the trophic pyramid as ecological dominants only deepens the problem by implying analogies between human and animal behavior.

Systems theory enhances the ecological framework and facilitates the understanding and even simulation of complex interrelationships. Above all it has great heuristic value by emphasizing the degree to which all interactions are interdependent. Changes within one population or variable can affect some, or many, or all of the other components of the ecosystem. Such change is channeled through a chain of interlinked structures that ultimately impinge on the original variable—negative or positive feedback loops that serve to either suppress or amplify change. Such change may be reflected in long-term, net trends (dynamic equilibrium), or in abrupt shifts (metastable equilibrium).

The systems perspective has been particularly helpful in projecting long-term environmental impacts, as well as in explaining and anticipating thresholds, ecological "simplification," or "catastrophic" readjustment. The limitations are equally apparent. Simulation is very difficult and quantification rarely possible, while the approach as such is too mechanistic and prone to overemphasize functional and materialistic attributes (e.g., Ellen 1982).

Cybernetics can be drawn upon to illuminate the peculiarly human role in the ecosystem. Culture represents encoded information, and individual as well as group behavior is regulated and implemented in the context of information. Decisions are made with respect to alternative information, within a social system characterized by established energy and information pathways, complicated by cooperation as well as competition at each "trophic" level, and screened by the experience and deeper values embodied in culture. Finally, technology and social organization in the broadest sense reflect information in varying degrees. Adaptive choices and cultural variety represent critical variables in such an information system, which at the highest level is operated, if not controlled, by human cognition.

Societies can therefore be viewed as interlocking human ecosystems. They operate on the basis of individual initiatives and actions, embodied in aggregate, community behavior and institutional structures. At the individual level, built-in goal conflicts and human unpredictability represent potentially powerful variables for *change,* while at the several community and institutional levels a wide range of negative feedbacks favor *stability*. Prediction, whether for long-term evolutionary change or rapid modification, is therefore difficult, even in probabilistic terms. The system involved is simply too complex to simulate effectively, as exemplified in the difficulty of economic or social prognoses. Even in historical perspective, societal behavior is difficult to analyze and explain satisfactorily.

Given these difficulties of normative study, cultural ecologists follow the precedent of biologists in focusing upon a limited range of variables to gain understanding of component processes. They have also increasingly found that particularistic case studies provide realistic experience with variability, resilience, stability, and change.

These theoretical tools are therefore no more than one means to an end, where cumulative experience, cultural sensitivity, and even intuition are of paramount importance in the drawing of inference.

INTERDISCIPLINARY CONNECTIONS

A widespread impression obtains that geographical cultural ecology is based on the anthropological work of Steward (1955). But both Steward and Sauer were influenced by the British geographer Forde (1934), who emphasized good case studies of subsistence economies. Also, Steward was at least indirectly indebted to Sauer for his emphasis on the environment. Nonetheless, Steward played a catalytic role for both geography and anthropology: he effectively made the point that nature and society are interlinked by cultural *adaptation,* i.e., strategies for ecological success (Denevan 1983).

Steward saw cultural ecology as the study of adaptive processes, whereby cultures adjusted to an environment through their subsistence activities. His "method" was (1) to establish the interrelationships between environment and exploitative technology, (2) to examine the patterns of behavior followed in appropriating specific technologies in that environment, and (3) to assess the degree to which behavioral patterns affected other aspects of culture (Steward 1955, 40–41). He envisioned ecological relationships as part of a network of cultural adjustments and adaptations that, collectively and incrementally, set in train a multilinear process of cultural evolution that incorporated alternative techno-environmental patterns and social behavior. He sought to explain the functional relationship between agricultural technology and output, population density, settlement patterns, and social organization. His unit of analysis was a "culture core," linked to a subregional environment (akin to the "culture area"), and he attempted to show by crosscultural studies that similar functional interrelationships recurred in different areas having different historical trajectories.

A second important contribution was made in the same period by another anthropologist, Barth (1956). In emphasizing the complementary lifeways of farmers and herders in Pakistan, Barth showed that two groups can achieve a symbiotic relationship within a single environment by exploiting different *econiches.*

A third influential study was that of another anthropologist, Geertz (1963). He compared two alternative agrosystems in Indonesia with the structure, productivity, energy flows, and stability of the tropical rainforest that they replaced. Shifting cultivation and wet-rice cultivation were found to be strikingly dissimilar systems with respect to diversity, nutrient cycling, type of equilibrium, and ability to absorb population increase through "involution," i.e., internal elaboration without fundamental change. Geertz demonstrated the utility of comparing *ecosystems,* drew attention to productivity and nutrient flows as empirical processes, and placed agricultural systems in a broader historical context of European overseas expansion and its consequences for local cultures.

A fourth group of productive concepts relates to population. Carneiro (1960), another anthropologist, elaborated the concept of *carrying capacity,* the maximum population that can theoretically be supported by a particular environment and with a particular technology. Greater utility for this measure of resource produc-

tivity awaited a bold proposition from Boserup, an agricultural economist; she argued (1965) that population growth would stimulate technological innovation and agricultural "intensification," thus increasing carrying capacity (see also Brookfield and Brown 1963). Although it is now recognized that population growth and agricultural transformation tend to covary, and are very difficult to separate, Boserup drew attention to the relationships between labor input and productivity in agroecology. As a result, *intensification* has become a major theme of cultural ecologists.

A fifth strand of ideas was integrated by the sociologist Buckley (1967). He proposed that human societies are "complex adaptive systems." Adaptive strategies were defined as sets of behaviors that reflect cognitive mapping of the environment and by which such systems adjust to both external and internal changes. Buckley singled out the value of a pool of adaptive variability in identifying new and more detailed varieties and constraints within the environment, allowing a society to incorporate such information. Adaptive variability implicitly allowed a role for cultural evolution through *cultural selection.* By emphasizing *cognition, decision-making,* and *perception,* Buckley anticipated the utility of identifying alternative adaptive solutions to environmental constraints. The "culture as information" approach was also simultaneously developed by the archaeologist D. Clarke (1968), who linked resources, technology, and culture in a scaled hierarchy. Within this same train of thought, the anthropologist Bennett (1969) outlined a first regional case study of competing "adaptive strategies" within a common ecological and economic environment, focusing upon events and the constant human potential for the emergence of innovative arrangements.

Finally, we can identify a sixth perspective, most effectively promoted by the anthropologist Rappaport (1968). He studied a small New Guinea group as an ecological subsystem, emphasizing the functional role of ritual in daily life as well as in relationships with competitive and reciprocating groups. The mass of quantitative caloric data collected was subsequently applied to quantify the energy cycle of this New Guinea group (Rappaport 1971), setting in train a vigorous *energetics* school. Emphasis was placed on negative feedbacks to maintain a homeostatic equilibrium.

This selection of key themes that emerged in the first decade or so of pioneer research in cultural ecology demonstrates that anthropology and other social sciences shared the parallel, theoretical revolution experienced by geography during the 1960s. It is indeed legitimate to speak of an interdisciplinary ferment, in which priority for ideas and conceptual elaborations is often difficult to assign. The first geographers engaged in cultural ecology, such as Brookfield (1962, 1968, 1969), Butzer (1964), Porter (1965), Denevan (1966), Harris (1969), Clarkson (1970), and Mikesell (1970), were an integral part of that process. As reticent as some geographers are to explicate systemic or normative views in cultural ecology, their key concepts and methods unambiguously derive from this era of logical positivism.

Indeed, as surprising as the conclusion may be to some of us, our particular mode of cultural ecology is very much a product of the theoretical revolution. Decidedly low-keyed, in contrast to the flamboyance of an emergent spatial geography, the more incremental crystallization of cultural ecology represented another fundamental break with established methodologies in geography.

Culture ecological research within geography can be roughly subdivided into two categories: synchronic and diachronic. On the one hand, the synchronic or "contemporary" approach began as a series of local case studies that served to develop a methodology, with successive examples offering new thematic insights at higher levels of generalization. Such work has increasingly been applied to a new view of Third World development. On the other hand, the diachronic or "historical" approach has used local studies to examine technological and related demographic changes over longer periods of time so as to understand the dynamics of cultural adaptation and change. Such historical experience provides a different perspective on equilibrium properties and helps identify alternative scenarios relevant to contemporary problems. Although fundamentally different, these synchronic and diachronic methods are complementary.

From Local Studies to Lessons for Development

Perhaps the key unifying thread in "contemporary" cultural ecology is a preoccupation with traditional farming. Within that context, an evolution of methodology and applicability can be traced from local studies of seemingly isolated groups to complex case studies in which smaller groups form exemplary parts of regional or even global networks.

The New Guinea Tradition. The starting model was the standard anthropological case study, with the goal of intensive and comprehensive understanding of a single community. But, whereas earlier anthropologists tended to select "autonomous" microcultural systems in order to identify cultural processes, Brookfield (1962) immediately redefined the ground rules in his first landmark study. He proposed extensive field observations over a wide area so as to recognize patterns and problems that would then be followed up by detailed local study; integration of the extensive and intensive observations would subsequently generate fresh interpretive insights. The resulting monographic study of the Chimbu of New Guinea by Brookfield and Brown (1963) explored a wide range of concepts, such as carrying capacity, as to how agricultural resources are evaluated, used, and allocated in a densely settled area.

Brookfield (1964) next questioned the premises of Berkeley cultural geography, which disclaimed the need to examine "the inner workings of culture" (Wagner and Mikesell 1962, 5), to argue that understanding of society-environment interrelationships was next to impossible without analyzing values, beliefs, and social organization. Subsequently, Brookfield (1969) explored the potential of perception studies to understand resource utilization, the role of new information, decision-making, and change in a traditional society.

Several dissertations on small New Guinea groups were subsequently completed and published by Americans or Canadians under Brookfield's guidance or influence. W. Clarke (1971) introduced time-scheduling, developed the theme of labor inputs versus yields, examined systemic stability, and argued for the possibility of progressive internal change in the process of steady-state adjustment (in other words, dynamic equilibrium).

Waddell (1972) identified three levels at which a small society operates. The base is provided by the biological resources and the environmental constraints that limit them; in the middle are the adaptive strategies employed to maximize productivity and minimize risk; and at the top is the individualistic manipulation of key human actors. Waddell suggests that intensification may be (1) a direct response to environmental variables that justify specialized techniques to increase productivity, (2) an involuntary response to arrest declining output, or (3) an accommodation to variations in population size, density or growth.

Grossmann (1984b, 1984c) completes this evolution by linking the local case study to a higher-order market economy, in which boom and bust cycles exert powerful feedback influences on social relationships, resource use, and ecological harmony. Grossman challenged the assumption that "subsistence affluence" was an enduring trait of traditional agriculture, by demonstrating that food production was quite variable from year to year, with repeated shortfalls. He showed that contemporary commodity production can conflict with and undermine subsistence agriculture, even when surplus land and labor are available, and that such conflicts can make subsistence systems more vulnerable to environmental problems. His work on time-allocation studies (Grossman 1984a) has broad applicability (see also Bergman 1980).

African Case Studies. In East Africa, Porter (1965, 1978, 1979) worked in association with a team of anthropologists, and was assigned the task of articulating land use and environment for a set of different socioeconomic groups. He employed an energy-water budget approach to relate environmental variety to crops and pasture grasses. Subsequently he moved from a Western categorization of soils to an indigenous one, in terms of terminology, criteria, and taxonomy. Only in this way could he understand indigenous agricultural practices, soil assessment, and management. He concluded by showing that indigenous land appraisal and sociopolitical organization interact to produce a livelihood system that exploits several environments at different elevations; the solution increased productivity, reduced subsistence risks, and smoothed out labor schedules.

Knight (1974), as a student of Porter, developed a comprehensive local study in which agroecology was complemented by systematic investigation of the rationale of indigenous "ethnoscience" (see also Newman 1970). The local study was then integrated into the larger political, social, and economic matrices in which the evolution of the study group was embedded—specifically, a plural society involved in rural modernization, guided and limited by national policies, and dependent upon a global politico-economic system. Knight's conclusions cast doubt on the efficacy of Western innovations and on the validity of the Western scientific system in unfamiliar environments.

Another exemplary African study, by Carr (1977), examined a pastoral group on the Ethiopian border, artificially restricted from using part of its traditional lands inside adjacent countries. Initially working with Butzer in the field, Carr extended her attention from pastoral ecology and supplementary riverine agriculture to an examination of how the social system facilitates the exploitation of multiple and fluctuating resources, and how range deterioration caused instability that has subsequently erupted into intertribal warfare. Johnson (1978) provided a more

general culture ecological rationale for nomadic pastoralists, and conflicts between pastoralists and agriculturalists in West Africa were elucidated by Vermeer (1981) and Bassett (1986).

New Approaches in Latin America. In Latin America, the Miskito Indians of Nicaragua were studied by Nietschmann (1973, 1979), a student of Denevan. In an exemplary application of the energetics approach, he first established the energy flows of their traditional economy, spread over four different biotopes, and then examined the impact of economic development on resource deterioration and impoverishment. For the Shipibo of the Amazon, Bergman (1980), also a Denevan student, made daily observations on time inputs into subsistence activities for the full annual cycle.

The second theme ("political ecology") has been developed by Hecht (1982) in regard to soil and forest destruction in the eastern Amazon Basin. The world cattle market and Brazil's strategy with respect to it create incentives and constraints that induce frontier farmers to abandon sound management procedures. Cattle exports in Costa Rica have had similar deleterious effects on environmental resources, food production, and traditional social organization (Place 1985).

In a very different genre is Kirkby's study (1973) of ecology and allocation of farm land and irrigation water in Oaxaca. Although ultimately focused upon prehistoric settlement, this is a model for sophistication in applying the geographer's art to integrate ecological variables into a synthetic whole. A microstudy by Doolittle (1984), a student of Turner, in the Rio Sonora valley demonstrates how the conversion of a tributary channel and its floodplain into a rationally exploited agricultural system is the cumulative result of innumerable ad hoc decisions by individual cultivators. The thrust is that agricultural intensification is, and presumably has often been, an incremental process.

Another case study, by Knapp (1984), a Denevan student, in highland Ecuador, examined the relationships among altitude, climate, slope, soil fertility, labor input, and crop yields for various Andean cultigens, to explain patterns of altitudinal zonation as they changed over time. The study concluded that soil fertility is the greatest single limiting factor and challenge for Andean farmers, and that historical changes of fertility-management technology have been associated with dramatic shifts in niche use and settlement. The resulting appreciation of indigenous adaptive strategies is of equal interest for an understanding of the present-day vulnerability of marginal farmers to climate change (Parry, Knapp, and Cañadas 1988).

Several more general studies can be singled out in this broader context. Turner and Doolittle (1978), for example, devised quantitative measures to assess degrees of agricultural intensification. Wilken (1987) took a didactic and nontheoretical approach in systematically outlining traditional agricultural procedures in Mesoamerica, creating the first approximation of a textbook to facilitate training of the next generation of field-grounded cultural ecologists. Another practical study by Denevan and Padoch (1987) provided recommendations for managed agroforestry based on intensive study of slash-and-burn "abandoned fields" in the Peruvian Amazon. Also at a general level is the collaborative work of a geographer and an anthropologist, Turner and Brush (1987), on comparative farming systems. It specifically addressed agricultural change in different physical, social, economic, and cultural environments.

HISTORICAL AND CULTURAL CONTRIBUTIONS TO GEOGRAPHIC UNDERSTANDING

Common Ground. This selection of synchronic studies in cultural ecology identifies a distinctively geographical approach, illuminating a broad sphere of interaction with respect to resources and the spatial matrix of the cultural and biophysical environment. The trend has also been to link the local group into the larger economic system of which they are part, a more realistic, open system and nonhomeostatic perspective.

By contrast, anthropological cultural ecology has tended to over-refine its theoretical constructs, while limiting empirical work to the processes and structures whereby relatively simple human groups match resources with their needs and incorporate them into their cultural behavior. The differences are striking, yet logical.

The thrust of synchronic cultural ecology within geography has found its primary application in a fresh look at Third World development. Cultural ecologists are firmly opposed to mindless modernization according to Western standards. They argue that traditional agriculture reflects much trial-and-error; minimizes risk; is more often than not based on intuitively good ecological decisions, if not sound evaluation; and that it is intimately interwoven with cultural values and perceptions. A common stance is that Westerners should first learn from indigenous groups before prescribing change, and that any changes should incorporate and emphasize the best components of the traditional system.

Cultural ecologists have also become active participants at international conferences and in national or international agencies which are evaluating development schemes. The demand for such expertise is high, so that the number of properly trained students barely matches the potential demand of the applied sector.

Political Economy. A major new arena for contemporary cultural ecology is the set of problems as to how integration into regional, state, and world economies affects the management of resources. A good example here is Watts (1983), a student of Nietschmann, who examined food production and periodic famine in northern Nigeria, and then integrated institutions and international structures into the explanation of a nature-society problem. Fitting in a similar context is the study of Blaikie and Brookfield (1987) on land degradation and society; in dealing with ecological issues, it again emphasizes institutions and political structures that set a matrix of limits, constraints, and possibilities for resource management.

Such perspectives from political economy move cultural ecology from the context of a small, closed society into a broad, hierarchical system. The focus is upon three basic issues (Watts 1983, 1987):

- the nested levels of system integration, including social, economic, and power relations beyond the individual or household unit of analysis,
- the constraints and possibilities imposed on the men and women who manage resources (as individuals and as households), and the degree to which systems of access to and control over resources "marginalize" certain social groups, and
- the historical processes of integration into the market, state, and world economies. Structuration theory offers further avenues for exploration.

All in all, this research in synchronic cultural ecology represents a very broad canvas, notable for its rapid elaboration and diversification. Each author has a sophis-

ticated grasp of ecological problems and strives to chart new intellectual ground in the understanding of contemporary problems. It is this sense of excitement and commitment that probably explains the rapid growth of the Specialty Group, as a community of scholars intensely concerned with food, population, and the sociocultural mechanisms that link them.

Change and the Historical Perspective

While synchronic investigation can better identify short-term system maintenance, historical or diachronic research seeks to recognize changing configurations and to understand the responsible processes. The "contemporary" cultural ecologist has little access to the time-depth necessary to evaluate the nature of systemic change, or more importantly, to study how alternative options to internal or external stress are chosen, and whether in the long run these are successful or not.

The development of historical cultural ecology shows some parallels to its more contemporary counterpart. Much of the work is local and intensive, with the goal of generating hard data as well as larger hypotheses for subsequent, more comprehensive investigation. There also is a similar trend to consider higher-order systemic interactions.

Abandoned Agricultural Landforms. One convenient category of research includes agricultural landforms, such as terraced, raised, channelized, and sunken fields, now mainly found in thinly inhabited parts of Latin America. The reason that these features are interesting is that they demonstrate intensified prehistoric agriculture and, by implication, higher populations in the past. This in turn raises questions about the agrosystems themselves, and the strategies by which they were devised. Equally intriguing are the factors responsible for abandonment, as well as the lessons such features provide for potential future increases in agricultural productivity.

The groundwork for examining past agricultural landforms as one central theme in historical cultural ecology is represented by the wide-ranging investigation of Spencer and Hale (1961) in Southeast Asia. Such features were subsequently found along the Amazonian margins of the Andes (Denevan 1970, 1982), and in the highlands of Ecuador and Peru (Farrington 1985; Denevan, Mathewson, and Knapp 1987). For the Colca Valley of highland Peru, Denevan (1987) directed an interdisciplinary project that exhaustively studied a terraced landscape, now partially abandoned, the origins of which go back well beyond the Inca past. Population data are first available from 1530, allowing wide-ranging inferences on demographic change, labor inputs, and productivity.

The Maya lowlands provide another case in point, but one where the initial question was to identify an adequate subsistence base to support the large populations verified archaeologically. This led to several interdisciplinary studies that identified alternative agrosystems and ultimately demonstrated a critical role for artificial landforms such as raised and channelized fields (Harrison and Turner 1978; Turner and Harrison 1983; Turner 1983). Team study served to disentangle the record of Maya wetland cultivation in terms of surface preparation, biotic associations, hydraulic agriculture, and settlement. The implications for high Maya population densities are

surprising (Whitmore et al. 1989), requiring a total reevaluation of the potential productivity of lowland tropical environments, as well as an interpretation via demand-based models.

Early Irrigation. A similar cluster of studies is linked to prehistoric and historic irrigation systems. The origin of complex societies has commonly been linked to a positive feedback system in which resource stress and population growth are thought to be instrumental in the development of irrigation agriculture, thus requiring a managerial bureaucracy, and ultimately, sociopolitical growth. In the case of the Egyptian Nile Valley (Butzer 1976), it can instead be argued that the emergence of an irrigation agrosystem was an incremental process and that it was, and continued to be, managed locally; in other words, intensification was not the stimulus for administrative centralization or social stratification.

In the Rio Sonora valley of northern Mexico, Doolittle (1988) reconstructed an irrigation-based sequence of prehistoric occupance, spanning about a millennium. He demonstrated changing orders of settlement hierarchies that reflected substantial changes in population and links to different exchange networks. The Sonoran example illustrates the flexibility of marginal environments in supporting larger populations, depending on the effort invested to improve productivity, as well as the broader rationale for such inputs within the context of a larger, open system.

Population Cycles. Demography provides the third theme for more comprehensive applications of the historical approach. Population growth is rarely possible without improved technology, social access to resources, or a combination of the two; decline points to fundamental social or environmental problems. Growth, stability, or decline also suggest different questions about the quality of life. Examples of such investigations include the linkages between progressive intensification and systemic breakdowns in ancient Egypt (Butzer 1976, 1980, 1984), several global analyses of demographic "millennial long waves" (Whitmore et al. 1989), and the catastrophic New World population loss due to the introduction of European epidemic diseases (Denevan 1976).

These case studies illustrate that, in the long-term view, populations may not only grow but may experience catastrophic collapse. They show that sociopolitical and socioeconomic variables are tightly interlocked, and that simplification is possible in one or the other, or both domains. Historical studies of this kind can be implemented at intermediate and small scales, to derive more-detailed understanding of the mechanisms of change, of the human costs involved, and of the decisions that communities or larger social groupings make when confronted with crisis.

A case study in the Sierra de Espadan of eastern Spain (Butzer 1989b) illustrates how population expansion and increasing resource scarcity since A.D. 1700 led to a series of temporary adaptive choices among different options, to forestall more fundamental changes that involved cultural values (such as family-size limitation) and ultimately emigration. It serves to show how social groups attempt to manage mounting crises, and that they deliberately weigh options with different sociocultural impacts. Some of the choices made are unpredictable and unexpected. Another such historical evaluation can be cited for European-Indian contacts in New England (Cronon 1983).

Discussion. Historical cultural ecology provides a powerful methodology to examine and understand change in a larger, systemic context. In this we can recognize parallels with the recent trend of synchronic cultural ecology to move from examination of agricultural production to examination of higher-order, interlinked structures. Study need not be confined to non-Western societies, a current predilection that relates more to the history of our endeavor than to the suitability of the materials or the promise of insights complementary to those obtained by other efforts of human geography. Ecological sophistication and cultural expertise can be applied with equal profit in the First World, as in the Third.[4]

By way of general conclusion, cultural ecology currently forms a center of intellectual activity, and the subfield can be expected to continue to evolve and mature over the next decade or two. It is likely that our perspectives and innovative methodologies in integrating the two domains of environment and society will attract many new converts in the process.

[4]We could, for example, profit from cultural ecological studies of Midwestern family farming communities, of West Texas cattle ranches, of lobster fishing towns on the Maine coast, or of intensified agriculture in the Salinas Valley of California (W. E. Doolittle, pers. com.) (see also Turner and Brush 1987).

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