Desertification as a Social Problem

Desertification and Development. Dryland Ecology in Social Perspective. BRIAN SPOONER and H. S. MANN, Eds. Academic Press, New York, 1982. xxii, 408 pp., illus. $52.

The 1968–1973 Sahelian drought focused worldwide attention on the problem of desertification, "the appearance or intensification of desert conditions in arid, semi-arid and sub-humid regions . . . where the long-term increase in human activity has suddenly accelerated in recent history as a result of population growth and economic development," in the words of the editors of the present volume. This concern led to the United Nations Conference on Desertification (UNCOD), held in Nairobi in 1977, a meeting primarily of ecologists and politicians. This U.N. campaign to combat desertification allowed no role for social scientists even though desertification, as diagnosed and defined by ecologists, involves human factors that are beyond the limits of ecological explanation.

At the tenth quinquennial congress of the International Union of Anthropological and Ethnological Sciences, held in New Delhi in December 1978, Spooner and Mann organized a symposium of social scientists working in desert areas of the non-Western world. *Desertification and Development* is a collection of 22 papers based on those delivered at the meetings that aims "to present a unitary statement on the problem of desertification that would redress the balance of the existing literature by directing attention to the most important social and sociological aspects" (p. xiv). Although not all the papers address this central issue, on the whole the book succeeds in its purpose.

The effects of the larger political and economic system, and not the local farmers and herders who generally are blamed for desertification, are documented by Jodha, who focuses on the role of administrative changes in India—the reforms in land tenure after the formation of the Rajasthan state: "The land reforms were only concerned with the exploitative features of the feudal order, as they related to the tillers of the land, and not to the land itself. Thus the need for preventing very intensive use of land was completely overlooked, and the conservation needs of the resource base never figured in the land reform laws. Indeed, the real consequence of agrarian reforms through the distribution of additional submarginal lands has been to accentuate the process of over exploitation" (p. 342).

Schulz points out the impact of Western political and economic policies on arid regions of the non-Western world. She notes that "desertification is a politically marginal issue relative to high technology in the international bureaucratic hierarchy" (p. 34). The international bureaucratic hierarchy (the World Bank, the Agency for International Development, the Harvard Institute for International Development, and agribusiness) is encouraging the investment in mechanization and high technology, which can contribute to degradation of the fragile tropical soils by removing the topsoil and by enabling farmers to extend their agricultural operations into areas marginal for crop cultivation. Making investments at the local level for conservation and for improving the land is less attractive.

Merrey identifies a similar problem in plans for economic development in Pakistan. Recent research has identified Pakistan's very low agricultural productivity despite favorable climate, fertile land, hard-working farmers, and the possession of the largest integrated irrigation system in the world as resulting from local-level waste and mismanagement of irrigation water, which puts constraints on improving agricultural activity as well as causes waterlogging salinity (p. 91). However, the solutions proposed by panels of international experts (which included no social scientists) ignored the research findings of social scientists and recommended the introduction of high technology, massive capital outlays, and a continuous assistance by foreign "experts."

Dennell and Conant demonstrate that long-term human use of an arid area does not necessarily change the environment in ways detrimental to further human use. Dennell's archeological study of check dams on the arid Tauran Plains of Iran shows that, although built for water storage, these dams collect silt and create pockets of highly productive alluvium along stream channels. "The overall effect of [building check dams] in the past has been to store large amounts of sediment that would otherwise be lost, and convert them into areas of high productivity" (p. 200). Conant questions the widely held belief that livestock, particularly goats, are among the more important causes of degradation and eventual desertification and that an aim of planners should be to reduce or eliminate traditional herding activities in order to realize the full bioclimatic potential of an area. With the aid of Landsat data and aerial photography, together with a series of observations on the ground, Conant documents changes in vegetation on the Masol Plain in northwestern Kenya, an area abandoned by Pokot pastoralists since 1974 because of "a state of near warfare" with livestock rustlers and neighboring groups. In the absence of regular burning and grazing by goats, which kept the growth of *Acacia* scrub in check, the vegetation has changed from grassy and herbaceous open savanna to dense, thorny bushland, and restoring this area to grazing land will be extremely difficult.

Sandford demonstrates that, because of the high variance in rainfall in many arid regions, the concept of carrying capacity has no utility in development planning. He emphasizes the problem to pastoralists that is presented by the very high variance in annual rainfall and therefore in fodder production. If the pastoralists adopt the conservative strategy that is favored by range scientists because it presents less risk of environmental degradation and maintain their number of grazing animals at a low and relatively constant level that will avoid overgrazing during years of relatively poor rainfall, they forgo livestock production by underutilizing fodder during years of relatively good rainfall. Pastoralists favor the opportunist strategy whereby the herd manager attempts to adjust herd size to grazing resources. Sandford suggests that economic development should strive for efficient opportunism, which varies livestock numbers at the appropriate time, not for the conservative strategy, and suggests some mechanisms whereby governments can encourage destocking in bad years. However, he does not identify effective mechanisms for restocking, a major obstacle to be overcome in all livestock production systems given the biological fact that livestock reproduction cannot

possibly track increases in plant productivity during years of good rainfall.

Malhotra and Mann trace the traditional food production system in Rajasthan and the impact of demographic and technological changes, and Dhir traces the history of human activities in the area since Paleolithic times.

Tadros discusses problems raised because the design of rural resettlement for people displaced by the Aswan High Dam failed to take into consideration the lifeways of the people.

The need for a historical perspective "to allow a realistic assessment of present trends in relation to the past" is emphasized both by Dennell, who discusses the importance of archeological studies, and by Moore and Stevenson, who discuss the contributions pollen studies can make to an understanding of the processes of desertification. Both papers present the limitations imposed by the present state of knowledge in these fields.

Bharara questioned selected villagers in central Rajasthan about their recollections of drought and found that out of 80 years five were perceived as "average," with 63 poor years (58 drought or severe drought, five mild drought) and 12 good or surplus years, suggesting that better criteria for judging are required. These findings run counter to those from studies of drought perceptions in the United States that people generally underestimate the frequency of hazard (T. Saarinen, *Univ. Chicago Dept. Geogr. Res. Pap. 106*, 1966).

Not enough hard data are presented in Martin's chapter on conservation at the local level in the Tauran Plain of Iran, in Nyerges's chapter on the processes of coadaptation of pastoralists, flocks, and vegetation, or in Horne's chapter on variations in fuel demand to convincingly substantiate the conclusions the authors reach. Bhadresa and Moore's discussion of desert shrubs and Breckle's of salinity do not have a social perspective.

Since desertification generally results from social and political problems at the local and regional levels and therefore cannot be understood in global terms, it is inevitable that this volume does not present an integrated social perspective on desertification. However, the emphasis in this volume on desertification as a social rather than an ecological problem is extremely important and long overdue.

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Genomic Reorganization

Mobile Genetic Elements. JAMES A. SHAPIRO, Ed. Academic Press, New York, 1983. xvi, 688 pp., illus. $65.

Though long analyzed at the genetic level, the instability of DNA arrangement promoted by mobile genetic elements has come into focus for the molecular biologist primarily as the result of work accomplished during the past ten years. The chief developments have been the detailed molecular characterization of prokaryotic transposable elements and the identification of analogous entities in eukaryotic cells, as well as a molecular understanding of specialized rearrangements such as those involved in the development of the immune system. We are now comfortable with the idea that a low but significant level of genomic rearrangement, mediated by mobile genetic elements, is probably a universal facet of biological systems.

This volume surveys mobile genetic elements in organisms ranging from bacteria to mammals. A great deal of thought has gone into the book. It is detailed, authoritative, and well illustrated. Throughout, one is solidly in the hands of experts, most of whom can write clearly. The volume begins with a discussion of controlling elements in maize, the first transposable elements studied, then proceeds in phylogenetic order, concluding with a consideration of four specialized systems involving DNA rearrangement.

The opening chapter (Fedoroff), on maize, with its color plates displaying 30 kernels, imparts an understanding of controlling elements, as well as an appreciation for the brilliance of McClintock's work. The rich genetic analysis of controlling elements is summarized, though most of the phenomena are not yet understood in molecular terms and detailed molecular explanations are not ventured. It is not difficult to speculate on how the changes in phase, state, and developmental timing will ultimately be explained in terms of differences in gene expression mediated by the elements' position, sequence, chromatin conformation, and the like. Actually, the purported uniqueness of the maize elements in sensing developmental parameters is challenged by the information in the succeeding chapters, which provide fragmentary evidence that similar phenomena occur in a variety of other elements. One comes away from the book with the impression that it is the favorable genetic system available in maize, in which clonal analysis of genetic change is possible by examining the pigmentation patterns on kernels, that has allowed the variation in frequency, timing, and intensity of gene expression mediated by controlling elements to be clearly perceived.

Fedoroff's chapter also raises a question that is pursued in subsequent chapters: what is the significance to the physiology and evolution of the organism of mobile elements that transpose with little or no target specificity? Transposable elements can clearly be adaptive in a general sense by mobilizing advantageous genes and thereby facilitating their spread, as in the dissemination of antibiotic resistance in bacteria. Furthermore, transposable elements generate variability for evolution to act upon since they constitute a sizable fraction of spontaneous mutations. Mobile elements are particularly adept at generating diversity because they typically carry transcriptional signals and introduce instability into the target region, producing a wide range of phenotypes. Many of the elements carry signals that are at least interactive with the rest of the genome. However, at present it seems more likely that mobile elements will provide useful information for understanding how gene expression is modulated than that these specific sequences are themselves mediating normal developmental change.

The ensuing chapters describe mobile elements whose molecular study is relatively advanced, beginning with a consideration of bacteriophage λ (Campbell). The discussion focuses on the genetic control of the integration and excision process, ending with proposals for its evolution. The integration of λ is likened not to transposition of prokaryotic insertion sequences but rather to the simpler, nonreplicative resolvase reaction of the Tn*3* family. It is no coincidence that only the λ integration-excision and the resolvase reactions have been successfully carried out in vitro. It is in the behavior of the virus-transposable element Mu (Touissaint and Résibois) that the importance of replication in the transposition of the prokaryotic mobile elements is most readily apparent. A comprehensive treatment of prokaryotic IS elements (Iida, Meyer, and Arber) is followed by detailed accounts of the transposons Tn*3* (Heffron) and Tn*10* (Kleckner). That transposition frequency of Tn*10* varies over a wide range of four orders of magnitude depending on the amount of transposase synthesized provides a basis for understanding how the variable frequency of transposition monitored, for example, by the pigmen-