Reciprocity in Cultural Ecology

RICHARD A. YARNELL[2]

Ecology is the study of the interrelationships between organisms and their environments. All organisms are biologically adapted to the environments in which they live, and it is these adaptations which govern the interrelationships. Man is adapted to his environment culturally as well as biologically, and he is adapted to cultural environment as well as to natural environment. It is the cultural adaptations to natural environment that concern us here, and the resulting interrelationships in particular.

Comments about these interrelationships are often phrased only in terms of the influence of natural environment upon culture. This is an oversimplification, because the influences are reciprocal. Environment does influence culture; but culture, as technology, has many significant effects upon environment. These effects in turn have counter-effects upon culture. Most investigators undoubtedly are aware of these counter-effects, but adequate reports of the mechanics or of the extent and kinds of resulting cultural adjustments are few.

There is a rather extensive literature that deals with the influence of cultural activities on the natural environment, and a considerable portion of it describes the kinds of modifications of nature effected by non-European cultures. Most of these writings are to be found in biological, geographical, and general science publications; but recently they have appeared in the anthropological literature with increasing frequency, climaxed by publication of the results of the International Symposium on Man's Role in Changing the Face of the Earth (Thomas, 1956). Robert F. Heizer (1955) has commented, in his excellent summary of this literature, that ". . . anthropologists have now accumulated sufficient evidence to argue that at any point in time or space where man has occupied a region he has materially affected the soil, the fauna, the flora, and even the climate, through the intermediacy of that one distinctive human possession which we call culture." Perhaps this is stated a little too strongly, however.

The activities connected with modern civilization have created by far the most extensive of the cultural modifications of natural environment. However, there have been considerable changes effected by less advanced cultures as the result of clearing and burning vegetation; collection of food, firewood and raw materials; disposal of waste; cultivation of soil, etc. Alteration of physical and chemical properties of the soil, increase of surface light, evaporation, soil erosion and sedimentation, alteration of plant and animal community composition, and dispersal and modification of plants and animals are some of the results of these activities. These results have variously increased and decreased the productivity of the environment for the cultures involved depending upon the kind, intensity, and duration of the activities and upon the environments in which they were carried out.

The northeastern United States is one area for which there is evidence of the influence of American Indian activities on their environment. Gordon M. Day (1953) has written a well documented review of this information which he summarizes as follows:

> These Indians created sizeable clearings for their villages and fields and probably expanded the clearings as they foraged incessantly for firewood and other necessary materials. Over much of the region, they set fire to the woods to improve travelling and visibility; to drive or enclose game; and to destroy "vermin." They probably exercised some influence on the forest through their control over the animals they hunted and through planting food and medicinal plants. It is certain that their activities destroyed the forest in some places and it is hardly to be doubted that they modified it over much larger areas. Seasonal migrations and the periodic relocation of villages widened the range of Indian

[1]Received for publication January 18, 1963.

[2]Instructor in Anthropology, Emory University, Atlanta, Georgia.

> influences, which extended into unexpected localities and supposedly uninhabited regions.

S. W. Bromley, an ecologist, has extensively studied the vegetation of southern New England and reports (1945) that Indian burning favored nut trees at the expense of other timber and perpetuated the blueberry heaths which furnished food for large numbers of game animals as well as for the Indians. Hu Maxwell (1910) has reviewed the evidence for the same kind of phenomena resulting from fire and clearing by Indians in Virginia and emphasizes the increased production of nuts, fruits, and game that resulted. Also he discusses the spread of plant species by the Indians, the results of which are still observable. Heizer (1955) states that habitation sites "have undoubtedly had a tremendous local effect upon soils, plant cover and the like" and that "Many uncultivated plant distributions are best explained as due to having been spread by man." He points out also that these two factors may have been responsible for the frequent occurrence of economic plants on archaeological sites, which in some cases are outside of the natural ranges of the plants involved.

In his *Trees of California* (1909), Jepson writes as follows:

> The long inhabitation of the country by the Indians and the peculiar local distribution of the Valley Oak in the rich valleys is in some way connected. These oak orchards, of great importance to the native tribes, indicate plainly the influence on the trees of Indian occupany of the country. . . . It is clear that the singular spacing of the trees is a result of the annual firing of the country—an aboriginal practice of which there is ample historical evidence.

It appears that the Indians increased or at least perpetuated the extent of oak groves and their productivity by eliminating competition and crowding and perhaps also were instrumental in extending the distribution of these trees. It may well be that this was a major factor in the development of an adaptation which discouraged the aboriginal adoption of maize agriculture in California (considered to be primarily a result of the seasonal distribution of precipitation by many authorities).

It should be kept in mind that these results of cultural activities are not necessarily intended nor even comprehended in every instance by the human agents. Indeed, many such results of cultural practices, including those leading to the origins of domestication, appear to have been purely incidental to the intended results.

The interrelationships between a culture and the natural environment in which it exists are frequently dynamic in their various aspects. The adaptation of a culture to the environmental changes which it creates has the result of further modifying its environment. This results in additional mutual adjustments which continue until a condition of relative stability is reached. This condition persists until the culture or the natural environment is altered sufficiently to upset the equilibrium. At this point a new series of adjustments ensues. If cultural change or environmental change is relatively rapid, it may forestall a condition of stability for a considerable period of time. The level of technological development is an important factor here because, as technology is more advanced, the influence of culture on environment is potentially greater. Thus the series of adjustments between a culture and its environment is likely to be more intensive and to result in greater change in both culture and environment.

The general modification of environment by aboriginal culture in North America can be conceived diagrammatically as a series of gradually ascending steps, continually growing shorter and higher through time until about 1800 A. D. At this time, the extent of Indian influence on environment decreases at a rapidly accelerating rate, but the total extent of cultural modification of environment increases at a rapidly accelerating rate until the present. This leaves us with a small remnant of the environment which still displays the results of Indian activities and perhaps an even smaller remnant which is unmodified. But the study of these remnants, when utilized in conjunction with paleoecology, archaeology, and the recorded observations of aboriginal practices is likely to become quite valuable to the student of abo-

riginal cultural ecology. This has been demonstrated partly by Bromley's studies in New England (1945).

Pollen analytical studies are beginning to tell us something of the vegetation that has existed at various times in the past in certain areas. The apparent changes in vegetational patterns are generally interpreted as the result of climatic change. However, Iverson (1949) has shown that some of these patterns in Europe were intensively influenced by human activities. When these interpretations are made, it is important to use care in deciding where human activities stand in the cause and effect sequence of vegetational change. Vegetation is part of man's environment, but also man and his influences are part of the environment of the vegetation.

The effects of various cultural influences are not necessarily the same from one type of environment to the next, especially when there is a major climatic difference between them. Burning in a humid forest might produce no lasting effect, whereas the same degree of burning in forest near the border of grassland could be all that is needed to upset the ecological balance enough to permanently destroy the forest. During or after a period of climatic change to dryer conditions, cultural influences could hasten or complete the destruction of forests which might otherwise have persisted precariously for a long time.

The influences of culture on environment can be divided into various categories. These can be collected under two headings: those with effects which are generally favorable to man (e.g., those increasing subsistence benefits) and those which are generally unfavorable. Of course, the effects of certain influences may have both favorable and unfavorable consequences or one or the other, depending upon various circumstances. However, the nature of the effects can be determined once the effects themselves are apparent. It is clear that activities which increase the number of nut-bearing trees at the expense of certain lumber trees are not necessarily desirable to modern advanced societies.

Paul B. Sears writes (1956) that ". . . the changes induced by man, whether by sheer destruction or indirectly by accelerating natural processes, are probably more serious to him than the so-called 'natural changes' for which he is not responsible." He goes on to state that the clearance of forests from the uplands around Mesopotamia stimulated erosion so that great amounts of silt were washed down which clogged irrigation ditches in the valley below. Jacobsen and Adams (1958) reiterate this point and add that raised water tables resulting from irrigation increased soil salinity which contributed to the downfall of past civilizations. Sears points out also that, when the rate of erosion is accelerated enough, the rich alluvium of the lowlands is buried by sterile mineral materials so that the productive capacity is greatly reduced. After making an extensive study of soil erosion and population in central Mexico, S. F. Cook reports (1949) that the land is poorest in those areas which formerly were heavily populated, and he concludes that erosion resulting from aboriginal practices caused serious destruction of farm lands. As early as 1874, George P. Marsh suggested that these factors implemented the decline of the classical Mediterranean civilization, and the same has been suggested for the Indus Valley civilization.

Several authors have suggested that the abandonment of the central Mayan area was the result of forest destruction and other environmental changes resulting from cultural causes. H. H. Bartlett, who has done extensive research on tropical agriculture, states in connection with the Maya (1956), "Land burned over too frequently became overgrown with perennial grasses, which rendered it useless for agricultural purposes with primitive implements." When studying the Mixe of southern Mexico, Beals (1945) found that most of the potential farmland has become worthless for them because, after clearing the tropical forest and cultivating the land, grassland appeared and that this has left many of the people in a serious situation.

The changes alluded to above are clearly the result of effects in our "unfavorable" category, which would normally bring about the necessity of a drastic readjustment of a culture to its environment. However, if this kind of relationship between culture and environment is found to have been a factor

contributing to the development and spread of agriculture, it should be considered highly favorable to humanity in general.

Literature Cited

1. Bartlett, H. H. 1956. Fire, Primitive Agriculture, and Grazing in the Tropics. Pp. 692-700 in Thomas, W. L. (ed.), Man's Role in Changing the Face of the Earth. Chicago.
2. Beals, Ralph L. 1945. Ethnology of the Western Mixe. University of California Publications in American Archaeology and Ethnology, Vol. 42, No. 1
3. Bromley, S. W. 1945. An Indian Relict Area. Scientific Monthly **60:** 153-154.
4. Cook, Sherburne. 1949. Soil Erosion and Population in Central America. Ibero-americana, No. 34. Berkeley and Los Angeles.
5. Day, Gordon M. 1953. The Indian as an Ecological Factor in the Northeastern Forest. Ecology **34:** 329-346.
6. Heizer, Robert F. 1955. Primitive Man as an Ecologic Factor. The Kroeber Anthropological Society Papers, No. 13: 1-31.
7. Iverson, J. 1949. The Influence of Prehistoric Man on Vegetation. Danmarks Geologiske Undersøgelse **3:** 5-25.
8. Jacobsen, Thorkild and Adams, Robert M. 1958. Salt and Silt in Ancient Mesopotamian Agriculture. Science **128:** 1251-1258.
9. Jepson, Willis L. 1909. The Trees of California. San Francisco.
10. Marsh, George P. 1874. The Earth as Modified by Human Action. New York.
11. Maxwell, Hu. 1910. The Use and Abuse of Forests by the Virginia Indians. William and Mary Quarterly Historical Magazine **19:** 73-103.
12. Sears, Paul B. 1956. The Processes in Environmental Change by Man. Pp. 471-484 in Thomas, W. L. (ed.), Man's Role in Changing the Face of the Earth. Chicago.
13. Thomas, W. L. (ed.), Man's Role in Changing the Face of the Earth. Chicago.