

I. ECOLOGICAL RESEARCH ON CORAL ATOLLS

Coral atolls, scattered over a large part of the tropical seas of the world, provide a natural laboratory for research in tropical ecology that is unique and has scarcely been utilized. Although a certain amount of marine research has centered around atolls, their biota is so simple that it has not attracted much attention from students of land ecology. However, this very simplicity provides a situation almost ideal for studies of total environment and of human adaptations to and effects upon an environment.

Ecological research may take many forms. Essentially, ecology is a point of view from which almost any subject matter may be considered, that which emphasizes the interrelationships of living things and their environments. One of the most interesting types of such research is the study of a situation to determine what organisms inhabit it, what effects the various characteristics of the situation have upon them, what effects they have on the physical surroundings, and, finally, what effects they have upon each other. This applies not only to individuals of different kinds, but also to the members of one population of the same kind. The most severe competition of all is that between members of the same population. Further, it must not be overlooked that man is, of all the kinds of organisms in almost any situation, the one that exerts the strongest and most general influence.

Situations are usually selected for study because they are representative of a class of similar ones, so that the results of the research may be applied to the others of the class and may be compared with results of similar studies of other representatives to arrive at generalities. As in many other fields, the ecologist studying situations is able to adopt either of two very different approaches, that of studying one or a few examples very intensively, or that of studying many examples but much less thoroughly. Which of these approaches is best is a philosophical question that is not likely to be solved very soon. It seems unquestionable, however, that where both methods may be applied to one problem, the results will be more sound than those from either one or the other.

The complexities dealt with by ecology are probably greater than those facing any other science. Involved are, necessarily, a complete knowledge of the physical situation and the organisms in it, and their characteristics, requirements, and behavior. This is merely basic information. Then the innumerable processes taking place must be detected and understood. Finally, the effects of these processes on each other and on the various organisms must be determined, and an understanding of the resultant of all of these processes and effects arrived at, which should be an understanding of the situation itself. This ideal final product, this understanding of total environment, is the ultimate objective of ecological research.

Its value is so apparent that it scarcely needs to be pointed out. Such understanding furnishes the only real basis for complete control over a situation, the only basis for predicting the consequences of any use or alteration of any

factor in an environment, and the only possible basis for any rational sustained program for permanent habitation of any area by man or his dependent organisms. In other words, it is the only completely sound foundation for conservation and management of any segment of the total resources of the world we live in.

Most ecology gives the impression of being mired down in such a mass of complexity as to be getting nowhere, or of dwelling on single items out of context of the web of which they are a part. This is a logical result of the enormous complexity of almost all situations, and is likely to be extremely discouraging to one who has vision enough to see the whole picture.

The logical way out seems to be to begin with some of the simpler classes of situations. An understanding of some of these may well provide the methods and basis for approaching more complex ones. And, indeed, such an approach seems to have given the best results so far. The ecology of the far north, of deserts, of ponds and lakes, of certain grasslands, and of moorlands have made the most substantial progress.

Coral atolls provide another class of such simple situations, and one of the few possible ones in the tropics.

One of the reasons why a study of total environment is one of the most refractory and difficult of all lines of investigation is that it does not lend itself readily to an experimental approach, as the very process of experimentation will certainly modify the environment being studied. Ordinary experimental technique consists of keeping certain variables constant and manipulating others, in order to ascertain their effects. The nearest thing to a possibility of such an approach in studies of total environment is in a type of natural situation where certain factors are reasonably constant while others differ in various examples.

Coral atolls present nearly an ideal set of such situations. They are flat, eliminating all of the variables commonly associated with altitudinal differences. They are tropical and oceanic, eliminating significant temperature differences. They are calcareous, eliminating most significant substratum differences. They are structurally simple, minimizing hydrologic complexities. Their flora and fauna are small, reducing biological influences and making the biotic communities relatively simple. Thus a fairly understandable basic ecological pattern is discernible. Over this are laid variations in precipitation, size of island, distance from geographic sources of fauna and flora, period of human occupancy, cultural character of human occupancy, etc.

Understanding of the effects of these variable factors and of the functional dependencies between them and other factors may be approached by making comparative studies of several different atolls exemplifying differences in such variables as mentioned above. Comprehensive studies, such as those made on Arno by a team of workers, would be highly significant if available in addition for, say, a small dry atoll in the central Pacific, a small moist atoll in the central Pacific, a moderate sized moist atoll remote from large land areas, such as in the Tuamotus, an uninhabited moist atoll, possibly Maria in the Australs, and an atoll near large land areas, such as one in the Melanesian area, i.e., Sikiana.

If, over a period of several years, such a series of detailed, integrated investigations might be made, a fairly broad base of modern reliable comparative information would be established. Into this would be integrated the enormous amount of existing information being brought together by the bibliographic phase of the investigation. As a result it might be possible that a coherent and understandable picture of a limited tropical total environment would emerge, comparable to that developed for English mountains and moorlands by Pearsall (1949).

The significance of this in terms of human values is quite clear. There is no question that, in spite of the limitations of this atoll type of environment, human populations are going to live there, just as they have for many hundreds of years, at least. Atoll peoples had, left to themselves, evolved a mode of life very well fitted to this environment, and in a fair equilibrium with it. Though rigorous and simple, it was, so far as we may know, a happy and satisfactory existence. These peoples had come to terms with their environment and made the necessary adaptations for life in it.

During the past century and a half, expanding Western European Civilization has burst in upon these self-contained microcosms, inevitably shattering the equilibria established over the previous centuries. Disease, an altered religion, commerce, war, and confusion were the gifts of this alien culture. To some this change may be a matter of regret, to others merely a matter of intellectual interest, to still others it is moral elevation, while some call it "progress". At any evaluation, it must be accepted as a fact, and as irreversible. Modern transportation has become so effective that isolation, even for these remote atolls, no longer exists. The influence of western culture must now be reckoned with as a factor in any new equilibrium that is brought into being. Life for these people is thereby enormously complicated.

If modern science is to be of any real benefit to these peoples, as well as to others, it is probable that it must be in helping them to come to terms again with their environment, the new environment that has resulted from the shattering of the old. It is here that ecology, particularly the aspect of it dealing with understanding of total environment, is of vast importance. Understanding is certainly the first requisite toward dealing with anything. If this study of atolls contributes, over the years, to the readaptation of atoll peoples to their place in the world, as well as providing a key to the understanding of other, more complex total environments, it will have amply justified itself.

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