NOTES AND COMMENTS

FUNDAMENTALS OF ECOLOGY[1]

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In addition to being the first attempt in several years at a concise, introductory treatment of the fundamentals of ecology, this book commends itself to evolutionists as a radical and refreshingly dynamic approach that emphasizes those principles and concepts that apply most to evolutionary problems. The study of group organization, or population and community ecology, is viewed by the author as "the unique part of ecology" that gives it an identity separate from work in other fields. Coupled with a sound, thoughtful treatment of energy relationships as the basis of community organization, this thesis provides a key to the content and organization of the book.

The usual "factor approach," which begins with individual factors and works toward the community level in what is assumed to be a logical development from simple to complex, has been abandoned entirely. Instead the book is divided into three main sections covering (1) the basic principles and concepts that apply to population and community activity generally, (2) freshwater, marine, and terrestrial habitats, their general characteristics and organization; and (3) applied ecology. In other words, the reader is introduced to ecology at the level of complexity he knows, namely the natural community. Individual factors are considered in their specific relations to particular events, but not until a groundwork of governing principles has first been established.

Although the general tone of the book seems often rather elementary, even for the most retarded freshman, some chapters are exceptionally good. Chapter 6 on "Principles and concepts pertaining to organization at the species population level" is without question the most competent and thorough introduction to population ecology that is available to the beginning student in this field. It cannot however, nor is it intended to, replace the definitive treatment of this subject by T. Park in "Principles of animal ecology" (1949), and in general readers will need to refer to this volume for a complete understanding of any particular problem.

In spite of excellent content, well-chosen examples, and a thoroughly reliable digest and outline of most of the basic principles and concepts in the field, this book suffers from inconsistent writing and an unfortunate style of presentation—each topic numbered and discussed under the subheadings *statement, explanation,* and *example.* It is difficult to believe that students and general readers need such a crutch and, certainly, it is not a device that offers serious competition to a well-written text.

GENE DISPERSAL AND THE ETHOLOGY OF THE RHINOCEROTIDAE

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Two species of *Rhinoceros* and one of *Dicerorhinus* exist in small numbers in Asia and two species of allied genera in rather larger numbers in Africa. The commonest of the Asiatic species is the Great Indian Rhinoceros *R. unicornis* of which Salim Ali and Ripley in Ali (1949) believe about 300 exist in the territory extending eastward into Assam. Ripley (1952) has brought together the available information on its territorial habits and breeding, which makes a most curious story. The individual animals of either sex live solitarily on definite territories during the greater part of the year. Such territories consist of a small pond around part of which is open grass land. Each territory is marked by a central dunghill and often by small such hills in its peripheral parts. The females apparently come into heat between February and June. The gestation period appears to be nineteen months, followed by a lactation period of several months. The female therefore cannot breed annually. There is evidence derived from captive animals that the male is sexually active for a very short period during the first half of the year. All local observers indicate that periodically the animals leave their territories and wander about over considerable distances. Ripley obtained evidence that this can happen in March, during the middle of the putative breeding season. He supposes

[1] Fundamentals of ecology by Eugene Odum. W. B. Saunders Co., Philadelphia, 1953: 1–384, figs. 1–119, $6.50.

that the wandering permits a female in heat to meet a bull that happens to be sexually active, and that this vague and random method of finding a mate has developed in the absence of environmental control except of the vaguest kind, in an animal whose whole female reproductive cycle from heat to the end of lactation is considerably greater than the annual seasonal cycle. There is a little evidence that in the almost extinct *Dicerorhinus sumatrensis,* the distance of wandering is even greater than in *R. unicornis* (Ansell, 1947). It is said that males and females may mate between July and October. It is obvious that in a population of not more than fifty individuals spread over a wide area from central Burma to southern Malaya random wandering during an ill-defined breeding season is not likely to produce many fertile unions and it is very difficult to see how *D. sumatrensis,* the smallest known living rhinoceros, will be able to survive even if it remains unmolested. Hoogerwerf (1950) reports ten Javan rhinoceros, *R. sondaicus* living in a single reserve in west Java. Nothing is known of this species' breeding behavior.

The African Black Rhinoceros, probably with five valid subspecies, was formerly distributed over the greater part of the thorn scrub and savannah areas of Central Africa; it is still probably the commonest of the five species. The White Rhinoceros, *Ceratotherium simum,* has existed during historic times in two populations which are highly discontinuous and subspecifically distinct, one on the west bank of the Nile in the Sudan and Uganda, the other in the Union of South Africa. Of the southern nominate subspecies, from one to two hundred specimens still survive in the Zululand Game Reserves. In a recent semipopular article Attwell (1948) has given some ethological notes on the rhinoceroses of Zululand that provide an interesting contrast to Ripley's observations. In Zululand the Black and White Rhinoceroses are essentially sympatric, but are ecologically differentiated. The Black feeds on bushes and trees, mainly *Acacia* and *Spirostachys*, while the White eats grasses and small shrubs. The Black appears to live either solitarily or in mated pairs; it is strongly territorial and very static, while the White may form small groups which wander. The curious habit of making a dunghill is exhibited by the White, but the Black, though it deposits its excreta in one place, is careful to spread them as if manuring a garden. It is quite clear that the two African and the Great Indian Rhinoceroses have different specific types of territorial behavior and it seems possible that the smaller almost extinct Asiatic *D. sumatrensis* resembles *R. unicornis* more closely than either African species in this regard.

It is clear, therefore, that within this closely allied assemblage of animals we have very different types of population structure. In *R. unicornis* and perhaps in *D. sumatrensis* the effective breeding population would be, under natural conditions, a very large fraction of the whole population, while in *Diceros bicornis* very small effective breeding populations would be expected. *C. simum* perhaps occupies an intermediate position.

At present the behaviour of *R. unicornis* and still more of *D. sumatrensis* is highly unadaptive. If their populations were larger, as in prehuman times, a rapid distribution of genes throughout the whole population would be expected. In the two African species the opportunities for random fixation of genotypes in local populations must be considerably greater than in the wandering species. It is the purpose of this note to call these conclusions to the attention of palaeontologists and others interested in evolution, as it is just possible that variations in evolutionary rate, dependent on differences in population structure, might be discovered in the different lineages in the family.

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