

## REVIEWS

## EVOLUTIONARY ECOLOGY

The science of ecology has matured dramatically in the last few years. From what was primarily a descriptive science has developed a new, mathematically-based, evolutionary ecology. Much of the growth in ecology has been into complex areas such as community matrix, biogeography, niche relationships and others incorporating genetics and population biology areas that were originally expressed mathematically, and that are sometimes difficult for the undergraduate student (and instructor) to comprehend. The problem, then, is to present these ideas along with traditional ecology concisely and correctly with a minimum of rigorous mathematical descriptions.

Several excellent texts have recently appeared to fill this new niche. Eric Pianka's *Evolutionary Ecology*<sup>1</sup> has achieved the purpose better than any I have seen. Pianka has the unique intellectual capacity to restate a complex idea or abstraction in terms understandable even to the novice. Several of his best known papers (e.g., on r and K selection and latitudinal gradients of species diversity) reviewed current theory, organized it and made previously confusing concepts easy to understand. His simplifying talent is now applied to the full range of topics in evolutionary ecology. The new concepts are logically integrated with the traditional, providing a satisfying picture of ecological theory today. Not only students will benefit from this book; professional ecologists whose area of expertise is not population biology who wish a complete and understandable explanation of recent concepts will benefit as well.

The introductory chapter outlines the scope of the book and reviews Mendelian genetics and natural selection. At its end there is a short section discussing tolerance limits and Levins' "principle of allocation." In essence this "principle" states that genetic adaptation to a particular set of environmental variables is not achieved without some "trade-offs." This idea sets the context in which the evolutionary biologist should view the material that is to follow.

Chapter 2 describes the general physical environment of the earth. Global determinants of climate and the earth's macroclimatic provinces and seasonality are discussed. This chapter sets the background on which all life exists. The following chapter, "The interface between climate and vegetation," is a brief treatment of plant ecology, biomes, microclimate, primary production, soil science and limnology. As brief as this chapter is, the material is well-covered for the purpose. It is well written and the pertinent points are noted without being belabored.

Chapter 4 begins the main theme of the book—population ecology. A clear description of life tables—their construction and utility is given—followed by sections on net reproductive value, age distribution, population growth and regulation. The important subjects and theories are treated with minimal exemplification. Instead, Pianka presents his own interpretations, thereby decreasing the verbiage, and, often, the contradictions and confusion that exist in literature. This tactic is used throughout the book. The remainder of chapter 4 treats concepts and theories bearing on the internal relation-

ships and evolution of populations: density dependence vs. density independence, r and K selection, evolution of reproductive and death rates, territoriality, foraging strategy, and sexual selection. The chapter ends with an enlightening discussion of social behavior and kin selection.

Chapter 5 treats interactions between populations emphasizing competition and predation. Starting with Lotka-Volterra, a lucid picture is developed incorporating various later theories and experiments. Mathematical treatments are held to a minimum; explanations and some pertinent examples are used in a manner that easily and adequately describes the history and relevance of these areas of intensive ecological investigation. The emphasis is on evolutionary consequences of the interactions. The chapter ends with sections on co-evolution and symbiosis.

Chapter 6 is devoted entirely to a discussion of ecological niche. Various and conflicting concepts of niche have caused more confusion than probably any other abstraction in ecology. Pianka, by setting the divergent ideas of niche in a separate chapter instead of leaving them intertwined with other discussions such as feeding and competition, has elucidated many of the ambiguities. A definition of niche is developed and various aspects such as niche breadth and niche overlap are treated in detail.

Chapter 7 on community structure includes conventional ideas such as food webs, trophic levels, and Eltonian pyramids. Integrated with these traditional views are community matrix; species diversity concepts; community stability; ecological equivalence; and community evolution. Chapter 8 is a summary of MacArthur and Wilson's *Island Biogeography* (1967, Princeton Univ. Press). Simberloff and Wilson's (1970, *Ecology* 51: 934-937) more recent tests of the equilibrium theory are discussed as well as the classical examples of the Galapagos finches and Krakatau recolonization.

The final chapter deals with man's relation to the ecological-evolutionary principles previously described. This is a brief overview of human population growth and man's exploitation of nature. The chapter ends with an "ethic of equilibrium" and a hopeful outlook for the future.

This is an excellent text for an undergraduate course in ecology. It is broader than the title implies. It is a relatively short book and could easily be covered in a one-quarter course for which it appears to be designed. The writing style is highly compressed, keyed on content and communicates an enormous amount of information to the student in a short space. There are few illustrations other than necessary graphs and no color photographs. A subject guide to selected references at the end of each chapter is provided for those who wish to pursue the original literature. This book will both educate and stimulate emerging biologists by giving them the fundamentals of modern ecology in the best achievable form.

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<sup>1</sup> Pianka, E. R. 1974. *Evolutionary ecology*. Harper & Row, New York. viii + 356 p. \$13.95.