A Species in Crisis

Conservation Biology and the Black-Footed Ferret. ULYSSES S. SEAL, E. TOM THORNE, MICHAEL A. BOGAN, and STANLEY H. ANDERSON, Eds. Yale University Press, New Haven, CT, 1989. xviii, 302 pp., illus. $40.

The recent history of the black-footed ferret is probably one of the best known stories in modern conservation. It has many of the characteristics of a good story, but also many that effectively illustrate the evolving sciences in conservation biology. The species was once widespread over much of the North American Midwest and largely dependent upon prairie dog colonies for food and shelter. Loss of the prairie habitat and systematic efforts to remove the prairie dogs led to its decline, and it was believed to be extinct until the chance rediscovery of a colony in Wyoming in 1981. Subsequent studies failed to locate further colonies, and it was agreed that a captive colony should be established as a safeguard for the species. Unfortunately, just as this initiative got under way an outbreak of canine distemper led to the death of all the captive animals and most of the remaining wild population. An effort to capture all the remaining ferrets was agreed on, and by the end of 1986 there were 18 wild-caught ferrets in captivity—probably all that remained of the species. Since then, captive management has resulted in a more secure population of over 150 animals, but only after the intensive application of systematic, molecular, population, and reproductive biology, not to mention over 2 million dollars.

This book arose from a meeting held in 1985, before the captive population was established, and its content reflects the concerns prevailing at that time. As Seal makes clear in the introductory section, the 19 chapters do not attempt a comprehensive treatment of conservation biology. Habitat management, disease control, nutrition, behavior, and other relevant topics are omitted because the critical need was to safeguard the species. First, successful reproduction was essential, and six chapters describe factors involved in natural and artificial reproduction, including the emerging technologies of embryo transfer and cryopreservation of gametes. Almost nothing was known of the basic biology of the black-footed ferret, and it was necessary to know much more. The morphological and molecular systematic studies by Anderson and by O'Brien *et al.* indicated that both polecats and other ferrets were sufficiently closely related to the black-footed ferret to serve as models, and most of the detail on reproduction is about these species. Of more general interest is a review of embryo technology by Wildt and Goodrowe, which presents some intriguing possibilities for the future but emphasizes that these were unlikely to be immediately useful for the black-footed ferret.

The book is very much a book of the crisis, and the chapters that will stand the test of time are those that address more general issues in the management of critically endangered species. A lesson to be learned throughout the sections on population biology and management is that species rescue is considerably more likely and less traumatic (for both the animals and the decision-makers) when the populations to be drawn on are in the thousands rather than in the tens or even hundreds. Demographic and genetic problems as well as more general extinction models are dealt with in detail in chapters by Ballou, Harris *et al.*, and Lacy and Clark. Much classical population biology theory, derived from models assuming infinite population size, has little relevance to small populations, where chance plays a major role, and new methods are needed. Brussard and Gilpin present a simple simulation model of colony extinction and recolonization and conclude that long-term management of the species will require multiple reserves with managed migration of individuals. Most of the chapters on population biology, and the management plan by Ballou and Oakleaf, suggest that reasonable goals for maintenance of genetic variability and demographic stability can be achieved if the population is expanded rapidly to a size of about 250 and a reintroduction program then initiated. Certainly during the gestation of the book the program has moved toward meeting these goals.

Another respect in which we clearly need to refine our skills is the making of decisions at moments of crisis when almost everything is uncertain. Emotions can run high, and the tendency may be to postpone action for fear of doing something disastrous. In the business and commercial world such situations are also common, and Maguire shows how decision theory can be applied just as well to conservation issues. There are differences, though, in the aims of conservation and of commerce; in the latter optimization is appropriate, but in conservation planning a course of action that is least likely to do irrevocable damage may be preferable.

The subject matter of this book is very broad, but its focus is narrow: a particular species at a particular time and place. While the specific applications will go out of date, the principles will become more and more significant as we face the same situation with more and more species. Many other works in conservation biology are felt to be too theoretical and hard to apply to specific cases. This is not so here. This is a practical book including chapters by leading theoreticians, and the authors and editors do an excellent job of taking general principles and applying them to a species about which very little was known.

GEORGINA M. MACE
Institute of Zoology, Zoological Society of London, London NW1 4RY, United Kindgom

Ecological Prediction

Biological Invasions. A Global Perspective. J. A. DRAKE *et al.*, Eds. Published for the Scientific Committee on Problems of the Environment, International Council of Scientific Unions, by Wiley, New York, 1989. xxiv, 525 pp. $146. SCOPE, 37.

This book is the culmination of an almost decade-long investigation of biological invasions sponsored by the International Council of Scientific Unions' Scientific Committee on the Problems of the Environment (SCOPE). It has significant redundancies with earlier volumes produced by regionally based SCOPE studies of invasion (see Ted Case's review of three of these in *Science* **236**, 1000 [1987]), but it is the most comprehensive. It is thus the best single book of the series for a personal library or for a graduate seminar. A central theme of this final volume is predictability—which species will fail to establish themselves in a new biogeographic region and which will succeed and with what consequences—and it is this topic I single out for review.

Biological invasions have been the ecological problem of the second half of the current millennium. Driven primarily by the movement of Western humans over the planet, exotic invaders have been the single greatest cause of species extinction, and certainly the major nexus between economics and ecology. Thus the intellectual focus of the SCOPE exercise was defined at the outset with two simple, seemingly straightforward questions: What are the factors that