

**William L. Robinson**  
**Eric G. Bolen**



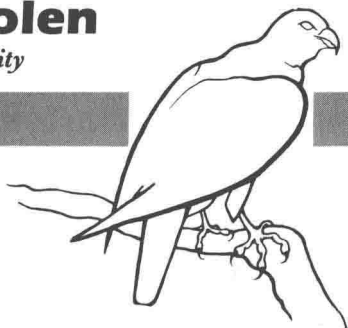
# **Wildlife Ecology and Management**

**William L. Robinson**

*Northern Michigan University*

**Eric G. Bolen**

*Texas Tech University*



# **Wildlife Ecology and Management**

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# Foreword

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Recent polls confirm that most Americans willingly support, in substantial measure, social and economic adjustments necessary to maintain our heritage of wildlife resources. This book stems from an appreciation for that heritage and regard for those young men and women who dedicate some or all of their education to the study of natural resources. Their commitment deserves a text integrating the principles and practices that form the basis of wildlife management. *Wildlife Ecology and Management* is such a book.

William L. Robinson and Eric G. Bolen have prepared an informative new text summarizing the growing volume of wildlife research findings and management experiences in a coherent, concise format. Virtually all elements of wildlife management are examined in relation to basic land and water uses affecting the landscape. Habitats essential for production and survival of wildlife are treated in connection with a coordinated, integrated management of forests, ranges, and farms. Factors influencing wildlife populations, including behavior, diseases, predators, and harvest, are covered in practical discussions. Overall, the book demonstrates that more intensive management of wildlife populations and habitats is necessary, feasible, and in the best interests of society. With sensitive management, wildlife can be perpetuated, continue to stimulate the economy through wildlife-associated activities, and provide citizens with untold hours of enjoyment.

The evolution of wildlife policy and administration in the United States began in 1639 when the Rhode Island Colony declared a closed season on deer hunting. Legal cornerstones provided subsequently include the Lacey Act (1900), Migratory Bird Treaty Act (1918), Endangered Species Act (1973), and Fish and

Wildlife Conservation Act (1980). These and other acts based on the long-standing public trust doctrine of law provide a firm legal footing for managing wildlife populations and their habitats on a comprehensive basis.

Responses to increasing demands for improving management of wildlife and related natural resources are set forth by the authors in a number of instructive case histories. These examples show that, given firm public support and adequate funding, the wildlife profession is capable of restoring and maintaining viable wildlife populations. Wood duck, white-tailed deer and other populations once reduced to perilously low numbers have responded to scientific management. Other species with depressed populations await application of management prescriptions based on the ecological principles and practices elaborated in this text.

While the ecological principles remain firm, management prescriptions for perpetuating wildlife populations and habitats—as the authors describe—must be molded to fit a variety of landscapes. For example, the scientifically based recovery plan for wolves in Minnesota blends ecological, economic, and social considerations in three management zones, each with specific objectives. The overall management strategy is designed to maintain the wolf population, control livestock losses, improve public attitudes toward wolves and the Endangered Species Act, and increase local support for maintaining the wolf population.

This comprehensive work clearly shows that wildlife must be subject to some degree of management if its populations and habitats are to be maintained as elements integrated in economic developments. The

trial-and-error approaches of the past now are being replaced with scientifically based management plans that meld social and economic considerations with ecological dimensions. New strategies focus on the design and maintenance of desired habitat patterns for wildlife communities. Except for species or populations in dire or precarious straits (e.g., threatened or endangered), specific management plans for each species of the 700 birds, 660 freshwater fishes, 380 mammals, 460 reptiles and amphibians, and the even larger number of invertebrate and plant species, in the United States lie beyond the realm of practicality. Instead, multidisciplinary teams of resource managers are required to coordinate land and water planning, to provide desirable habitat patterns—particularly vegetation of different types and ages—to perpetuate overall species richness in delineated landscape units. Intensive land and water developments dictate that fish and wildlife habitats must be fitted into plans for wilderness, rural, and suburban areas—including backyards. While some accomplishments have been registered, much remains to be done.

The authors challenge students to absorb more than segmented scientific knowledge in order to deal with a variety of subject areas and the public in resource planning and management. Natural and man-dominated landscape communities function as dynamic systems. An understanding of their workings, together with better development of communication skills, must receive greater emphasis if young biologists and managers are to perform effectively in the future. Similarly, seasoned employees in natural resource

agencies must be encouraged with opportunities for in-service training to incorporate new knowledge into their thinking and activities. This book is a valuable reference for these important purposes.

The authors identify the pressing need for continuing research. New facts and more refined understanding are needed for the application of ecological, economic, and social concepts in wildlife management. Devastating impacts associated with “acid rain” emphasize that ever-changing conditions require new studies. Findings are needed to develop approaches to manage man-made environmental factors that shape landscape units and associated wildlife communities.

Students considering a career in resource management should recognize the complexities and frustrations, as well as the joys, of working with wildlife and other wild living resources. A successful career is built on solid academic preparation, practical field experiences, love for the out-of-doors, and dedication to wise use and stewardship of natural resources. Professionals and nonprofessionals alike must understand the needs for and approaches to sound management. Only as informed citizens can we help strengthen resource management.

*Wildlife Ecology and Management* contains a wealth of useful information for all students, educators, and citizens. For experienced resource administrators and managers, it can help improve professional performance and provide insight for shaping attitudes in social and political arenas. It is in these arenas that the nature, magnitude, and application of scientific resource management for wildlife will be determined.

Laurence R. Jahn, Vice-President  
Wildlife Management Institute  
June 1983

# Preface

The purpose of this book is to introduce students to the science of wildlife management. We hope our audience includes nonmajors as well as students beginning a formal curriculum in wildlife management. Growing numbers of students from other disciplines are selecting elective courses in natural resources and, for this reason, we have tried to provide a comprehensive text for all who might use our book in their first—and perhaps only—course in wildlife management.

To accomplish our purpose, we have presented discussions of traditional topics such as population dynamics and management of game animals as well as some newer concepts such as management of endangered species and of urban wildlife. The approach includes descriptions of classical situations where, for example, students might learn of predator–prey interactions revealed by long-term studies on Isle Royale. Contemporary issues such as acid rain and clearcutting also are included, for it will be the students of today—from all walks of life—who tomorrow will assume the leadership needed to resolve these matters. Indeed, our assumption is that wildlife and other natural resources not only *can* be managed by a knowledgeable society, but *must* be managed as an integral part of the community of life to which mankind belongs.

Human attitudes toward wildlife vary, of course, with some individuals advocating hunting as a legitimate human pursuit and others championing the fullest measure of animal rights. Nonetheless, wildlife remains central to either point of view and, with either, scientific understanding should be a fundamental requisite. Thus, throughout the text, our intent has been to link principles of ecology with their application

toward managing wildlife populations and their habitats. We trust this book serves as a beginning for that comprehension.

The authors, whose personal and professional friendship began in the late 1950s when both were wildlife students at the University of Maine, now teach wildlife management at two state universities widely separated by both philosophy and geography. Liberal arts are stressed at Northern Michigan University, and only a single course in wildlife management is offered there in a biology curriculum. At Texas Tech University, a wildlife management program is offered from B.S. to the Ph.D. degree. We believe these differences have helped shape our focus in preparing this text.

The sequence of chapters begins with an introduction to the subject of wildlife management, then proceeds to a series of chapters dealing with ecological principles such as the functioning of ecosystems and communities, populations, animal behavior, and the basic requirements of food, cover, and water. Major human impacts upon the ecological well-being of wildlife follow in chapters devoted to farming, range management, and forestry, along with the interactions each of these forms of land use may have with wildlife management. Direct mortality from diseases, predation, and hunting then are discussed, followed by a treatment of the special management of urban settings, exotic animals, and endangered species. Concluding chapters address economic values and policies developed for wildlife in North America.

Other arrangements may better suit the needs of individual courses and instructors and, to that end, we have tried to write the chapters as independent units so that their sequence may be altered in classroom pre-

sentations. For example, scientific names are repeated the first time a species is mentioned in each chapter. Critical readers of the entire book will find places where some subjects are repeated. Much of this was unavoidable in order to maintain the independent status of each unit. Wildlife ecology and management have many facets defying categorical treatment under the headings of a single chapter, and we necessarily have reemphasized some topics to assure the chapter-by-chapter coverage we desired.

Also, in keeping with current scientific standards, we have used metric units and, except for such awkward and unavoidable units as "acre-feet," we have transformed English units from earlier literature into metric measurements. This, at times, required use of qualified statements such as "about 2.5 nests per hectare," when the original source was the more definite "1 nest per acre."

No one could undertake the task we have attempted without the collaboration of many other persons. Some provided critical comments or called our attention to literature we overlooked. Still others offered advice and infusions of much-needed encouragement when the task seemed too great to complete. We acknowledge all who shared with us their time, expertise, and labor. Special mention goes to Alda S. Ingram and Patricia M. Wagner for tirelessly typing and retyping many drafts, often under the trying conditions associated with deadlines, endless alterations, and our own idiosyncrasies. Our families also shared with us the "agony and ecstasy" of the task, and we extend our heartfelt appreciation to them for bearing with us during the years we worked on this book. We appreciate copyright releases from The Wildlife Society, the Society for Range Management, and the Wildlife Management Institute, as well as from numerous authors who released copyrighted material for our use. Gregory Payne and Joel Brauser of Macmillan Publishing

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Finally, we thank our students who often served as willing test subjects for early drafts of the book. They read our work, commented freely, and, we trust, learned as we did from that experience. Our students were the reason we toiled, for they—and those who follow them—will assume the responsibility for maintaining a world enriched with wildlife.

W.L.R.  
E.G.B.

# **Wildlife Ecology and Management**



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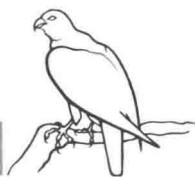
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## What Is Wildlife Management?

*The purpose of science is not to conquer the land, but to understand the mechanisms of ecosystems and to fit man into the resources he has available on the planet on which he has evolved.*

J. J. Hickey (1974)

A precise and universally agreed upon definition of the word *wildlife* does not exist. The term implies all things that are living outside the direct control of man, and therefore includes all noncultivated plants and non-domestic animals. But there is a definite tendency among professional and amateur groups that concern themselves with wildlife to favor the so-called “higher” forms of animal life, particularly birds and mammals. The *Journal of Wildlife Management*, a professional publication of The Wildlife Society, deals almost entirely with birds and mammals. *National Wildlife* and *International Wildlife*, published by the National Wildlife Federation and International Wildlife Federation, do give coverage to plants, invertebrate animals, fish, reptiles, and amphibians, but birds and mammals are featured disproportionately relative to their abundance in nature.

In the United States, fish were separated from other wildlife through a political decision made in 1940, when President Franklin Roosevelt combined the Bureau of Biological Survey, an agency that was concerned with native flora, birds, and mammals, with the

Bureau of Fisheries. The new agency was to be called the U.S. Wildlife Service; but when the fisheries people felt they might be neglected under such a name, Roosevelt added the words “Fish and” to the new agency’s title and signed the proclamation (Hickey, 1974). The meaning of the term wildlife was thereby restricted by implying that fish are somehow in a different category.

A definition of wildlife is implied in the definition of wildlife management given in the first issue of the *Journal of Wildlife Management* (1937): “the practical ecology of all vertebrates and their plant and animal associates.” The *Journal* further stated that wildlife management “along sound biological lines is part of the greater movement for conservation of our entire native fauna and flora.”

*Management* implies human decision and manipulation. Hickey (1974) expressed fear that management of wildlife is premised on the concept of conquering nature, and suggested that attempts by man to dominate nature contradict the ethic of conservation of resources. Wildlife management, according to Hickey, might better be termed wildlife conservation, as in

some circumstances the best technique for conserving a landscape is to leave it alone, and doing so may not fit the definition of management.

While in such instances the “best” management may be no management at all, the decision as to what is best is a human decision. Since we are human, we have, like all other animals, a natural bias toward our own survival. If a wolf (*Canis lupus*) could write a book about wildlife management, it might reflect some of the same concerns that informed humans have for preservation of natural communities, but it would also likely include more emphasis on perpetuating numbers of deer (*Odocoileus* spp.), moose (*Alces alces*), and caribou (*Rangifer tarandus*), and probably a section on control of an invading exotic species called man. A bald eagle (*Haliaeetus leucocephalus*) might see fit to emphasize reduction of pesticides and development of a more reliable fishery, and a book written by a sea turtle (*Chelonia* sp.) might contain information on management of marine algae, preservation of breeding beaches, and control of depredations by gulls (*Larus* spp.) on young turtles. Try as we might we cannot remove our human bias from our perception of dealing with animals and plants around us. We therefore suggest that *wildlife management is the application of ecological knowledge to populations of vertebrate animals and their plant and animal associates in a manner that strikes a balance between the needs of those populations and the needs of people.* Application of ecological knowledge involves three basic management approaches: (1) preservation by allowing nature to take its course without human intervention; (2) direct manipulation of animal populations by trapping, shooting, poisoning, and stocking, and (3) indirect manipulation of animal populations by altering the vegetation present.

## A Brief History

Until the 1960s, wildlife management was primarily *game* management, the husbandry and regulation of populations of birds and mammals hunted for sport. Game management continues to be an important part of the profession of wildlife management, but the wildlife manager now must expect to deal with songbirds and turtles in addition to grouse and deer. The days are gone when wildlife management was, as some wildlife students used to anticipate falsely but eagerly, “hiking, hunting, and fishing and getting paid for it.”

Wildlife management is changing, but its past remains relevant. The practice of wildlife management is rooted in the intermingling of human ethics, attitudes, and written laws. For example, a fundamental historical difference exists between the European and North American concept of ownership of wildlife. In European countries, with some exceptions, animals belong to landowners, and the responsibility for regulation of populations of animals is in their hands. Foresters with training in wildlife management and gamekeepers often are employed by large landowners to regulate hunting and to tend game animals that roam the premises. In North America, wildlife traditionally belongs not to the owner of the property that the animals inhabit but rather to the people of the state, or with migratory species, to the people of the nation. Although these differences affect the ways by which animals can be harvested and the segment of the public for whom the wildlife is managed, the basic ecological concepts governing wildlife in populations remain the same.

In the 1800s, wildlife management in North America consisted mainly of establishing hunting regulations. There was a feeling among some people that wildlife was a perpetually dwindling resource and regulations were designed to ration its use, making it last longer—simply postponing that ultimate fateful day when the last mule deer (*Odocoileus hemionus*) would be felled by a rifle shot, or the day when mallards (*Anas platyrhynchos*) could be seen only in zoos, and grouse only in museum cases. Recently, we have realized that wildlife is a renewable resource—one that, with proper management, can be perpetuated indefinitely.

Wildlife management was developed as a science in the 1930s largely through the work, example, and writing of Aldo Leopold (1933a), Professor of Forestry at the University of Wisconsin. State and federal governments began to recognize a need for scientific information to regulate hunting and fishing. Trained biologists were needed to census deer and ducks and to estimate the reproductive potential and harvest rates of grouse, to find ways to produce more pheasants (*Phasianus colchicus*) per hectare, and to restore wild turkeys (*Meleagris gallopavo*).

In 1937, the U.S. Congress passed the Pittman–Robertson Act, placing a 10 percent tax on all sporting arms and ammunition. The money was to be distributed to the states for wildlife management and research. This provided a substantial financial base



with which states could supplement their own wildlife management programs. Because P-R money came from hunters, it followed that its use would be directed toward the management of game species. Great strides were taken in understanding the biology of white-tailed deer (*Odocoileus virginianus*), in assessing the productivity and survival of ducks, and in learning details of managing many small game species. The three decades beginning in 1940 witnessed a number of achievements in scientific game management that permitted sportsmen to be reasonably sure that there would be animals to hunt each fall. But such success did not fully meet expectations of the public at large. New perspectives and expectations for wildlife management emerged in the 1970s.

Scheffer (1976) thoughtfully summarized some of the changes taking place in wildlife management in the United States in the late 1970s and 1980s. He noted that an increasing number of Americans are interested in wildlife but less interested in shooting and trapping. The influence of the hunter and the manufacturers of sporting goods upon state and federal wildlife programs must necessarily be lessened as nonhunters express these interests. Because wildlife programs for decades depended upon financial support of hunters, many hunters resisted the new influence from the nonhunters. But, Scheffer says, "I think that hunters and trappers must accept the probability that many, if not most, Americans, have a spiritual or emotional interest in wildlife which is as strong and as legitimate as their own."

Scheffer (1976) noted that the management of game species must be reconciled with ecological principles and that the goal of *maximum* yield, the desire of the hunter, must be supplanted by *optimum* yield, which takes into account the needs of society and those of other animals in the community dependent upon a hunted species. The wildlife manager will be called upon not only to know *what* and *how* to manipulate a population or community of organisms but also to be able to answer *why* he or she is doing so.

## What Does a Wildlife Manager Do?

The wildlife biologist must be a combination of researcher and manager. In seeking a solution to a problem of local importance, a biologist must be able to (1) explore the scientific literature and find parallel

situations that suggest an approach to solving the problem, and (2) determine, through field observation and often through laboratory analysis, the cause of a local problem.

Let us consider a hypothetical problem a wildlife manager might be called upon to solve. The Audubon Society Chapter of Columbus County observed over the past 20 summers that the number of eastern bluebirds (*Sialia sialis*) counted in the county declined from 200 to 20 pairs. The bluebird, predator on insects, prey of the merlin (*Falco columbarius*), symbol of happiness, and source of pleasure for many people is disappearing. What can Janet Smith, a wildlife manager, do to help restore bluebirds in Columbus County?

Assuming that her salary to investigate bluebirds can be paid, the wildlife manager must begin a systematic process first to determine the cause of the reduced counts of the bluebirds; then, if the decline in bluebirds is real, the wildlife manager must determine whether its cause is something that can be remedied by practical action, and must then take that action to restore bluebird numbers in the county. This assumes that a political decision has been made that bluebirds should be restored. A question the wildlife manager must ask is: Did the bluebirds really decline or have they moved to places where they are not being counted? Then, if they have actually declined, she must seek the reason. She will look into the published scientific literature on bluebirds in *Auk*, the *Wilson Bulletin*, and other ornithology journals. Is the problem local or have bluebirds declined on a national scale? Is the problem localized in the summer range or is there some deficiency in the winter range? Have there been weather changes that have affected bluebird survival? Is the cause of the decline in Columbus County man-made—from pesticide applications, say, causing either a food shortage or direct mortality of birds? Is it loss of dead trees with their cavity nest sites? Is it competition for such sites by starlings (*Sternus vulgaris*) or house sparrows (*Passer domesticus*)? Is it some combination of these factors? The answers may be found in a few weeks if good literature and good field data are available and good information on local bluebirds can be obtained, or it may take several years of careful fieldwork.

When the answers to these questions and others are found it may not be easy to implement a solution that would restore bluebirds. Suppose the cause for the decline of bluebirds is attributed to pesticides and the