Wildlife Management And the Maintenance of Biological Diversity

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Both forest management and wildlife management have traditionally focused primarily on commodity production—of timber and game species—but both practices are now in the midst of rapid change. The change has taken forestry from the Multiple Use-Sustained Yield Act of 1960, which expanded the purview of national forests to outdoor recreation, range, timber, watershed, and wildlife and fisheries, through the National Forest Management Act of 1976, which requires forests to maintain viable populations of all vertebrate species, to “New Perspectives,” a philosophy that reaffirms the need to manage forest lands for sustainable multiple use.

The New Perspectives philosophy is to be implemented through New Forestry, an approach to forest management that incorporates ecological and social values into silvicultural and other management decisions (Clark and Stankey 1991). In wildlife management, this translates into an emphasis on conservation biology, where the goal is maintenance of all wildlife populations, rather than production of a select few.

Both forestry and wildlife management were born at the turn of the century in times of crisis and were, in many respects, compromises. Vast clearcutting in the Intermountain West by “timber barons” and a drive by preservationists to set aside more areas as national parks and preserves led to the designation of large blocks of land as national forests. These were established, in part, to ensure a continuous supply of timber, something that was not considered a certainty at the time. Gifford Pinchot and others defined the term conservation as “wise use.”

Wildlife management had a somewhat similar history. Before European settlement, there were an estimated 60 to 100 million bison in North America. These populations were not significantly reduced on the Great Plains until the 1840s, and large declines did not begin until the years following the Civil War. The series of Homestead Acts during the mid-19th century, along with a desire to subdue the Indians in the West, led to widespread slaughter of the bison. A bill passed by Congress in 1874 to protect the remaining bison was vetoed by President Grant on the advice of
General William Tecumseh Sherman, who felt that elimination of the bison was the surest way to solve the "Indian problem."

Bison were not the only species driven to near extinction at the time. Elk, once common on the plains, were eliminated there and greatly reduced in the mountains. White-tailed deer, once found in all of the lower 48 states except, perhaps, California and Nevada, were virtually eliminated everywhere except in small pockets around the Great Lakes, the Adirondacks and some bayous in Louisiana and Mississippi. Pronghorn were almost eliminated, as were bighorn sheep and mountain goats. The passenger pigeon and heath hen (a subspecies of the prairie chicken) went extinct in the early decades of this century.

The emerging field of wildlife conservation initially focused on the populations obviously in decline. The new field had a dichotomy of purpose. Like many foresters, wildlife biologists often concentrated on production for human uses. Here wildlife managers accomplished a great deal of what they set out to: help game animals recover from near extinction. Another, until recently minor focus of the profession was on ecosystems, a broad range of species and non-consumptive uses. For reasons becoming increasingly apparent, that aspect of the profession is now particularly important.

Species extinction rates are high and accelerating rapidly worldwide. Although 1.4 million plant and animal species have been named, some experts estimate there may be as many as 30 million species on earth today (Wilson 1988). Current estimates project that about 25 percent of these species will go extinct in the next 30 years and that between one and four species are going extinct each day. Most of these are insects and plants, and most occur in the tropics.

Extinctions are due to many factors, but two have been predominant since 1600. Over-exploitation was the cause of about 33 percent of the mammalian extinctions (Fisher et al. 1969). The rate is much lower today, and most is related to the high value of certain animals and plants for the pet or medicinal trade.

By far the leading cause of extinction today is habitat alteration. Habitat for all species is changing rapidly. More than half of the wetlands present when Columbus landed in what is now the United States have been drained. Agriculture has claimed much of the prairies. Urbanization and suburbanization have claimed many low elevation areas, eliminating habitat of both game and non-game species.

For example, many studies indicate that the breeding populations of some long-distance migratory birds are declining (Terborgh 1980, Briggs and Criswell 1979, Robbins et al. 1989). Most of these authors suggest that deforestation in the migrants' tropical winter areas may be the principal reason for the decline, but others have conjectured that deforestation and habitat fragmentation of the breeding grounds may be contributing factors (Hutto 1988, Askins et al. 1990).

A recent study of the diversity of large mammals in U.S. national parks has suggested that these areas do not contain enough habitat for between

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one and seven percent of the mammals they once supported (Newmark 1985). In the 14 national parks examined, 42 species had already disappeared; these tend to be large species with large home ranges, and the parks are not large enough to contain minimum viable populations (Newmark 1987). For example, there are no longer any grizzlies or wolves in national parks in California.

The major factor behind both over-exploitation and habitat alteration is the over-population of one species — humans. The human population is now about 5.5 billion and increasing at a rate of about three individuals per second. Every three days, the earth has about 800,000 additional humans to support, representing ever increasing demands on natural areas.

Biodiversity can be defined most simply as the variety of life at all organizational levels. Biologists often define biodiversity at four levels:

- **Genetic** — the amount of genetic variation within a species. More variation is generally considered “good” because it allows a species to persist in the face of environmental change.

- **Species** — the number of species existing at a given time. This is probably the most commonly discussed category of biodiversity. A large number of species in an area is not necessarily considered good, however. The fact that there are now more plant species than there were 50 years ago in Glacier National Park attests to that since most of them are weeds (Martinka 1991). Maintaining species diversity refers to the natural complement of species in a particular community over an area of appropriate size. This, in turn, means consideration of much larger landscape contexts than people are accustomed to thinking about. For example, maintenance of migratory songbird populations in Montana may require conservation programs in Central America.

- **Community** — identifiable groups of plants and animals on a scale of hundreds or thousands of acres.

- **Ecosystem** — an area large enough to maintain viable populations of all the species found within them. These may be hundreds of thousands of acres in size. One example is the short-grass prairie ecosystem.

Processes are the ecological events that generate diversity at all of these levels — things such as fire, decay, nutrient cycling, insect epidemics, predator-prey relationship, etc. These processes are themselves valuable. It is probably not possible, and certainly not practical, to try to maintain all the genetic variants or populations of all species everywhere. Nonetheless, if higher order patterns and processes are maintained, the smaller parts of the system will also be maintained.

Why is it important to maintain biological diversity? A diversity of life has many values, some economic, some not. Many of the species that may soon be lost could be tremendously valuable to humans. The endangered manatee, for example, has blood that clots slowly, and some scientists believe that study of this species could lead to a cure for hemophilia.

Who would have guessed that bread mold would produce something as valuable as penicillin, that a small plant would yield digitalis for the treatment of heart ailments, that Pacific yew could be used to treat cancer? Approximately half of the prescriptions written in the United States contain a drug from natural origins. Some species are the progenitors of human food crops, and their genetic material may prove extremely useful in future cross-breeding projects.

Diversity also has other values that might not be considered as “essential.” Many people value the opportunity to see endangered species, which often have aesthetic appeal, either for their physical attractiveness or symbolic importance. Species have different value to different people, but the public is more informed and interested than it has ever been.

Every five years, the U.S. Fish and Wildlife Service surveys fish and wildlife “users” in the United States. The most recent published survey was conducted in 1985. While the percentage of the U.S. public that hunts has stayed fairly constant over the past 20 years at about 10 percent, the proportion of non-consumptive users has now reached 58 percent. Almost half of the households surveyed fed birds, and the total expenditures by non-consumptive participants totaled $14.3 billion (U.S. Fish and Wildlife Service 1988).

Among the different attitudes toward wildlife, utilitarian (primary
concern for animals' practical and material value) and negative (desire to avoid animals through either indifference, dislike or fear) attitudes appear to be declining. Those now on the increase are naturalistic (satisfaction in direct contact with wildlife and the outdoors), humanistic (strong affection for individual animals) and ecological (viewing the environment as a system of independent parts) (Kellert 1983, 1985).

Increasing ecological awareness and concern for the natural environment are results of this basic shift. Yet as both public attitudes and the natural environment itself are changing rapidly, critics of land and wildlife management agencies believe that the agencies have not moved very far from the single-species focus of the turn of the century.

Aldo Leopold, considered the father of wildlife management, wrote 50 years ago about the need for a broader ethic and concern. His classic A Sand County Almanac is still required reading in most wildlife curricula and is mailed to every new district ranger in the U.S. Forest Service's Northern Region by the regional forester.

Leopold called for a new ethic, one that extends the current set of ethics between individuals and between individuals and the community to one between individuals and the land:

In short, a land ethic changes the role of Homo sapiens from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow members and also respect for the community as such.

Land here is defined broadly to include all organisms. This relationship between individuals and the land requires obligations and responsibilities, as well as use (not instead of use). Again turning to Leopold:

The "key" log which must be moved to release the evolutionary process for an ethic is simply this: quit thinking about decent land-use as solely an economic problem. Examine each question in terms of what is ethically and aesthetically right, as well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise.

Regrettably, some interests (including some land management agencies) have used a veneer of ecological statements to further their respective causes. These include:

- [Clearcutting/hunting] mimics natural processes. Which natural processes do they mimic? Certainly not fire or insect outbreaks, which leave standing dead material ideally suited for primary and, later, secondary cavity nesters. Certainly not blow-downs — unless that natural process breaks trees off at the base and deposits them in another watershed — which also leaves dead material suitable for many species of small mammals. Fire makes nutrients available immediately, and insect and disease outbreaks release them slowly; clearcutting exports nutrients from a watershed. As for hunting, the age and sex structures of hunted large-mammal populations are usually very different from those in areas that are not hunted.

- Clearcutting will destroy the ecology of the ecosystem. Species come and go, relationships change, and an ecosystem can look very different after clearcutting. Ecology, however, cannot be destroyed.

- A [cutover forest/hunted population] is a healthy [forest/population]. This is certainly untrue for an organism that requires "over-mature," dead and dying trees. Many biologists would argue today that ecosystems are healthy when all stages of succession and the natural processes that produce them — fire, insects, predation, etc. — are allowed to occur.

- If this species goes extinct, the ecosystem may collapse. Species have gone extinct for millennia, with no evidence of ecosystem collapse. Something valuable is lost, and this will affect the manner in which energy flows and nutrients cycle, but ecosystems will surely not collapse.

- There are more [fill in the species] now than there were [fill in the time span] years ago. Yes, there are more Douglas-fir trees in young than in old stands, and game managers have successfully and
sometimes dramatically increased the numbers of some species. But is there a correlation between these increases and declines in taxonomic groups as dissimilar as amphibians and forest-interior songbirds?

- Every individual must be protected.
  There are those who argue that individual plants and animals have rights. Although that argument is beyond the scope of this article, it can be said that protection of all individuals is not usually necessary from an ecological viewpoint. Concern is more appropriate for species, communities and ecosystems, except when the population of a given species is very low and requires attention to individuals.

People see wildlife biologists and forests differently then they did 50 years ago. When both fields began, managers were seen as saviors of forests and animal populations. Now, increasingly, managers are seen as destroyers of pristine areas. Foresters are regarded as commodity-oriented, and wildlife managers are perceived as focusing on game production only, with an emphasis on harvest.

Caughey (1977) explained that wildlife management is actually a very simple field, in which there are really only three problems: 1) There are too many individuals of a particular species, and the goal is to reduce the population, 2) there are too few individuals of a species, and the goal is to increase numbers, and/or 3) how can yield from a population be sustained? Too often, critics claim, managers focus on number 3 when they should have recognized a fourth problem: Populations of many species are declining rapidly, species are disappearing, and we want to stop the trend.

Habitat set aside for individual species or species groups, such as waterfowl, undoubtedly benefits other species that require that type of habitat. One of the empirical facts of ecology, however, is that no two species occupy the same niche. In other words, there is no such thing as wildlife habitat: Each species has its own habitat requirements, and maintenance of conditions for one does not necessarily translate into proper conditions for any other. Unfortunately, biologists have operated under an “indicator species” concept, in which one species is used to indicate viable conditions for all other wildlife species. Because indicator species management is not the same as management for biological diversity, we now find ourselves in an awkward situation: We have lots of information about a very limited number of species.

Our purpose here is certainly not to condemn all consumptive uses of fiber and food from forest and plains ecosystems. Humans are a part of those ecosystems too. What we are calling for is adherence to the principles of “New Forestry,” an approach that represents “... a kinder and gentler forestry that better accommodates ecological values, while allowing for the extraction of commodities” (Franklin 1989).

We know that we have a long way to go before we can really see the effects of our tinkering. But habitat is being altered while traditional wildlife managers and others concerned with the maintenance of biological diversity argue. It is time to stop the bickering and get down to the business at hand — managing to meet the needs of a broader group of species and a much broader public constituency.

LITERATURE CITED


