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"Wilderness Wildlife: Research Opportunities and Limitations  
in Designated Wilderness Areas of the United States"

by

John C. Hendee, Assistant Director  
US Dept. of Agriculture-Forest Service  
Southeastern Forest Experiment Station  
Asheville, North Carolina

Clay Schoenfeld, Professor  
Wildlife Ecology and Journalism and  
Director-Center for Environmental Communications  
University of Wisconsin  
Madison, Wisconsin

James Peek  
Professor of Wildlife Resources  
University of Idaho  
Moscow, Idaho

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Wilderness wildlife: research opportunities and limitations in wilderness areas of the United States. Hendee, J. C. (USDA Forest Service, P. O. Box 2570, Asheville, North Carolina, 28802, U.S.A.), Schoenfeld, C. (School of Natural Resources, Univ. of Wisconsin, Madison, Wisconsin, 53706, U.S.A.) & Peek, J. (Department of Wildlife Resources, Univ. of Idaho, Moscow, Idaho, 83843, U.S.A.). The United States National Wilderness Preservation System contains 257 areas totaling 80 million acres (32 million hectares). These areas are managed for naturalness and solitude and provide unique opportunities to study wildlife under natural conditions. But few areas are large enough to contain whole ecosystems and, despite protective management, man's activities, such as from fire suppression, management, recreational use, mineral exploration, and livestock grazing, upset naturalness. Research and other uses of wilderness are controlled by restrictions embodied in law, regulation, policy, tradition, physical difficulty, and expense. Research is needed to provide important information about habitat and native animal population responses to massive natural disturbance, normal predator-prey relationships, and natural baselines for comparison with managed conditions. Scientific values of wilderness will be greatest if they are managed to preserve naturalness and solitude to the greatest extent possible.



" W I L D E R N E S S   W I L D L I F E :  
R E S E A R C H   O P P O R T U N I T I E S   A N D   L I M I T A T I O N S  
I N   D E S I G N A T E D   W I L D E R N E S S   A R E A S  
O F   T H E   U N I T E D   S T A T E S "

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John C. Hendee, Assistant Director  
US Dept. of Agriculture-Forest Service  
Southeastern Forest Experiment Station

Clay Schoenfeld, Professor  
School of Natural Resources  
University of Wisconsin

James Peek  
Professor of Wildlife Resources  
University of Idaho

INTRODUCTION

The National Wilderness Preservation System (NWPS) in the United States consists of public lands that are essentially roadless and natural and have been legally designated as wilderness to protect their qualities of naturalness and solitude. With some exceptions, motorized uses and developments such as roads, recreation facilities and timber harvest are prohibited. The NWPS was established by the Wilderness Act of 1964 which designated 54 wilderness areas totaling 9.1 million acres (3.68 million hectares), and directed review of another 34 areas totaling 5.4 million acres (2.2 million hectares) for possible designation as wilderness. The Wilderness Act also set basic management direction and established procedures for future study, review and possible designation of additional lands proposed as wilderness. By the end of 1980, 257 areas totaling nearly 80 million acres (32.4 million hectares) had been classified as wilderness; about 56.4 million of those acres (22.8 million hectares) are in Alaska (see Table 1). Another 40-60 million acres (16.2-24.3 million hectares) may be potentially suitable for wilderness classification because of their essentially roadless and natural condition.

Wilderness areas are managed by the public agency having jurisdiction over the lands of which they are a part. Wilderness areas have been established in National Forests, National Parks, and Wildlife Refuges and on Public Domain lands administered by the Bureau of Land Management.



Table 1.--Areas in the National Wilderness Preservation System as of December 31, 1980, by Management Agency and Alaska Versus Other States.

States included and management agency	No. areas	Million acres	Million hectares	Percent
<u>Lower 48 States &amp; Hawaii</u>				
Forest Service, USDA	144	19.77	8.00	84.4
National Park Service, USDI	26	2.98	1.21	12.7
Fish and Wildlife Service, USDI	44	.66	.27	2.8
Bureau of Land Management, USDI	(4)	.01	--	0.1
TOTAL	214	23.42	9.48	100.0
<u>Alaska</u>				
Forest Service, USDA	14	5.36	2.17	9.5
National Park Service, USDI	8	32.36	13.10	57.4
Fish and Wildlife Service, USDI	21	18.68	7.56	33.1
TOTAL	43	56.40	22.83	100.0
<u>All States</u>				
Forest Service, USDA	158	25.13	10.17	31.5
National Park Service, USDI	34	35.33	14.30	44.3
Fish and Wildlife Service, USDI	65	19.33	7.83	24.2
Bureau of Land Management, USDI	(4)	.01	--	--
GRAND TOTAL	257	79.80	32.30	100.0



Intense controversy surrounds the proposal of any individual area for wilderness designation because the land is often valuable for many other uses. Separate wilderness designation acts are required by Congress to classify new areas as wilderness and thereby place them under protection and management guidelines of the Wilderness Act of 1964.

A hierarchy of wilderness management direction appears in the Wilderness Act of 1964, Federal Regulations that interpret and clarify that Act, national wilderness management policies of the administering agencies, and individual wilderness area management plans that specify how national direction will be applied on the ground. In some cases, Congressional Acts classifying individual areas into the NWPS may specify how particularly controversial wilderness management issues will be handled. For example, the Alaska National Interest Lands Conservation Act of 1980 (Public Law 96-487) designated large tracts of wilderness in Alaska but provided for continuation of "traditional" uses, including even subsistence uses of fish and wildlife in the wilderness it established in National Parks where hunting is usually prohibited. Likewise, some recent wilderness classification acts include language to insure that livestock grazing will continue.

Local tradition and custom influence management and use of wilderness areas. Congressional clarification of management direction in wilderness classification acts adding areas to the NWPS is generally in response to concerns of local residents about how a particular use such as grazing or fish stocking would be treated if the area became wilderness. In recent years the U.S. Congress has increasingly relied on state Congressional Delegations to approve boundaries and any special conditions for management in areas added to the NWPS. This trend may gradually change the character of the NWPS, but at the same time has facilitated the compromises necessary to add areas to the System.

#### Wilderness-Wildlife Relationships

Etymologically, ecologically, and esthetically, wilderness and wildlife go together. The distribution and numbers of its various wildlife species can be a measure of the naturalness of wilderness. Because wildlife reflects ecological conditions and their changes over time, wildlife can serve as a barometer of wilderness quality, in fact and in human perception. As Crisler (1958) said in her book Arctic Wild, "Wilderness without wildlife is mere scenery."

Wildlife is an inseparable part of wilderness, playing a vital role in the development and maintenance of the skin of soil and vegetation that covers wilderness topography. Wildlife directly affects the soil and vegetation mantle in key ways: dispersal, planting, and germination of seeds; conversion of dead plants into organic matter more usable by living plants; pollination; and modification of vegetation and soil.



Likewise, wilderness may be crucial to the survival of key wildlife species, particularly those with highly specialized and natural habitat needs, or intolerance to man's presence. Wilderness also provides essential seasonal habitat for some species. Wilderness can function as a wildlife bank and may be most valuable in the long run as a wildlife gene pool.

The wilderness-wildlife web is also a baseline for assessing human influence on the planet. As a barometer of comparable biological change caused by water and air pollution and as a measure of environmental health, wilderness-wildlife ecosystems have no substitute.

Wilderness and its wildlife have economic, social, and esthetic values which are substantial but largely immeasurable. Recreational use of wilderness has increased faster than most other forms of outdoor recreation in the U.S. and opportunity to see wildlife in natural settings contributes greatly to these outdoor recreation experiences. Movies, TV documentaries and books extol the virtues of wilderness and entertain millions with educational material about wildlife living under natural conditions. Many citizens believe that environmental health and our ability and commitment to preserve it are measured by the presence of wilderness wildlife.

For 100 years wilderness conservation has been promoted by hunters, fishermen, and wildlife lovers spurred by their belief in wilderness as a place with abundant fish and wildlife. For example, in 1977 when the Forest Service initiated their most recent Roadless Area Review and Evaluation, commonly called RARE II, it asked the public what factors should be considered in proposing additional wilderness. The presence of wilderness-associated wildlife--that is, wildlife associated with wilderness in the minds of people even if not in ecological fact--was a major factor suggested. And in subsequent public comment, four wildlife-related reasons were among the 10 most frequent reasons given to support wilderness designation for individual areas under review (Hendee et al, 1980).

The relationship of wildlife to wilderness is often romanticized by the public, which seems to believe that most wildlife will flourish in wilderness when in fact many species require habitat manipulations prohibited in wilderness. Actually, only a few species are "wilderness dependent" in that they are vulnerable to human influence and are dependent--at least seasonally--on the relatively wild, extensive, and undisturbed habitat characteristic of wilderness; examples are grizzly bear, cougar, wolverine, wolves and mountain sheep (Schoenfeld and Hendee 1978). But many more species, including marmots, eagles, deer, bears, elk, moose, and mountain goats, are "wilderness-associated" in that they are commonly associated in human perception (if not in ecological fact) with habitat characteristic of wilderness. These misperceptions are typical of the public's low level of knowledge about wilderness. For example, a public opinion survey at the height of the widely publicized RARE II indicated that only 15 percent of the public could correctly identify the term "Federal Wilderness" (Opinion Research Corporation, 1978). Thus, while the public holds strong wildlife-related



values for wilderness, these values are often symbolic and based on poor understanding of ecological realities.

#### Human Impacts on Naturalness of Wilderness-Wildlife Relationships

Despite their dedication to a natural condition, designated wilderness, areas and their wildlife are impacted by many direct and indirect influences that illustrate man's ubiquitous intrusions and the scarcity of unaffected reserves.

Some of man's indirect influences are nearly global, affecting wilderness and nonwilderness alike. Atmospheric depositions including acid rain has impacted fisheries; air pollution has damaged vegetation and increased cloud cover with yet to be defined impacts on vegetation regimes; noise from airplane traffic may affect wildlife distributions and behavior; some chemical pollutants from pesticides and industry have accumulated in food chains affecting wildlife even in designated wilderness areas.

Other impacts of man on wilderness wildlife are more direct. The nearly 23 million acres of wilderness in the National Parks and National Forests of the lower 48 States have nearly 20,000 miles of trails which sustain an annual average of 468 visitor-days per mile of trail; use is twice that high in the more crowded Northeast and South (Washburn 1981).

Hunting and fishing are key activities in many wildernesses. Humans have preyed on wildlife for eons, but modern trophy hunting and fishing practices do not mimic natural predation or the predation patterns of early man. We can only speculate on the overall effects of such harvests on naturalness of wildlife populations, distribution, behavior, and evolution. Ecological influences of previous management practices, such as logging and fire protection, influence wilderness-wildlife populations. Recreation use and nonconforming but allowed uses such as grazing and mining can impact natural habitat and disturb wildlife populations (Ream 1980). Some wildlife species such as elk, deer, and waterfowl migrate seasonally in and out of wilderness. In some areas foreign vegetation has been widely introduced; Canadian Thistles, for example, has been introduced in feed carried for recreational livestock. Wildlife species such as elk, cougar, and grizzly bear once roamed a wide area of the American plains but have been driven by pressures of civilization to remote mountain areas including wilderness.

Even the wilderness management efforts of agencies lead to intrusions as necessary compromises with naturalness are made to comply with requirements of the Act (such as for mining and grazing), balance competing uses (such as hunting, fishing and recreation), and protect the wilderness resource. For example, a 1980 survey of 127 designated wilderness areas totaling about 15 million acres (6.1 million hectares) in the National Forests, where wilderness management is generally the most restrictive, revealed the following human



impacts and activities: <sup>1/</sup> 50 shelters; 118 administrative sites (although 28 such sites have been eliminated since 1964); 806 outfitter camps, 76 of them with permanent facilities; 1,160 miles of new trail constructed the past 5 years; 729 grazing allotments to provide almost 400,000 animal unit months of grazing for cattle, sheep, horses and recreational livestock; 1,787 structural range improvements such as fences, corrals and water developments, 17 with motorized access permitted; 177 water control or use structures; 1,242 helispots and 15 airfields open to public use; 561 mineral leasing projects and 76 prospecting or operating plans, 29 with mechanized access pending, although 16 areas have been removed from mineral entry; 308 approved projects using motorized or mechanical equipment for trail construction, administrative purposes or other agency use during the previous 3 years; 3,341 identified cultural sites revealing evidence of man's historic and prehistoric use, with the inventory still incomplete.

With respect to wildlife, there had been 68 fish or wildlife habitat projects the past 10 years, 33 involving Threatened or Endangered species; 40 wildlife transplant projects and 93 fish stocking projects, 65 of them by aerial means; all of the areas were open to hunting and fishing with 110 known trapping operations; and 9 approved predator control projects during the previous 5 years. Potentially serious in their impact on wilderness ecology are 12 weather modification projects, 9 of them outside wilderness but affecting it. Potentially beneficial to naturalness and wildlife is restoration of a more natural role for fire in 24 approved fire management areas--the remaining areas have "suppression by 10:00 a.m." as the intended treatment of fire.

No wilderness exists in a vacuum; each wilderness is surrounded by or adjoins something that can affect naturalness within the area. Perhaps the most pervasive influence is simply the kaleidoscope of human activity on the periphery that collectively can impact adjacent wilderness ecosystems. New highways or logging roads increase wilderness access; dam and canal developments change water regimes; winter resorts, subdivisions, control of pests and disease, predator control, agricultural crops, weather modification all create subtle impacts on the adjacent "ecological islands" wilderness areas represent.

These intrusions are why we have a National Wilderness Preservation System--to ensure that the permeating influences of civilization are controlled short of displacing naturalness and solitude everywhere. Yet these many influences remind us that even designated wilderness areas are not free from disturbance by man. It is only an illusion that we have stopped dilution of naturalness and solitude in designated wilderness areas; the challenge of the future is to manage these areas to minimize such loss. The degree of impact on wilderness naturalness probably varies with the size of wilderness and the degree to which entire natural systems are included so as to insulate them from civilization by distance. Yet only a few designated wilderness areas or contiguous groups of areas outside of Alaska contain a million acres or more.

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<sup>1/</sup> USDA, Forest Service, Wilderness Activity Summary Sheet, October 1980, 7 pp., mimeo. Based on research data in press (Cole and Washburn 1982).



## Restrictions on Wilderness Wildlife Research

Scientific values of wilderness are great, and they increase as other areas are lost to development. The above survey of activities in National Forest wilderness revealed only 55 research projects, though they may be undercounted since registration is often not required.

Research in designated wilderness is restricted by the same laws, regulations, and policy as other uses and by the physical difficulty of executing studies in vast, remote and often precipitous terrain.

Two major principles of wilderness management that also apply to research are: (1) do only what is necessary and (2) use the minimum methods, approaches, or tools that will accomplish desired results (Hendee et al 1978; Hendee 1981).

Generally accepted policies on wilderness wildlife research are stated in a document prepared by the International Association of Fish and Wildlife Agencies (IAFWA 1977). The IAFWA guidelines state "Research on wildlife, their habitats and the recreational users of those resources is a legitimate activity...Methods which temporarily infringe on the wilderness character may be used provided the information sought is essential and alternative methods or locations are not available. For example, to conduct approved fish and wildlife research...aircraft shall be used in a manner to minimize disturbance to other users, including humans and wildlife."

Thus, although sophisticated instrumentation and mechanization may be permitted for wilderness wildlife research, they must meet the above criteria and be sensitively applied. Some would argue that if sophisticated mechanization is approved in wilderness for scientific purposes then why not approve it for other uses such as radar installations for monitoring air traffic, telecommunication installations, instrumentation of headwaters to provide water yield information for flood control and irrigation purposes, climatological data gathering for weather forecasting, and so forth.

Wilderness wildlife research needs to be strongly justified as a source of information about natural processes that is essential to wilderness protection, to improved understanding of man's global impacts on nature and thus to man's continued well being on the planet. At the same time, only carefully planned studies using minimum necessary methods are justified to keep from degrading naturalness directly or to helping justify further intrusions on natural values by other activities in wilderness.

## Research Priorities

What then are the wilderness wildlife research priorities, given the important ecological and symbolic values of wildlife in the 80-million-acre (30 million hectare) NWPS in the United States, and the limitations imposed



by geography and restrictions established to prevent loss of naturalness? Three research topics seem essential in that they focus on information dependent on wilderness conditions of naturalness and solitude: (1) habitat and native animal behavior and population response to massive natural disturbance, (2) normal predator-prey relationships, and (3) natural baselines for comparison with managed conditions. Inevitably these topics overlap and they cannot be neatly separated, as the following examples illustrate.

Expanding knowledge of wildlife ecology, including better understanding of population dynamics and habitat relationships of species in relatively undisturbed environments, is needed as a basis for designing and evaluating management elsewhere. Such baseline work directed at the autecological, synecological, and ecosystem levels is especially needed for game, predatory, and threatened and endangered species. For example, predators such as the coyote and bobcat, which have been extensively controlled and studied where they cause problems, have still not been investigated in undisturbed environments. Increased knowledge about how these species space themselves and are naturally regulated without human interference in undisturbed habitats could help management of the prey to alleviate predation on domestic livestock.

Larger carnivores, such as the grizzly bear and timber wolf, can be maintained in wilderness conditions where there is sufficient area to sustain breeding populations. Perpetuation of these species in the contiguous United States may mean reintroduction into suitable wilderness where they once existed. Further, comparative research into grizzly behavior in undisturbed wilderness and in the crowded National Parks where they pose a serious human safety problem could help management reduce human injuries from encounters with bears. Efforts to manage wolves in Alaska and elsewhere could be enhanced by comparative data from undisturbed populations of wolves and their effects on similarly undisturbed big game.

Long-standing questions about what factors control population levels of ungulates and the larger carnivores require study in large, undisturbed areas. Research to test the competing hypotheses about how ungulate populations are naturally regulated (ungulate habitat versus predator interactions), in addition to other important hypotheses, will require relatively intact ecosystems found only in large designated wilderness areas (Peek 1980, 1981). This work has important ramifications for management of native ungulates outside and inside of wilderness.

Hunting, a popular and legitimate use of National Forest and Bureau of Land Management designated wilderness, alters population structure and behavior but the degree of alteration is unknown. Populations of big game, such as elk and deer, are heavily hunted in some wilderness areas. Comparative studies with the unhunted wilderness areas of the National Parks are needed to increase understanding of population dynamics, behavior, and habitat interactions and thus improve wildlife management capabilities.



Interactions between large mammals are often artificial or a result of human influences in managed areas--for example, artificially enhanced populations of large ungulates such as elk and deer. These synecological relationships may be affecting habitat selection, behavior, and dynamics. African investigations into these relationships have provided useful information for management and use of their wildlands, and similar studies should be conducted in North American wilderness (Bell 1971).

The special interaction between predator and prey is in particular need of investigation in undisturbed settings. The moose-wolf interaction on Isle Royale National Park (Allen 1979), a subject of long-term investigation, should be extended and replicated in other systems and with other species. Such work can only be conducted in larger wilderness areas.

Programs to restore threatened or endangered species include assessment of minimum breeding populations. Such populations must contain an adequate gene pool to allow evolutionary adaptations to continue. While we currently know a little about how to generate numbers of animals, we know very little about what is needed in gene pool variability to perpetuate a species.

In special need of investigation is population response to natural change in undisturbed environments--knowledge that will be of value in anticipating response to artificial change and the limits of adaptability of a population to habitat change. Rapid, but natural habitat changes do occur such as with wildfire, hurricanes, land slumps, and volcanic eruptions. But changes that are artificial, such as from pesticides and logging, are more frequent and widespread. In a world where human impacts are ever more pervasive, wildlife must coexist in increasingly artificialized environments.

Investigations (Likens et al 1967) aimed at understanding nutrient cycling within ecosystems need to be extended to more complex and large-scale, but undisturbed systems. Some wilderness areas lend themselves to nutrient cycling studies which include the faunal component; for example, recent studies of wild boar in Great Smoky Mountains National Park (Singer et al 1981).

In summary, the greatest scientific values of wilderness are based on the opportunity to study whole or large pieces of ecosystems that are, relatively speaking, undisturbed. Wilderness wildlife is an integral part of these ecosystems, sometimes dependent on and reflective of their degree of naturalness and solitude. Study of wilderness-wildlife ecosystems can reveal natural processes, providing management and baseline information for assessing man's influence on the planet. Such information is increasingly important as resource management becomes more complex and man's influence expands. But even ecosystems preserved in the 257 areas encompassing 80 million acres (32 million hectares) in the NWPS in the United States are not completely free from man's influences within and adjacent to these reserves. Scientific values of these areas will be greatest if they are managed to preserve naturalness and solitude to the greatest extent possible.



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