THE REINTRODUCTION OF GRAY WOLVES TO YELLOWSTONE NATIONAL PARK AND CENTRAL IDAHO

DRAFT Environmental Impact Statement

Fish and Wildlife Service

U.S. Department of the Interior

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

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DES 93-26

D R A F T

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ABSTRACT

The U.S. Fish and Wildlife Service (FWS) proposes to establish an experimental population rule and reintroduce gray wolves into Yellowstone National Park and central Idaho, if 2 naturally occurring wolf packs can not be located in either area before October 1994. The rule would allow liberal management of wolves by government agencies and the public to minimize conflicts over public lands, effects on domestic animals and livestock, and impacts on ungulate (deer, elk, etc.) populations. There will be no land use restrictions for wolves. State and tribal wildlife agencies are encouraged to lead wolf management outside national parks and national wildlife refuges. Reintroduction would result in wolf population recovery (10 breeding pairs, about 100 wolves/area for 3 successive years) in and around Yellowstone National Park and in central Idaho by 2002.

The Yellowstone area is about 25,000 mi² and 76% federal land. This area has over 95,000 ungulates, has a hunter harvest of 14,314 ungulates, is grazed by about 412,000 livestock, has a $4.2 billion local economy, and receives about 14,500,000 recreational visits annually. The central Idaho area is about 20,700 mi² and is nearly all USDA Forest Service land. The central Idaho area has about 241,400 ungulates, has a hunter harvest of 33,358 ungulates, is grazed by about 306,525 livestock, has a $1.43 billion local economy, and receives about 8,000,000 recreational visits annually.

A recovered wolf population in the Yellowstone area would kill about 19 cattle (1-32) and 68 sheep (17-110) and up to 1,200 ungulates each year. A recovered wolf population would not affect hunter harvest of male ungulates but may reduce hunter harvests of female elk, deer, and moose for some herds. A recovered wolf population would not affect hunter harvests or populations of bighorn sheep, mountain goats or antelope. A recovered wolf population may reduce populations of elk 5%-30% (30% in some small herds), deer 3%-19%, moose 7%-13%, and bison up to 15%. The presence of wolves would not change uses of public or private land except for potential use of M-44 cyanide devices ("coyote getters") in occupied wolf range. Visitor use would increase (+5% for out of area residents and +10% for local residents), and generate $7 -$10 million in additional net local economic benefits each year.

A recovered wolf population in the central Idaho area would kill about 10 cattle (1-17) and 57 sheep (32-92) and up to 1,650 ungulates each year. A recovered wolf population will not affect hunter harvest of male elk but may reduce harvest of female elk 10%-15%. A recovered wolf population will not measurably impact hunter harvest of deer, moose, bighorn sheep, or mountain goats. A recovered wolf population will not measurably impact ungulate populations in central Idaho. Wolf presence will not change uses of public or private land (except for use of M-44 devices in occupied wolf range). Visitor use would likely increase (+8% for out of area residents and +2% to -12% for area residents), and generate $5.6-$8.4 million in additional net local economic benefits each year.

Alternative 1. Reintroduction of Experimental Populations Alternative (The Proposal).
Alternative 2. Natural Recovery Alternative -- The No Action Alternative. Encourage wolf populations to naturally expand into Idaho and Yellowstone.
Alternative 3. No Wolf Alternative. Change laws and prevent wolf recovery.
Alternative 4. Wolf Management Committee Alternative. Establish legislation so the states could implement wolf recovery and liberal management without federal oversight.
Alternative 5. Reintroduction of Nonexperimental Wolves Alternative. Reintroduction and high level of protection for wolves without establishing an experimental population rule to address local concerns.

Public Comments on the DEIS are welcome and will be accepted from July 12, 1993, through October 15, 1993. Public hearings will be held during this period. A final EIS will then be prepared. Comments should be directed to: Ed Bangs, U.S. Fish and Wildlife Service Project Leader, GRAY WOLF EIS, P.O. BOX 8017, HELENA, MONTANA 59601.

Ralph O. Morgenweck
Regional Director, Region 6
U.S. Fish and Wildlife Service

Approved Ralph O. Morgenweck

Date June 8, 1993

D R A F T
ENVIRONMENTAL IMPACT STATEMENT

THE REINTRODUCTION OF GRAY WOLVES TO YELLOWSTONE NATIONAL PARK AND CENTRAL IDAHO

U.S. Fish and Wildlife Service
Gray Wolf EIS
P.O. Box 8017
Helena, Montana 59601

July 1993

SUMMARY

This summary of the draft Environmental Impact Statement (DEIS) describes 5 alternative ways that wolves could be reintroduced in Yellowstone National Park and central Idaho, the process used to develop the alternatives, and the environmental consequences of implementing each alternative. Three alternatives [Reintroduction of Experimental Populations (the FWS's proposal), Wolf Management Committee, and Reintroduction of Nonexperimental Wolves] involve capturing and releasing wolves. One alternative (Natural Recovery or No Action) simply encourages natural wolf recovery. One alternative (No wolf) prevents wolf recovery. All issues and concerns identified by the public were considered and the most significant analyzed in detail. The potential effects of each alternative on livestock, land use, ungulate (deer, elk, etc.) populations, hunter harvest, visitor use, and regional economies are also described.

Important

In order to be considered in development of the final plan, comments on the DEIS must be received by October 15, 1993. Public comments will not be available for public review until after the DEIS comment period ends. Copies of the DEIS have been sent to public libraries in Montana, Wyoming, Idaho, and those cities where open houses were held. In addition, several hundred copies of the DEIS were sent to organizations or individuals who represent people who may be significantly impacted by any decision. Those wishing to review the complete draft Environmental Impact Statement (DEIS) or needing further information should contact:

Ed Bangs, Gray Wolf EIS Project Leader
P.O. Box 8017
Helena, Montana 59601
(406) 449-5202

PURPOSE AND NEED FOR THE ACTION

The gray wolf (*Canis lupus*) was common in the northern Rocky Mountain states prior to 1870. After bison, deer, elk, and other ungulates were decimated by unregulated hunting and human settlement, people tried to exterminate all remaining large predators, primarily because of conflicts with livestock. Wolf populations disappeared from the western United States (U.S.) by 1930. In 1973, the Endangered Species Act (ESA) listed wolves as endangered.

The U.S. Fish and Wildlife Service (FWS) is the primary agency responsible for the recovery and conservation of endangered species in the U.S., including the gray wolf. Recovery of wolves in the northern Rocky Mountains requires that 10 breeding pairs of wolves (about 100 wolves), become established in each of 3 recovery areas (northwest Montana, central Idaho, and the area in and near Yellowstone National Park) for 3 consecutive years. After that had occurred wolves would be removed from the list of threatened species and endangered species and managed solely by the respective states. Currently, as a result of natural dispersal of wolves from Canada over the past 15 years, about 5 wolf packs (45 wolves) live in northwest Montana. While lone wolves are occasionally seen or killed in the Yellowstone or central Idaho areas, wolf packs still do not exist in these areas. In 1991, Congress directed the FWS to prepare a DEIS on wolf reintroduction in Yellowstone National Park and central Idaho and required that it cover a broad range of alternatives. In 1992, Congress directed the FWS to complete the EIS by January 1994 and stated that it expected the preferred alternative to conform to existing law.

LOCATION OF THE PROPOSED ACTION

The 2 areas analyzed for wolf recovery are in and around Yellowstone National Park and USDA Forest Service lands in central Idaho (Fig. S-1). The center of these areas are large contiguous blocks (about 12 million acres each) of land managed by the federal government, primarily as National Parks or National Forests. Not all wolves will remain solely on federal or other public lands, so the analysis areas include adjacent lands, including those privately owned, where wolves may occur and potentially cause some impacts.

Table S-1 presents the basic information about the Yellowstone and central Idaho primary analysis areas. It helps describe those areas and may be useful in understanding the potential impact of wolf reintroduction. This information represents the situation that currently exists without wolf populations in these areas.

THE PLANNING PROCESS

One of the first steps in the planning process was to design a public participation and interagency coordination program to assist in identifying issues that needed to be addressed in the plan. Natural resource and public use information was gathered. Previous plans and reports dealing with wolf recovery were reviewed. The FWS is solely responsible for the DEIS, although representatives from the National Park Service, USDA Forest Service, USDA Animal Damage Control (ADC), Idaho Department of Fish and Game, Wyoming Game and Fish Department, Montana Department of Fish, Wildlife and Parks, Wind River Tribes, and University of Montana assisted in its preparation. Participation and review by representatives of other agencies does not imply concurrence, endorsement, or agreement to any recommendations, conclusions, or statements in the DEIS.

Issue Scoping

Thirty-four open houses were held in April 1992 throughout Wyoming, Montana, and Idaho and at 7 other locations in the U.S. to identify issues that the public wanted considered in the DEIS. More than 1,730 people attended these meetings, and nearly 4,000 comments were received. All issues were considered, organized into 39 separate headings, and were addressed in the following way:

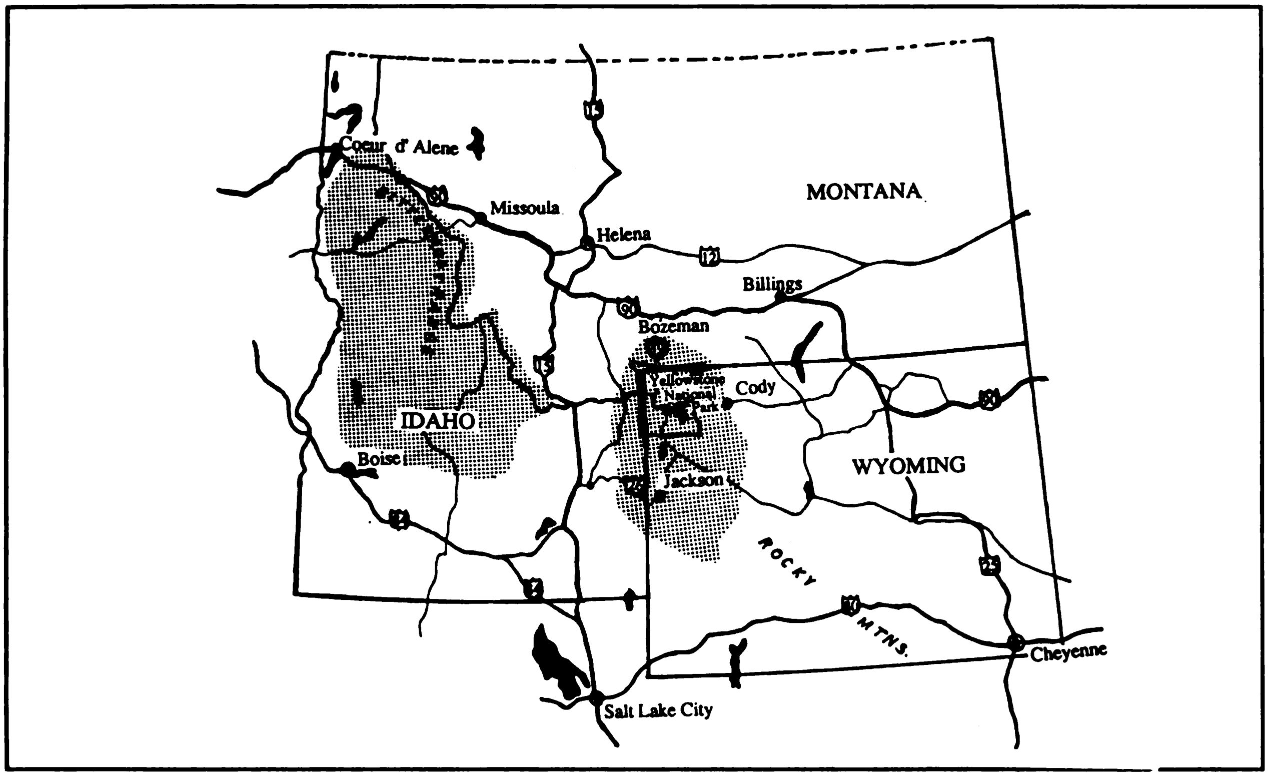

Figure S-1. Shaded portions indicate the approximate location of the Yellowstone National Park and central Idaho primary analysis areas for the DEIS.

Eighteen issues were addressed as part of one or more wolf management alternatives

Amending the ESA
Missing component of the ecosystem
Humane treatment of wolves
Enjoying wolves
Regulated public take
Cost of program
State, tribal, federal authority
Viable population
Travel corridors

Range requirements
Control strategies
Illegal killing
Compensation
Delisting
Need for education
Spiritual/cultural
Social/cultural environment
Recovery areas

Six issues were analyzed in detail in the EIS because they are potentially impacted by wolves or wolf recovery strategies

big game
hunting harvest
domestic animal depredation

land use restrictions
visitor use
local economies

Table S-1. A summary of the key characteristics of the primary analysis area (PAA) that were analyzed as potentially being impacted by wolf recovery in and around Yellowstone National Park (includes parts of 17 adjacent counties) and in central Idaho (includes parts of 10 adjacent counties).

	Yellowstone	Central Idaho
People/Land		
Acres	16,000,000	13,300,000
% Federal Ownership	76%	99%
% Private ownership	21%	trace
% National Park, Wilderness, or Wildlife Refuge	41%	30%
Regional Population (including surrounding communities)	288,000 5.2 people/ mi.^{2}	92,400 2.6 people/mi.^{2}
Recreational visits to federal land/year	14,500,000	8,000,000
Public land uses[a]		
Open to grazing (acres)	4,000,000	4,357,822
Suitable for timber harvest (acres)	1,500,000	5,015,968
Timber harvested or planned for harvest/year (acres)	28,000	41,199
Total miles of system trails/roads on public land	13,457	20,346
Roads/trails open to motor vehicles (mi.)	8,057	9,541
National Forest area not open to motorized use (includes wilderness and roadless areas)	44%	44%
Estimated miles of hiking trails	4,643	13,105
Current active sites for M-44 use (coyote cyanide devices)	185 ranches	31 ranches
People/Land Economy (including surrounding counties)		
Total income	$4.2 billion	$1.43 billion
Per capita income	$14,676	$15,552
Farm	6.4% (55% by livestock)	8.0% (65% by livestock)
Services	39.5%	34.6%
Other Industry	19.8%	24.8%
Other non-earned[b]	34.3%	32.6%
Livestock		
Peak numbers of livestock on PAA including the surrounding counties- (spring) cattle	354,000	384,990
(spring) sheep	117,000	100,713
On USDA Forest Service in PAA (May through October)		
Adult cattle and calves	145,658	81,893
Adult sheep and lambs	265,152	223,523
Horses	1,270	1,109
Total livestock grazed on national forests	412,080	306,525
Estimated current livestock mortality in the PAA and surrounding counties from all causes per year based upon spring cattle/sheep numbers: cattle	8,340 2.36% loss (67% calf)	12,314 3.2% loss (69% calf)
sheep	12,993 11.1% loss (74% lambs)	9,366 9.3% loss (72% lambs)
horses	Unknown, very low	unknown, very low

	Yellowstone	Idaho
Ungulates (after hunting season)		
Elk	56,100	76,300
Deer (mule & white-tailed)	29,500	159,600
Moose	5,800	1,700
Bighorn sheep	3,900	1,800
Bison	3,600	0
Mountain goat	few	2,000
Pronghorn antelope	400	0
Total	99,300[c]	241,400
Hunter harvest/year	14,314	33,358
Estimated ungulates dying/year (all causes)[d]	48,559	153,539
Other Animals		
Black bears	3,000	abundant
Grizzly bears	228	none
Mountain lions	some	abundant
Coyotes	abundant	common

[a] A wide variety of land use restrictions (seasonal and permanent) are employed on public lands throughout the Yellowstone and central Idaho areas for protection of natural resources and public safety including: on motorized vehicles, construction of structures, Animal Damage Control activities, big game winter range, calving areas, security and migration habitat, raptor nest sites, endangered species (including grizzly bears), erosion control, wetland protection, to provide a variety of outdoor experiences (motorized or nonmotorized, wilderness or developed, etc.).

[b] Non-earned income represents investments, entitlements, and retirement income that often does not depend on where a person lives. The growth of this segment of the economy from 25% to 34% over the last 2 decades results from people with this type of income moving into the central Idaho or Yellowstone area because these areas are perceived to have a lifestyle that people want to participate in (wild spaces, abundant wildlife, less crowding, low crime, clean air, etc.).

[c] Including only ungulate herds at least partly associated with Yellowstone National Park. Estimated over twice that number using public and private lands in overall Yellowstone area.

[d] Including hunting, crippling loss, poaching, road kill, predation, disease, starvation, drowning, winter kill, accidents, fighting, etc. (Appendix 10).

Fifteen issues/impacts were not evaluated further in the DEIS because they were not significant to the decision being made

Wolves not native to Yellowstone National Park
Wolf rights
Federal "subsidies"
Human safety/health
Other predators and scavengers
Endangered species
Plants, invertebrates, fish, reptiles, amphibians, birds, and mammals
Diseases and parasites
Private property rights
Wolf recovery in other areas
Existing wolves in central Idaho and Yellowstone
Existing wolves in northwestern Montana
Wolf subspecies
Wolf/dog/coyote hybridization
Need for research

Alternative Scoping

Twenty-seven open houses and 6 formal public hearings were held in Wyoming, Montana, and Idaho and 3 other locations in the U.S. in August and September 1992 to ask the public to help identify different ways (alternatives) that wolf populations could be managed. In addition, an alternative scoping brochure was inserted into 230,000

Sunday newspapers in Wyoming, Montana, and Idaho. Nearly 2,000 citizens attended the meetings, and about 5,000 comments were received. All the alternatives and issues that were identified by the public were considered, organized into separate and distinct alternatives, and addressed the following way.

ALTERNATIVES CONSIDERED BUT NOT ANALYZED FURTHER IN THE DEIS

Six basic wolf management alternatives were identified but were not evaluated further in the DEIS. Those alternatives were:

1. Immediately delist wolves and let the states assume management and recovery.--No wolf reintroduction would occur. States would manage the gray wolf the same as other resident wildlife species without federal oversight. Wolves are listed as state endangered species in Montana and Idaho but other Idaho law prohibits wolf management, including law enforcement, by the Idaho Fish and Game Department, except for assisting with control of nuisance wolves and participation on any wolf recovery team. Wolves are listed as predators by state law in Wyoming, and cannot be managed by Wyoming Game and Fish Department. Wolves can be killed at any time without limit. This alternative is not being considered further because of the conflicting intent and uncertain direction of state law.

2. State management of nonessential experimental populations.--Wolves would be reintroduced into Yellowstone National Park and central Idaho. In areas without resident wolf packs, liberal management would be allowed to address local concerns about livestock, land use restrictions, and ungulate populations. The respective states would develop wolf management plans that conform to federal law and would lead wolf recovery and management. Federal funding would support state management, compensation for livestock losses caused by wolves, and enhancement of ungulate habitat. Except for the provisions calling for federal compensation for livestock losses and ungulate enhancement, this alternative was incorporated into the DEIS as the FWS's proposed action.

3. No cow or bison-based, sustained subsistence economy.--Livestock growing would be eliminated, fencing removed, control of predators stopped, and wolves and bison reintroduced throughout the wolf recovery areas. This alternative is not being considered further in the DEIS because it is far beyond any reasonable use of federal authority and is not practical.

4. Recovery of existing wolves.--This alternative would recover the existing population of wolves that some people believe were never totally extirpated from the Yellowstone area. No reintroduction would occur and other wolves would be prevented from affecting these genetically unique wolves. This alternative is not being considered further in the DEIS because all wolves, regardless of potential subspecies classification, were listed in 1978. Current information suggests wolves that once inhabited the Yellowstone area were more widely distributed and less distinct than previously believed. Scientific evidence does not indicate that any population of wolves persisted or currently exists in the Yellowstone or central Idaho areas.

5. 1987 Wolf Recovery Plan.--The plan recommended preparation of an EIS, wolves be reintroduced as a nonessential experimental population into Yellowstone National Park, and natural recovery be monitored in central Idaho. If 2 breeding pairs of wolves had not been documented in Idaho within 5 years other wolf conservation measures would be considered. No EIS was prepared as a result of this plan, no reintroduction occurred, and no breeding wolves have been documented in the Yellowstone or Idaho areas. Therefore, this alternative is not being considered as a separate alternative in the DEIS.

6. Accelerated Wolf Recovery.--Wolves would be immediately reintroduced into the Yellowstone and central Idaho areas until wolf population recovery was achieved. A wide variety of land use restrictions would be used to enhance habitat for wolves over a very broad area, including: reducing the number of roads on public lands that are used by motorized vehicles, not permitting livestock or people in areas used by denning wolves, not controlling wolves that attacked livestock, and increasing the number of ungulates by improving or purchasing important habitat. This alternative was unduly restrictive and more severe than was reasonably required to achieve wolf recovery and it is not being considered further.

ALTERNATIVES ANALYZED IN DETAIL IN THE DEIS

Based upon public comments during alternative scoping, 5 alternatives were developed and are considered in depth in the DEIS because they represent a broad range of alternatives and respond to the public's concerns expressed about the potential issues and impacts involved in wolf reintroduction. Those alternatives are:

1. Reintroduction of Experimental Populations (FWS proposal)

2. Natural Recovery (No action or current management strategy)

3. No Wolf

4. Wolf Management Committee

5. Reintroduction of Nonexperimental Wolves

Description and Impacts of the Proposed Action and Alternatives

Alternative 1. Reintroduction of Experimental Populations (Proposed action)

Summary.--Two nonessential experimental population areas (Figure S-2) would be established through regulation by the FWS under section 10 (j) of the ESA. The ongoing wolf monitoring efforts would continue. Prior to any reintroduction, the FWS would determine the status of any naturally occurring wolf population in those 2 areas. Wolves would be reintroduced into either or both Yellowstone National Park and central Idaho unless a wolf population (2 wild breeding pair, raising at least 2 young for the previous 2 years in an area) had been documented. Wolves outside national parks and wildlife refuges would be managed by the states and tribes under special federal regulations. If the states and tribes did not assume wolf management, the FWS would. Management would allow wolves to be killed or moved under some conditions by federal, state, and tribal agencies for domestic animal depredations and excessive predation on ungulate populations. Under some conditions, the public could harass and kill wolves attacking livestock (cattle, sheep, horses, and mules only). There would be no federal compensation program, but compensation from existing private funding sources would be encouraged. There would be no land use restrictions applied or critical habitat designated. Use of toxicants lethal to wolves in areas occupied by wolves would still be prohibited by existing ADC policy and EPA labeling restrictions but other ADC activities would not be affected. Wolf populations would recover by 2002.

Management Actions.--If a wolf population was not discovered in either the Yellowstone or central Idaho areas before October 1994, (agency efforts to locate wolf packs in these areas have already been intensified but no packs have been found at the present time) the following would occur in each area that did not have a wolf population:

NOTE: If a wolf population was discovered in either the Yellowstone and/or central Idaho areas, reintroduction under an experimental population rule would not occur and any wolf population would be managed as a naturally recovering population (see Alternative 2) in that area, unless a decision maker decided otherwise.

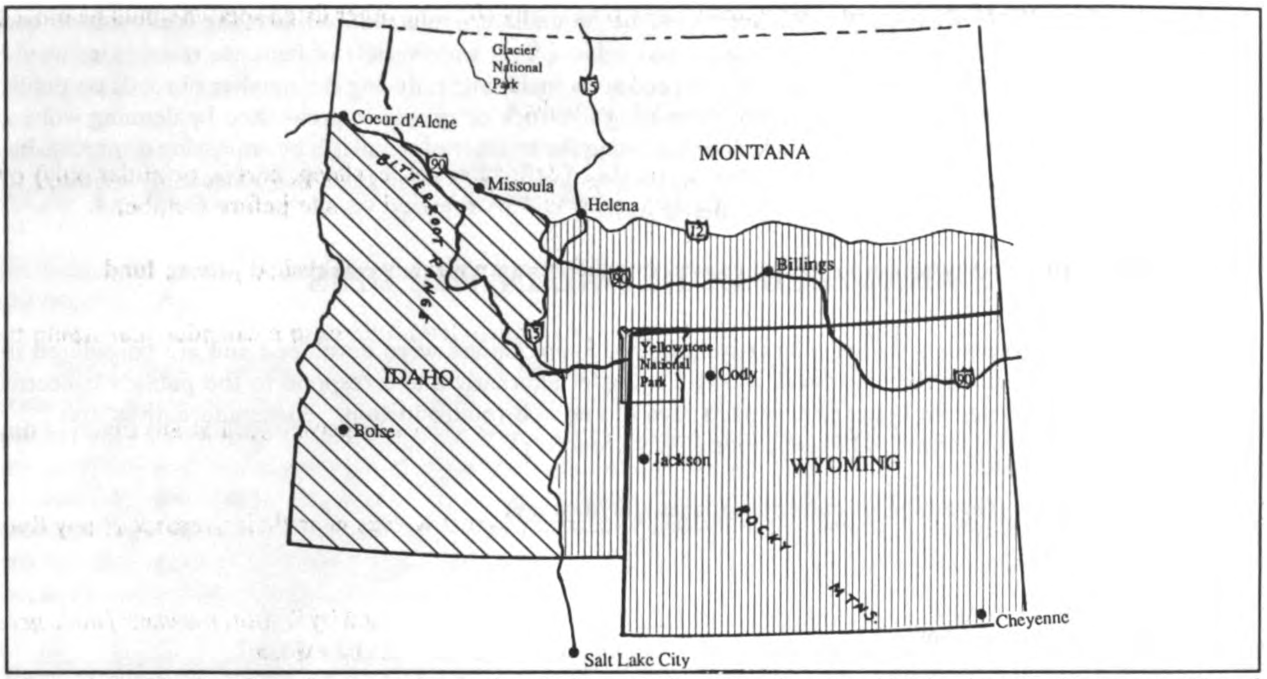

Figure S-2. The location of proposed experimental population areas in central Idaho (south of Interstate 90 and west of Interstate 15) and Yellowstone National Park (south of Highway 12 and east of Interstate 15).

NOTE: **The proposed boundaries of the experimental population areas were established by considering the combination of the current southern expansion of naturally formed wolf packs in Montana, location of high quality wolf habitat and potential wolf release sites, and the likelihood of any wolf packs documented inside the experimental area resulting from reintroduction into central Idaho or Yellowstone National Park rather than from natural dispersal from Canada or northwestern Montana. Therefore, the boundaries of the proposed experimental population areas could be affected by formation of new wolf packs before any decision about implementing a nonessential experimental population rule and wolf reintroduction is made (at the earliest 1994).**

Two nonessential experimental population areas and special rules for each of those areas would be established. These rules would permit the following in the experimental areas:

-Beginning in October 1994, 30 wild wolves would be captured in Canada and released in the experimental population areas, until a wild wolf population was established in each area (estimated 3-5 years). Breeding adults and their pups (15/year) would be held 6-8 weeks at 3 sites in Yellowstone National Park and released in December. Yearlings and non-breeding adults (15/year) would be immediately released in central Idaho to simulate natural dispersal and pack formation. Reintroduced wolves would be monitored with radio telemetry and moved as necessary to enhance wolf population recovery.

-Designate all wolves in the experimental areas as experimental animals once reintroduced wolves were released.

-The states and tribes would implement and lead wolf management outside national parks and national wildlife refuges within federal guidelines. The FWS would implement wolf management otherwise.

-Wolves severely impacting wild ungulate populations or potentially affecting other listed species would be moved as necessary.

-There would be no land use restrictions implemented for wolves.

-Agencies would move or kill wolves that attacked livestock (defined as cattle, sheep, horses, or mules only) on public or private land. Females with pups on public land would be released on site before October 1.

-Compensation for livestock killed by wolves would be paid from an already established private fund.

-Wolves that attack domestic animals, other than livestock, on private land 3 times in a calendar year would be moved.

-Land owners could, in an opportunistic noninjurious manner, harass wolves on private land at any time (14 day reporting).

-Public land grazing permittees could, in a noninjurious manner, harass wolves near their livestock at any time (14 day reporting).

-Wolves in the act of wounding or killing livestock on private land could be killed by livestock owners/managers (24 hour reporting and evidence of livestock freshly wounded by wolves must be evident).

-If agencies could not resolve wolf depredations on livestock on public land, grazing permittees would receive permits to kill wolves in the act of attacking livestock (24 hour reporting and evidence of livestock freshly wounded by wolves must be evident).

-After thorough investigation, take (killing or injuring) of wolves by unavoidable and unintentional actions during otherwise legal activities would not be prosecuted.

See Tables S-2 through S-4 for a comparison of the expected actions and effects of this alternative.

Alternative 2. Natural Recovery (No action or current management strategy)

Summary.--No wolf reintroductions would occur. Enhanced wolf management programs similar to the one currently used in Montana would be established in Idaho and Wyoming. Wolves would be encouraged to naturally expand their ranges into any area they choose, eventually into the central Idaho and Yellowstone areas. Wolves would eventually recolonize the recovery areas, but would also recolonize other areas throughout the northern Rocky Mountains and would be allowed to remain there if few conflicts occurred and wolf recovery was not precluded by moving those wolves. Because wolves would settle in some areas where their presence was undesirable, there would be occasional conflicts, particularly with livestock. Depredating wolves would be controlled by agencies as long as control did not preclude wolf population recovery. There would be no federal compensation program, although a private fund does exist and its use by livestock producers would be encouraged. Wolves would not be controlled if there were conflicts with pets or state big game management objectives. There would be some land use restrictions primarily around active den sites and on some ADC activities in occupied wolf habitat. Illegal killing, at a level that precluded or severely inhibited recovery, would result in additional land use restrictions, primarily a reduction in the number of roads open to motorized vehicles. Excessive wolf conflict with livestock would affect the location and duration of livestock grazing on public land. This alternative would likely result in recovered wolf populations in central Idaho about 2012 and in the Yellowstone area about 2025.

Management Actions.--An enhanced FWS wolf recovery program would be established in Idaho and Wyoming. FWS biologists and other agency cooperators would conduct the following activities:

-Wolf monitoring efforts would continue but would be enhanced to solicit more reports from the public and agency personnel, increase efforts to conduct more field surveys in all areas of suspected wolf activity, and increase attempts to place radio collars on members of any wolf packs that were located.

-An ADC wolf management specialist position would be established once wolf packs formed in Idaho or Wyoming. All reports of wolf depredations on legally present livestock would be investigated. Wolves that depredated on livestock (but not pets) and were likely to do so again, would be moved after the first depredation and killed or placed in captivity after subsequent depredations. Females and their young would be released on site prior to August 1. Wolves would not be controlled in areas critical to wolves (dens or ungulate calving areas) or if wolves were attracted to the area by poor livestock husbandry practices (improper carrion disposal). After 6 packs became established in each recovery area, depredating wolves would be killed. Wolf control is permitted only so long as wolf recovery is not prevented by such management. The public may not attempt to harm or harass any wolf unless it is necessary for the immediate protection of human life or safety, which is highly unlikely.

-Compensation for livestock losses would be paid by an already established private fund.

-Wolves would not be controlled to reduce predation on wild ungulate populations.

-FWS would encourage and support research on wolves and their prey.

-FWS would encourage land management agencies to maintain or enhance ungulate populations to ensure adequate wolf prey.

-FWS would lead an aggressive public information and education program that would provide accurate information about wolves and wolf recovery under the ESA.

-There would be very few land use restrictions implemented unless illegal killing began to inhibit wolf recovery. Currently, it is recommended that land management agencies restrict obtrusive human activity within 1 mile of active wolf dens from March 1 to July 1 and that ADC not conduct predator control activities (primarily use of toxic devices- M-44s) in a manner that may accidently kill a wolf. Land use restrictions, such as reducing the amount of roads or area open to motorized vehicles, seasonal closures on coyote hunting, reducing livestock grazing on public land, and closing areas near den or rendezvous sites to human activity have been applied in a few areas and, although unlikely, are possible in the northern Rocky Mountains.

See Tables S-2 through S-4 for a comparison of the expected actions and effects of this alternative.

Alternative 3. No Wolf

Summary.--Congress would pass legislation to remove wolves in Montana, Wyoming, and Idaho from the list of Endangered Species. The FWS would stop all funding and management activity towards wolf monitoring, education, research, and control in the northern Rocky Mountains of the U.S. Furthermore, the states of Montana and Idaho would remove wolves from the protection of state law. Unregulated killing by the public would prevent wolf recovery in these areas. ADC activity would remove any wolves that threatened livestock. Wolf populations would not recover in the Yellowstone or central Idaho areas.

Management Actions

-Federal legislation would be passed that removed wolves in the northern Rocky Mountains from federal protection.

-Montana and Idaho state legislation would be passed that removed protection for wolves.

-Allowing people to kill wolves at any time, without restriction would by itself prevent wolf population recovery.

-ADC would kill any wolves causing potential conflicts with livestock.

See Tables S-2 through S-4 for a comparison of the expected actions and effects of this alternative.

Alternative 4. Wolf Management Committee

Summary.--Congress would be requested to immediately either amend the ESA or pass special legislation to designate wolves in Wyoming, Montana, and Idaho (except in and immediately west of Glacier National Park and in Yellowstone National Park) as a special state-managed nonessential experimental population. The states would develop plans to recover wolves in northwestern Montana, central Idaho, and Yellowstone National Park. Wolves would be recovered through natural dispersal in northwestern Montana and central Idaho and would be reintroduced in Yellowstone National Park. Wolves attacking or harassing livestock, working animals, or pets could be killed or moved by the public and by state, tribal, and federal agencies. Compensation for domestic animal losses, increased ungulate monitoring, and habitat enhancement would be paid from a federal trust fund. There would be few land use restrictions. Wolves would be moved to address state big game management goals. Wolf populations would recover in the Yellowstone area about 2010 and in central Idaho about 2015.

Management Actions

-Congress would amend the ESA and designate wolves, outside National Parks and National Wildlife Refuges, in Wyoming and Idaho and nearly all of Montana as a special nonessential experimental population and establish an interagency committee and federal trust fund.

-States would develop wolf management plans and assume management authority within 2 years.

-Wolves would be reintroduced into Yellowstone National Park and after 5 years possibly central Idaho.

-Agencies would move (if less than 6 packs were present) or kill (if 6 or more packs were present) wolves that attacked livestock, working animals, or pets.

-Owners of livestock, working animals, and pets could kill any wolves they believed were harassing or attacking their animals. Incidents must be reported within 48 hours on private land and 14 days on public land. Any wolves killed would be replaced. The alternative requires an education program for livestock producers.

-Wolves affecting state big game management objectives would be moved.

-Compensation for domestic animal losses from a federal trust.

-Establish public land use restrictions around active den sites between April 1 and June 15 and restrict toxicants lethal to wolves in areas where wolf occupancy was desired.

-Conduct an active information and education program.

-Monitor and enhance ungulate populations.

See Tables S-2 through S-4 for a comparison of the expected actions and effects of this alternative.

Alternative 5. Reintroduction of Nonexperimental Wolves

Summary.--Wolves would be reintroduced into areas in and near central Idaho and Yellowstone National Park until 10 breeding pairs were established. They would not be designated an experimental population. Wolf recovery would be a high priority on all surrounding federal lands. If required, land use restrictions such as road and trail closures, redistribution of grazing allotments, and protection of key wolf habitats would be promoted. If wolves depredated on livestock on public land or impacted state big game management objectives, no control would occur. If repeated chronic wolf depredation on livestock occurred on private lands, wolves would be moved. Compensation for livestock losses would be available only from existing private programs. Habitat for ungulates and wolf security would be enhanced to provide abundant prey. Wolf populations would likely recover rapidly and by 2000.

Management Actions

-The FWS would establish enhanced wolf recovery programs in Wyoming and Idaho (see Alternative 2) to conduct monitoring, research, and education programs.

-The FWS would reintroduce wolves into the Yellowstone and central Idaho areas until 10 breeding pairs were established, regardless if other wolves were documented in those areas.

-The USDA Forest Service and BLM, within the primary analysis areas, would use road closures and habitat enhancement on at least 35 square miles of lands they administer outside of wilderness.

-Wolves would not be controlled for livestock conflicts, except in chronic problem areas on private land, or for conflicts with ungulate populations.

-Land management agencies would spend about $3,000,000/year to purchase or enhance important ungulate/wolf habitat.

-Law enforcement programs would be significantly enhanced.

See Tables S-2 through S-4 for a comparison of the expected actions and effects of this alternative.

Table S-2. Alternatives and expected actions associated with them.

Alternatives	Control of livestock losses	Compensation for losses	Control of big game predation	Management of wolves	Land use restrictions for wolves	Where wolves would be recovered	Date of wolf recovery	Wolf mgt. cost until recovery	Legislation needed to implement
Reintroduction of Experimental Population	Agencies move/kill wolves for killing livestock/pets. Public harass and control under some conditions.	Probably private funds	Wolves moved if problem documented. Encourage land agencies to enhance ungulate habitat.	By states and tribes; some federal oversight.	None for wolves	YNP 17,600 mi^2 ID 20,700 mi^2	YNP & ID 2002	$6,008,750	None but publish experimental rule in federal register.
Natural Recovery	Agencies move wolves for livestock depredations	Probably private funds	None	Federal	1 mi. around dens 35^2 mi. affected. More possible	YNP 23,300 mi^2 ID 23,900 mi^2	YNP 2025 ID 2012	$10,000,000-$15,000,000	None
No Wolf	All wolves killed	None	All wolves killed	None for recovery by agencies	None for wolves	Nowhere	Never	$100,000	Modify state (MT & ID) and federal laws
Wolf Management Committee	Agencies move/kill wolves. Public kill wolves for harassing and attacking livestock/pets/working animals	Compensation by federal trust	Wolves moved, habitat enhanced, increased ungulate monitoring	By states. No federal oversight.	1 mi. around dens 35^2 mi. affected	YNP 12,070 mi^2 ID 9,450 mi^2	YNP 2010 ID 2015	$100,000,000-$129,000,000	Modify state and federal laws
Reintroduction of Nonexperimental Wolves	Agencies move wolves only in chronic problem areas on private land	Probably private funds	Habitat enhanced	Federal	1 mi. around dens 35^2 mi. affected. Some roads may be closed.	YNP 29,130 mi^2 ID 29,530 mi^2	YNP & ID 2000	$28,209,750	None

Table S-3. Expected impacts of recovered wolf population (100 wolves) by alternative--Yellowstone area.

Alternatives / Impact	Reintroduction of Experimental Population	Natural Recovery (No Action)	No Wolf	Wolf Management Committee	Reintroduction of Nonexperimental Population
Impact to big game populations	Elk 5%-20% reduction, mule deer 10% reduction, bison 5%-10% reduction, others no effect. Effects over Yellowstone area.	Same as Experimental but will occur several decades later. Short term negative effect to 30% possible.	None	Similar to Experimental population with effects confined mostly to YNP and wilderness areas	Slightly higher than Experimental but wolves recover sooner.
Effects on hunter harvest	Reduced antlerless harvest 8%(range 2%-30%), no effect on antlered harvest over Yellowstone area.	Same as Experimental but will occur several decades later. Short term 30% possible.	None	Similar to Experimental population with effects confined mostly to YNP and wilderness areas	Slightly greater than Experimental (15%) but wolves recover by 2000.
Livestock depredation	Annual average 19 (range 3-32) cattle, average 68 (range 38-110) sheep.	A few (10%) more over a longer period (30 years). Losses on private land more likely.	None	Losses likely toward lower range (3 cattle & 38 sheep) of that projected for experimental population.	Losses likely from upper range (32 cattle & 110 sheep) of projected to several times that level.
Land use restrictions	None	Reduce human activity one mile around active wolf dens. 35 mi^2 more possible road closures, etc.	None	Reduce human activity one mile around active wolf dens. 35 mi^2 more possible road closures, etc.	One mile around active wolf dens. If wolves illegally killed may include road closures, removal of livestock, and limits on activities on public lands.
Visitor use	Probable 5% increase in nonresident and 10% increase in local visitation.	5%-10% increase in 2025, after wolves become established.	None	Probable increase (5%-10%) in visitation by 2010.	Probable increase (5%-10%) in visitation by 2000.
Economic effects	Net positive benefit; $7 to $10 million annually beginning by 2002.	Net positive benefit $1.4-$2.1 million by 2025.	None	Net positive benefit $3.3-$6.1 million; slightly lower than experimental population by 2010.	Net positive benefit; $3.8-$6.7 million annually beginning by 2000.

Table S-4. Expected impacts of recovered wolf population (100 wolves) by alternative--central Idaho area.

Alternatives / Impact	Reintroduction of Experimental Population	Natural Recovery (No Action)	No Wolf	Wolf Management Committee	Reintroduction of Nonexperimental Population
Impact to big game populations	Elk 5%-10% reduction, others no effect in central Idaho area by 2002.	Same as Experimental but will occur a decade later. Bighorn sheep could decrease temporarily.	No new	Similar to experimental population with effects confined mostly to wilderness areas and later (2015).	Slightly higher than Experimental but wolves recover sooner. Bighorn sheep may be temporarily decreased.
Effects on hunter harvest	Reduced antlerless harvest (elk only) 10%-15%, no effect on antlered harvest in central Idaho area.	Same as Experimental but will occur a decade later. Some Bighorn sheep could be affected.	No new	Similar to experimental population with effects confined mostly to wilderness areas and later.	Slightly greater than Experimental (15%) during recovery but wolves recover by 2000.
Livestock depredation	Average 10 (range 1-19) cattle, average 57 (range 32-92) sheep.	A few more (12 cattle, 60 sheep) over a longer period (30 years). Losses on private land more likely.	No new	Losses likely toward lower range (8 cattle, 40 sheep) of that projected for experimental population.	Losses likely from upper range (14 cattle, 70 sheep) of projected to several times that level.
Land use restrictions	None	One mile around active wolf dens. 35 mi^2 impacted. More possible road closures, etc.	No new	One mile around active wolf dens. 35 mi^2 impacted.	One mile around active wolf dens. If wolves illegally killed may include road closures, removal of livestock, and limits on activities on public lands.
Visitor use	The projected effect is unclear, but 2% increase likely.	The projected effect is unclear, but likely 2% increase in 2012.	No new	The projected effect is unclear but likely to increase in 2015.	The projected effect is unclear, but likely to 2% increase in 2000.
Economic effects	Net positive benefit; $5.6 to $8.4 million annually.	Net benefit $3.5 to $5.2 million.	No new	Net positive benefit $2.9 to $5.6 million; slightly lower than experimental population beginning in 2015.	Net positive benefit; $3.4 to $6.2 million annually.

Response Form

Mail comments to Gray Wolf EIS, P.O. Box 8017, Helena, MT 59601
by October 15, 1993.

Alternative 1.
Alternative 2.
Alternative 3.

Summary

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INTRODUCTION

Wolves, once common in the northern Rocky Mountains of the United States, were exterminated by 1930. Wolves were listed as an endangered species in 1973. In 1987 a wolf recovery plan recommended wolf populations be recovered by establishing 3 populations, 1 each in northwestern Montana, central Idaho, and the area in and around Yellowstone National Park. Wolves have naturally dispersed from Canada and established a population in northwestern Montana but are still absent from Yellowstone and central Idaho.

This document describes 5 alternative ways that wolves could be reintroduced in Yellowstone National Park and central Idaho. Three alternatives (including the proposal) involve capturing and releasing wolves. One alternative (No Action) simply encourages natural wolf recovery. One alternative does not allow wolf recovery. All issues and concerns identified by the public were considered and the most significant analyzed in detail. The probable effects of each alternative on livestock, land use, ungulate populations, hunter harvest, visitor use, and regional economies are also described.

CHAPTER I

PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

This section of the draft Environmental Impact Statement (DEIS) discusses the purpose and need for the action, background of why the DEIS is being developed, the project location, the legal constraints of any decision, how the planning process was developed, the scoping of the DEIS, and the major issues and concerns that were considered in detail in the DEIS.

PURPOSE OF THE ACTION

The U.S. Fish and Wildlife Service (FWS) proposes to recover, and then delist (remove from federal protection), the gray wolf (*Canis lupus*) in the northern Rocky Mountains by establishing a minimum of 10 breeding pairs of gray wolves, for 3 consecutive years, in each wolf recovery area in (1) northwestern Montana, (2) central Idaho, and (3) the greater Yellowstone area. Wolves have been dispersing naturally into northwestern Montana and have established a population. The Yellowstone and central Idaho areas represent 2 of 3 wolf recovery areas in the northern Rocky Mountains of the United States (U.S.) that were identified in the 1987 Northern Rocky Mountain Wolf Recovery Plan as being necessary for the recovery and conservation of endangered gray wolves, but wolf populations do not currently exist in these areas. This proposal covers only the Yellowstone and central Idaho areas.

NEED FOR THE ACTION

The FWS is the primary agency responsible for the recovery and conservation of endangered species, including the gray wolf in the U.S. In 1991, Congress directed the FWS to prepare a DEIS on reintroduction of wolves into Yellowstone National Park and central Idaho.

BACKGROUND

Gray wolves were common in the northern Rocky Mountain states prior to 1870. After bison (*Bison bison*), elk (*Cervus elaphus*), deer (*Odocoileus spp.*), and other ungulates were decimated by unregulated hunting and human settlement, wolves and other large predators threatened the expanding livestock industry. By 1930, government predator control programs severely reduced predators and eliminated wolves from the western U.S.

The northern Rocky Mountain wolf subspecies (*Canis lupus irremotus*) was listed as an endangered species in 1973 (38 Federal Register 14678, June 4, 1973). However, because modern taxonomists recognized fewer subspecies, the entire species (*Canis lupus*) was listed as an endangered species throughout the contiguous U.S., except in Minnesota where wolves were listed as threatened, in 1978 (43 Federal Register 9612, March 1978). As enacted by Congress, the purposes of the Endangered Species Act (ESA) are "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth..." The ESA "further declared to be the policy of Congress that all Federal Departments and agencies shall seek to conserve endangered species and threatened species and shall use their authorities in furtherance of this Act." The ESA also stated "The Secretary shall develop and implement plans (herein..referred to as 'recovery plans') for the conservation and survival of endangered species..."

The Northern Rocky Mountain Wolf Recovery Plan was first approved by the FWS in 1980. The plan was "intended to provide direction and coordination for efforts toward recovery of at least 2 viable Northern Rocky Mountain Wolf (*Canis lupus irremotus*) populations in the lower 48 states." The plan recommended among other things that wolf status and distribution be determined, management programs for any existing wolves be established, and wolf populations in unoccupied habitat be established through dispersal and introduction.

The Northern Rocky Mountain Wolf Recovery Plan was revised and approved by the FWS in 1987. The primary goal of the revised plan was "to remove the Northern Rocky Mountain wolf from the endangered and threatened species list by securing and maintaining a minimum of 10 breeding pairs of wolves in each of three recovery areas for a minimum of three successive years." That plan recommended wolf population recovery through natural colonization in the northwest Montana and central Idaho recovery areas. If monitoring efforts in those recovery areas did not indicate satisfactory progress (2 breeding pairs) toward recovery through natural recolonization within 5 years, other conservation measures would be identified and implemented. Due to Yellowstone National Park's geographic isolation from areas with established wolf populations, the recovery plan recommended the reintroduction of wolves there, designated as a nonessential experimental population. However, before any reintroduction effort was initiated, the appropriate National Environmental Policy Act documents (Environmental Impact Statement) were to be prepared with full public involvement.

In the 1990 Department of the Interior Appropriations Bill (PL 101-512 enacted on November 5, 1990) Congress directed the Secretary of Interior to appoint a 10-member committee, composed of representatives of the National Park Service (NPS), FWS, USDA Forest Service, representatives from fish and game agencies from Idaho, Montana, and Wyoming, conservation groups, and livestock and hunting communities. The Committee's task was to develop a gray wolf reintroduction and management plan for Yellowstone National Park and the central Idaho Wilderness Area. The Committee was further charged with making its completed plan and its recommendations available to the Secretary and the Congress by May 15, 1991. The Committee's plan was to represent a consensus agreement with at least 6 members supporting the plan. Seven members (FWS, USDA Forest Service, 3 State agencies, hunting and livestock representatives) voted for the plan, 1 abstained

(NPS), and 2 voted against it (conservation group representatives). The report was presented to Congress on schedule, but, to date, no action has been taken on the Committee's recommendation.

On November 13, 1991, Congress directed the FWS, in consultation with the NPS and USDA Forest Service, to prepare a DEIS on wolf reintroduction into Yellowstone National Park and central Idaho. Congress further directed the DEIS be completed by May 13, 1993 and that it cover a broad range of alternatives about wolf reintroduction (PL102-154). In October 1992, Congress directed the FWS to complete the final EIS by January 1994, and stated that it expected the preferred alternative be consistent with existing law.

PROJECT LOCATION AND DESCRIPTION

This project involves the northern Rocky Mountains of the U.S., and specifically refers to the states of Montana, Idaho, and Wyoming. Congress directed the FWS to evaluate wolf reintroduction into Yellowstone National Park and central Idaho (Figure 1-1).

LEGAL CONTEXT

Endangered Species Act (ESA)

The purposes of the ESA are "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in subsection (a) of this section."

FWS Policy

The mission of the FWS is "to provide the federal leadership in the conservation, protection, and enhancement of fish and wildlife populations and their habitats for the continuing benefit of people."

National Refuge System Administration Act of 1966

This act provides fundamental policies for administration and management of all units of the National Wildlife Refuge System including the National Elk Refuge and Red Rock Lakes National Wildlife Refuge. This act also establishes the concept of "compatibility" whereby proposed uses of refuge lands must first be determined to be compatible with the purposes for which individual refuges were established.

USDA Forest Service Creative Act of 1891

National forests are established under the Creative Act of March 3, 1891, which allows the President to set aside and reserve national forests from the public domain. Management

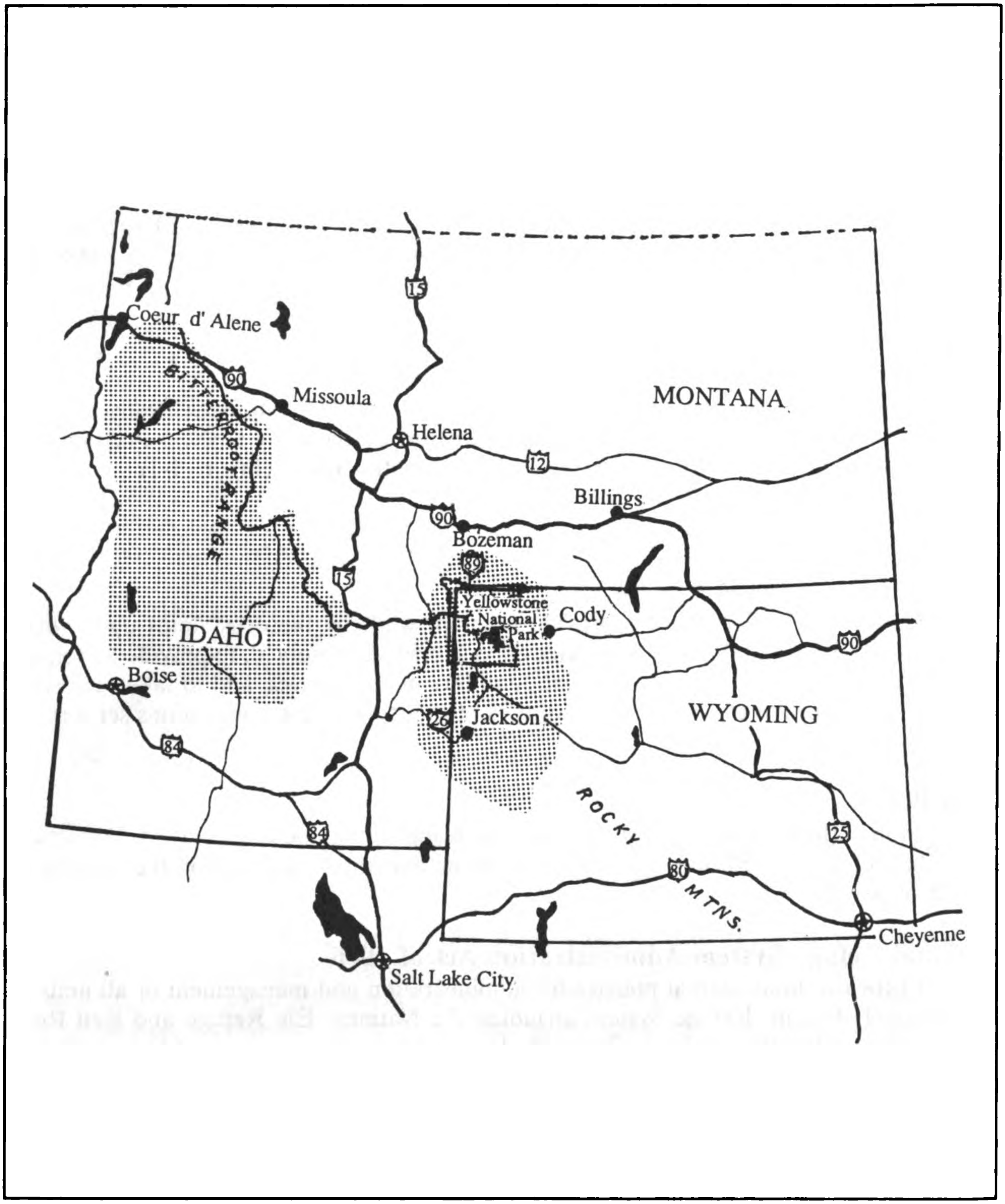

Figure 1-1. Shaded portions indicate the approximate location of the Yellowstone National Park and central Idaho primary analysis areas for the DEIS.

of national forests by the USDA Forest Service was established under the Organic Act of June 4, 1897, stating "No National Forest shall be established, except to improve and protect the Forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the U.S." (16 USC 551).

USDA Forest Service Policy

The National Forest Management Act of 1976 (16 USC 472) directs the management of national forests. Plans are prepared for each forest as required by the Forest and Rangeland Renewable Resources Planning Act of 1974 (16 USC 581). These forest plans guide natural resource management activities on the national forests and, along with the associated laws and regulations, are the basis for management of the national forests, production of outputs, use by the public, and protection of not only the natural and cultural resources located there but the protection of the millions of people visiting the national forests.

The National Park Service Organic Act of 1916

The Organic Act of 1916 (16 USC 1) established the NPS to "promote and regulate the use of the Federal areas known as national parks, monuments, and reservations... by such means and measures as conform to the fundamental purpose of said parks, ..., which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

National Park Service Policy

The NPS will manage the natural resources of the national park system to maintain, rehabilitate, and perpetuate their inherent integrity. The NPS will strive to restore native species to parks whenever all the following criteria can be met: (1) Adequate habitat exists and a natural population can be self-perpetuating, (2) The species does not pose a serious threat to safety of park visitors, park resources, or persons or property outside park boundaries, (3) The species used in restoration most nearly approximates the extirpated subspecies or race, and (4) The species disappeared, or was substantially diminished, as a direct or indirect result of human-induced change to the species or the ecosystem.

Yellowstone National Park Act of 1872

The world's first National Park--Yellowstone--was established in 1872, at which time Congress set aside more than 2 million acres (8,100 km^2) as "a public park or pleasuring-ground for the benefit and enjoyment of the people." The legislation assigned the new park to the control of the Secretary of the Interior, who would be responsible for issuing regulations to provide for the "preservation, from injury or spoilation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and retention in their natural condition." Other park management functions were to include the development of visitor accommodations, the construction of roads and bridle trails, the removal of trespassers from the park, and protection "against the wanton destruction of fish and game" (16 USC 21-22).

Animal Damage Control Act of 1931

The USDA, Animal and Plant Health Inspection Service, Animal Damage Control (ADC) program is conducted pursuant to the Animal Damage control Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b), as amended, which states, in part:

> "The Secretary... is authorized and directed to conduct such investigations, experiments, and tests as he may deem necessary...on public domain, State, ...privately owned lands of ... animals injurious to agriculture, ... forestry, ... wild game animals, ... and for the protection of stock...' and to conduct...control...of such animals...and may cooperate with States, individual and public and private agencies, organizations and institutions."

The overall mission of the ADC Program is to: "Assist in protecting the wildlife resource by providing national leadership in the control of conflicts between wildlife and man."

Wilderness Act of 1964

This act provides the framework for designation by Congress of units of the National Wilderness Preservation System and prescribes policy for their management. "A wilderness is recognized as an area where the earth and its community of life are untrammeled by man... Wilderness areas... shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness... and the preservation of their wilderness character" (16 USC 1131).

National Environmental Policy Act of 1969 (NEPA)

This act requires that the responsible official submit a detailed report on "major federal actions significantly affecting the quality of the human environment" prior to taking major federal actions (42 USC 4321). Implementation of any one of the alternative plans for reintroduction of wolves into Yellowstone National Park and central Idaho is considered a major action and this planning effort is, therefore, subject to NEPA requirements.

Montana State Law

The wolf is listed as a State endangered species in Montana. Under the Nongame and Endangered Species Conservation Act (87-5-109), taking of wolves is authorized for scientific, zoological, or education purposes, for propagation in captivity, or for other special purposes by permit issued by the Director, Montana Department of Fish, Wildlife, and Parks (MDFWP). Where necessary to alleviate property damage, state endangered species may be taken under permit issued by the Director, MDFWP, and where possible under the supervision of Department personnel. They may also be taken without permit in emergency situations involving immediate threat to human life.

Idaho State Law
The wolf is listed as an endangered species in Idaho, and State statutes and regulations allow taking of wildlife, including wolves, to protect human life and property. Reporting the taking of animals under these situations is required. However, certain restrictions currently exist as described under Idaho Code, Section 36-715(2), which reads, "The Idaho Department of Fish and Game (IDFG) shall not be authorized to expend funds, transfer assets or enter into a cooperative agreement with any agency, department, or entity of the U.S. government concerning wolves unless expressly authorized by State statute except that the department is authorized to provide a representative to participate on the northern Rocky Mountain Wolf Recovery Team and in activities regarding nuisance wolves." In 1992, the legislature authorized the IDFG to participate in preparation of the Gray Wolf EIS.

Wyoming State Law
The wolf is listed as a predator in Wyoming and, under State statute (23-1-101 VIII), may be taken at any time without limit. There is no reporting requirement for killing a wolf. The Wyoming Game and Fish Department (WGFD) has no authority to manage wolves.

International Treaties
Several treaties affect how the federal government manages federal land and wildlife (including endangered species) under federal authorities, including the Convention on Nature Protection and Wildlife Conservation in the Western Hemisphere and Council on International Trade in Endangered Species (CITES). These treaties differ in emphasis and species of primary concern, but collectively provide clear mandates for identifying and protecting important habitats and ecosystems, and protecting and managing individual species.

PLANNING/EIS PROCESS

The process used to develop alternatives for wolf reintroduction into Yellowstone National Park and central Idaho was designed to fulfill the legal mandates cited above. Four alternatives in this DEIS represent a long-range strategy that achieves wolf recovery. One alternative prevents wolf recovery. When alternatives require changes in existing law to be implemented, those changes are clearly identified.

Scoping Process and Public Participation
To identify issues and alternatives to be considered, a public participation and interagency coordination program was developed. This effort, called "scoping," included reviewing previously developed plans and documents regarding wolf recovery in Yellowstone National Park and central Idaho (Weaver 1978, USFWS 1980, 1987 and 1988, Kaminski and Hansen 1984, YNP et al. 1990, Peek et al. 1991, Wise et al. 1991, Varley and Brewster 1992, Wolf Management Committee 1991).

The next step was to contact nearly 2,500 groups or individuals previously expressing interest in wolf recovery to solicit their input. A series of 34 informational meetings was held in April 1992 to obtain comments on issues of concern to the public about wolf reintroduction and its impacts. A series of 27 meetings and 6 formal hearings was held in August 1992 to report on the issues identified and solicit input on the range of alternatives to be considered in the EIS. Brochures detailing the results of the issue identification and alternatives formulation were sent to nearly 32,000 individuals and groups that requested to receive information. The mailing list included individuals representing all 50 states and 40 foreign countries. Nearly 4,000 comments on issues and about 5,000 comments on alternatives were received from the public. See Chapter 5, Consultation and Coordination for further information.

SCOPING OF ISSUES

Introduction

During scoping, 39 wolf recovery issues were identified by the public. These issues were either not analyzed further and the reasons why explained, or included in an alternative, or analyzed in detail as an issue or potential impact of wolf recovery. The decision to classify an issue as a major issue or concern that will be analyzed in detail in the DEIS is made solely on its relevance to the decision that is being made or based on the best scientific judgement that the issue is significant to the decision being made. For instance, some people were concerned about the impact of wolves on a variety of rodents or fish. Because wolves are not documented to have impacts on populations of these types of animals, the issue is not significantly impacted by wolf recovery and therefore not analyzed further. In contrast, the decision about how wolves are recovered and managed will have an impact on the extent of livestock losses. Consequently, this issue was classified under a major issue and concern heading, "How will depredations on domestic animals be controlled?" and is addressed as an impact of wolf recovery in the EIS. All issues raised were considered but not all were analyzed because they were not significant, as explained later.

The issues and alternatives identified and their resulting impacts were divided into 2 categories: those analyzed in detail and those eliminated from detailed consideration. Issues and alternatives analyzed in the EIS are divided into 2 additional categories: those incorporated into alternatives, and those evaluated as impact topics. The following list represents those issues. Descriptions of the reasons for evaluating or eliminating issues/alternatives and their impacts from consideration follow each list.

Issues/Impacts Evaluated in the EIS

Issues Addressed as Part of Alternatives

Amending the Endangered Species Act
Wolves as a missing component of the ecosystem
Humane treatment of wolves

Enjoying wolves
Regulated public take of wolves
Cost of program
State, tribal, and federal authority
Viable population
Travel corridors
Range requirements
Control strategies
Illegal killing
Compensation
Delisting
Need for education
Spiritual/cultural
Social/cultural environment
Recovery areas

These issues/impacts are addressed as part of 1 or more alternatives in the plan.

Impact of wolf recovery on amending the Endangered Species Act.--Wolf recovery will not impact federal authority or the legal processes already identified to change the ESA if Congress so desired. In the 1993 federal appropriations bill, Congress stated that it "expects... that the preferred alternative will be consistent with existing law." However, this issue is addressed in 1 or more alternatives to present a broad range of alternatives, including some that would require changes in legislation.

Impact of wolf recovery on ecosystem completeness.--Wolf recovery in Yellowstone National Park and central Idaho will be addressed as part of 1 or more of the alternatives. The wolf is the only member of the mammalian biotic community of Yellowstone National Park that was present in historic times that is missing. Wolf recovery in the Yellowstone and central Idaho areas will restore a large predator to the food chain in those systems, making predator/prey relationships more complete. Prey populations will likely fluctuate slightly less, because of reduced winterkill, and fewer injured or unhealthy individuals will be present in the general prey population.

Impact of wolf recovery on humane treatment of wolves.--It is the policy of the FWS to conduct wildlife research, control, and management humanely. Humane treatment of wolves would be part of every management alternative that includes capturing, transporting, holding, controlling, and monitoring wolves, and is mandated by Federal policy.

Impact of wolf recovery on public enjoyment of wolves.--The ability of people to enjoy either the presence or absence of wolves is reflected in the various alternatives.

Impact of wolf recovery on regulated take by the general public.--Some alternatives permit regulated take of wolves by the public. The decision on how to manage wolves after delisting will be made by the respective states, and will likely include harvest by the public. All alternatives that result in wolf population recovery will ultimately result in state management programs that can potentially include regulated take by the public.

The FWS recognizes that regulated public harvest is a valuable wildlife management tool. Public harvest can be one of the most efficient, humane, least expensive, and locally acceptable methods of managing wolf populations and minimizing wolf/human conflicts after wolf populations are recovered and delisted.

Impact of wolf recovery on program cost.--Costs of the wolf recovery program will vary between alternatives and are displayed for each alternative.

Impact of wolf recovery on state, tribal, and federal authority.--Wolf recovery will not change the authority of local, state, tribal, or federal government as defined by law. However, the various alternatives do place different emphasis on the level of state or tribal involvement and responsibility in implementing various wolf recovery strategies. Public comment during issue and alternative scoping indicated that people believed that wolf management should be addressed differently on private property than on public property. This concern is reflected in 1 or more of the alternatives that allow more management flexibility on private property.

Impact of wolf recovery on wolf population viability.--Wolf recovery will not impact the number, distribution, or persistence of wolves that, in combination, define the basis of a determination of whether a population is viable. The current definition for a viable wolf population in Montana, Wyoming, and Idaho is 10 breeding pairs, in each of 3 recovery areas (with some level of wolf exchange between them) for 3 consecutive years. This definition may change based upon future scientific or biological information, but would not vary between alternatives that result in wolf recovery. A recent scientific investigation into the question of population viability indicates that the definition of a viable wolf population outlined in the 1987 Wolf Recovery Plan (10 breeding pairs, in each of 3 recovery areas for 3 successive years with some level of interchange between areas) is still an appropriate measure for determining if gray wolves require federal protection under ESA (S.H. Fritts pers. commun., USFWS, Helena, Mont.). This analysis also emphasized the importance of increasing the number of population "founders", and establishing expanding wolf populations in all three areas simultaneously, arguing for reintroduction rather than natural dispersal, particularly in the Yellowstone area, to enhance wolf population viability and genetic diversity (Appendix 9).

Impact of wolf recovery on wolf travel corridors.--Wolf recovery will not result in wolf travel corridors or linkage zones being established. The Yellowstone and central Idaho areas are separated from northwestern Montana by enough human settlement (a social rather than physical obstacle that results in some level of increased wolf mortality) that it could take decades for population recovery to begin. However, once established in each of the recovery areas, enough wolves from each area would disperse that some would successfully travel through or live in areas other than those in Yellowstone National Park and central Idaho. The size and proximity of 3 areas where wolves will be managed for recovery are large enough, close enough, and have enough public land between them that additional areas (travel corridors) are not required in the foreseeable future to maintain a viable wolf population after the 3 subpopulations become established.

Impact of wolf recovery on the range requirements of wolves.--This issue relates to the areas that wolves require and the fact that, by their nature, all wolves will not be confined to a specific area. This issue is addressed by identifying management strategies for wolves in specific areas in the various alternatives. Certain types of management will restrict the range of wolf populations.

Wolf control strategies.--Various methods to control wolf depredations on livestock and reduce the potential effect on big game populations are addressed in the alternatives. In 1991 Congress appropriated additional funding ($291,000) to fund wolf control programs by ADC so that funding for other ADC control programs would not be reduced to fund wolf control activities.

Impact of wolf recovery on illegal killing of wolves.--The federal penalties for killing an endangered species can be up to a $100,000 fine, 1 year imprisonment, loss of federal permits (grazing and guiding/outfitting), loss of hunting, fishing, and trapping privileges, and loss of personal property used in the crime. Substantial anonymous rewards (thousands) are available for information leading to the arrest and conviction of offenders. Montana and Idaho state laws also have penalties for illegally killing wolves.

Wolves have been illegally killed in Montana, Idaho, Wyoming, and in Canada adjacent to Glacier National Park. At least 5 wolves have been illegally killed in Montana within the past 5 years. Two were mistaken for dogs and were killed by livestock producers who reported they were harassing livestock. Neither of those producers was prosecuted. Three other wolves were found illegally killed. In 1978 a wolf was shot in central Idaho. In 1991, 1 wolf, and possible others, were illegally poisoned in central Idaho. In 1992, a man near Yellowstone National Park shot a wolf after mistaking it for a coyote. He was not prosecuted. If wolves become present in an area, some will be illegally killed by people. The level of illegal killing is a function of attitudes about wolves, local public confidence in the government to legally address conflicts, public education, law enforcement, and land management strategies to reduce human/wolf conflicts. Illegal killing is addressed in various alternatives by establishing when wolves may or may not be legally harassed or killed and setting different levels of land use restrictions and enforcement.

Compensation for livestock killed by wolves.--The issue of compensation is addressed in 1 or more of the alternatives.

Impact of wolf recovery on delisting of wolves.--Wolf recovery will result in a viable wolf population that will be delisted according to the provisions of the ESA. Wolf reintroduction will not affect those criteria. The Federal role is limited to wolf recovery. Delisting wolves with ultimate management by states and tribes is part of all alternatives. Some alternatives result in wolf populations reaching recovery in all 3 areas at about the same time, accelerating delisting. Others result in recovery in 1 area long before others, greatly prolonging delisting. These differences are pointed out among the various alternatives.

Because wolves are so symbolic to many people, delisting wolves, even after populations reach recovery levels and no longer require federal protection, will be controversial. Recent events in Alaska and Canada (where the wildlife departments recommended shooting some wolves in a few areas from airplanes to increase big game populations) and in Minnesota (where recommendations were made to initiate public harvest of wolves before they were removed from the list of threatened species) indicated many people became angered when they perceived that wolves were about to be harmed or treated unfairly. While the large number of people, big game species, and roads in the northern Rocky Mountains makes it highly unlikely that any wildlife manager would ever need to recommend shooting wolves from aircraft, regulated public harvest (hunting) will, at some time, become part of state management of recovered wolf populations. Many people will strongly oppose any attempts to delist wolves for this reason. The FWS will continue to follow the procedures established in the ESA to fully recover and then delist populations of threatened and endangered species, including controversial species such as wolves.

The FWS recognizes that regulated public harvest is a valuable wildlife management tool. Public harvest can be one of the most efficient, humane, inexpensive, and locally acceptable method of managing wolf populations and minimizing wolf/human conflicts once wolf populations are recovered and delisted.

Impact of wolf recovery on the need for education.--Many of the issues dealing with wolf recovery can be addressed by providing accurate information to the public so they can make informed choices about wolves and wolf management. Education is part of 1 or more of the alternatives.

Impact of wolf recovery on spiritual and cultural values that people place on wolves.--Wolf recovery will not have a major impact on the cultural and spiritual values that people associate with wolves. However, the presence or absence of wolves and how they are managed are affected by various alternatives, which in turn impacts the intensity of those spiritual and cultural values.

Impact of wolf recovery on the cultural and social environment.--The presence or absence of wolves will influence perceptions of people about the Yellowstone and central Idaho areas. The area occupied by wolf populations is reflected in various alternatives in the DEIS.

Impact of wolf recovery on wolf recovery areas.--Wolf recovery alternatives will result in differences in the sizes of the areas that are managed for wolf population recovery.

The 1987 Northern Rocky Mountain Wolf Recovery Plan recommended that wolf recovery areas be better defined. A zone management concept was recommended whereby recovery would be most strongly encouraged in areas with few people and livestock (parks and wilderness), tolerated in areas with minor conflicts (public land) and discouraged in areas with likely conflicts (private land). The 1988 wolf control plan (USFWS 1988) incorporated that concept as one factor in determining when and how wolves that had or were likely to attack livestock would be controlled. The concept of wolf management zones was discussed in Fritts (1990). The concept of managing wolves differently in various areas depending upon the level of potential conflicts is reflected in various ways in all alternatives. Allowing wolves to be harassed at any time on private land but not on public land under an experimental population rule is one example. Trying to actively confine all wolves only to a specific area is unrealistic because wolves can disperse long distances, and lone animals are difficult to document. However, by varying management strategies in different areas, wolves will in fact be passively managed so that wolf population recovery is restricted to specific "zones."

Issues/Impacts Analyzed in the EIS

Impact of wolf recovery on ungulate populations
Impact of wolf recovery on hunter harvest
Impact of wolf recovery on domestic livestock
Impact of wolf recovery on land use
Impact of wolf recovery on visitor use
Impact of wolf recovery on economics

Potential impacts of wolf recovery on each of the following issues/impacts will be analyzed under each alternative.

Impact of wolf recovery on ungulate populations.--Wolf recovery is predicted to have an impact on big game populations. White-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), elk, moose (*Alces alces*), bison, bighorn sheep (*Ovis canadensis*), mountain goats (*Oreamnos americanus*), and antelope (*Antilocapra americana*) will be killed by wolves. Effects of wolf recovery on populations of these species will vary and will be analyzed to the extent possible for each alternative.

Impact of wolf recovery on hunter harvest.--Wolf recovery is predicted to have an impact on the hunter harvest of big game (primarily female ungulates). The impact of wolf recovery on the harvest of big game by human hunters will be an area of impact analysis. Other types of hunter opportunity and harvest (small game, game birds, waterfowl, and varmint) will not be measurably impacted.

Impact of wolf recovery on domestic livestock.--Wolf recovery is predicted to have an impact on domestic animal losses. Livestock depredations will be a subject of impact analysis in the DEIS as part of 1 or more alternatives. Non-livestock domestic animal losses (primarily dogs) are expected to be uncommon but will be addressed under some alternatives in the DEIS. The issue of wolf control strategies and compensation to address domestic animal depredations will directly affect the level of depredations and local human tolerance of wolf recovery.

Impact of wolf recovery on land use.--Wolf recovery can have an impact on the types of land use restrictions used on public lands. Restrictions affecting open road density, ADC activities, motor vehicle use, and hiking have been used in some limited areas to enhance wolf recovery where illegal killing or disturbance near den sites by humans was a major factor affecting wolf survival. In some areas habitat manipulation (logging or fire) was used to enhance the prey base for wolves. Various alternatives reflect different levels of land use restrictions and/or prey enhancement.

Impact of wolf recovery on visitor use.--Wolf recovery is predicted to have an effect on visitor use in Yellowstone National Park and central Idaho.

Impact of wolf recovery on economics.--Wolf recovery will have an impact on the economics of the affected areas.

Significant Issues/Impacts and Concerns

The specific issues/impacts (listed and discussed above) that were identified by the public and incorporated into the DEIS, as either parts of the alternatives (18) or as areas potentially impacted by wolves (6), share a common set of wolf management concerns. All of these issues/impacts can be summarized into an examination of the who, what, when, where, and how of wolf recovery and management. To clarify how various alternatives address the issues/impacts and concerns of the public, they were grouped into 9 general wolf management questions (concerns) the FWS considers most significant. An example of how the issues/impacts were grouped is portrayed in the question "Where will wolf populations be recovered?" which involves parts of the issues of: wolves as a missing component of the ecosystem, enjoying wolves, travel corridors, range requirements, and recovery areas and will affect the potential impact of wolf populations on all 6 impact analysis areas. The other eight questions address a variety of these and other issues/impacts that were also important to the public. These 9 questions form a basis to consistently describe and compare each alternative being analyzed in the DEIS and how each addresses all significant public issues/impacts and concerns.

Those 9 major issues/impacts and concerns that are used to describe the alternatives are:

1. How will depredations on domestic animals be controlled?
2. How will livestock producers be compensated for losses?
3. How will potential impacts to big game populations be managed?
4. Who will manage wolves?
5. What kind of land use restrictions will occur?
6. Where will wolf populations be recovered?
7. When will wolf populations recover?
8. How much will wolf recovery cost?
9. Are changes in current state or federal law required?

Issues/Impacts Not Evaluated in the EIS

Impact of wolf recovery on wolves because wolves were not native to Yellowstone National Park
Impact of wolf recovery on wolf rights
Impact of wolf recovery on federal "subsidies"
Impact of wolf recovery on human safety/health
Impact of wolf recovery on other predators and scavengers
Impact of wolf recovery on other endangered species
Impact of wolf recovery on plants, invertebrates, fish, reptiles, amphibians, birds, and mammals
Impact of wolf recovery on diseases and parasites
Impact of wolf recovery on private property rights
Impact of wolf recovery in the northern Rocky Mountains on wolf recovery in other areas
Impact of wolf recovery on existing wolves in the Yellowstone or central Idaho areas
Impact of wolf recovery on existing wolves in northwestern Montana
Impact of wolf recovery on wolf subspecies
Impact of wolf recovery on wolf/dog/coyote hybridization
Impact of wolf recovery on the need for research

Issues/impacts that are not within the scope of the decision to be made in the EIS or will not be significantly impacted by the alternatives are not analyzed further in the DEIS. Issues not analyzed in detail and the reasons why they were not chosen for detailed analysis in the DEIS are explained in the following section.

Impact of wolf recovery on wolves because wolves were not native to Yellowstone National Park.--Wolves were native to the Yellowstone National Park area, although their historic numbers cannot be determined. In recent times, wolves were the most widely distributed land mammal in the world next to humans. Wolves occupied nearly all habitats in the northern hemisphere that contained large ungulates. In the 1700s, wolves occupied most of North America north of what is now Mexico City. Recent investigations indicated that wolves were part of the original fauna of the area now containing Yellowstone National Park from historic times until they were extirpated by humans around 1926. For references see Koth et al. 1990, Cannon 1992, Laundre' 1992, Schullery and Whittlesey 1992, and Kay 1993.

Impact of wolf recovery on wolf rights.--Alternatives will not change the status of animal rights in local, state, or federal law.

Impact of wolf recovery on federal "subsidies".--Some people believed that extraction of natural resources on public lands and/or government expenditures for "non-consumptive" natural resource programs were government "subsidies" to various special interest groups. Wolf recovery will not change allocation of federal funding for other agency programs. Wolf reintroduction will also not change the rights of private citizens and organizations to promote their own viewpoints about wolves, the Endangered Species Act, or wolf reintroduction or to raise funds based upon the public's strong emotional response to these issues.

Impact of wolf recovery on human safety/health.--Wolf recovery will not significantly affect the risk to human safety or health. As with all wild animals, wolves are capable of posing a threat to human safety, but such occurrences are rare and unlikely. There are many historical and some recent reports of wolves in Europe and Asia attacking people, but documentation is limited. There are a few historical reports of wolves in North America killing or seriously injuring people, but these reported incidents were poorly documented and can never be scientifically confirmed or denied. During the past 100 years, millions of people in North America have lived, worked, and recreated in areas inhabited by wolves. However, since about 1890, when reliable scientific records of the causes of human injury and death began to be recorded in North America, no one has been documented to have been killed or seriously injured by a healthy wild wolf. However, if wolves did threaten human safety, the Act allows protection of human health and safety to be a defense against prosecution for take of a listed species. Current FWS wolf control policy in the region states that any wolf that presents a human health hazard would be promptly removed from the wild, quarantined, and killed (USFWS 1988). For reference see Mech 1990.

Impact of wolf recovery on other predators and scavengers.--Wolves live in the same habitats as a variety of other predators and scavengers in North America and are not documented to have major impacts on any predator or scavenger population. Nonetheless, wolf recovery may have some limited effects on other predators. Wolves will kill some coyotes (*Canis latrans*, Paquet 1992) and possibly mountain lions (*Felis concolor*, White and Boyd 1989), lynx (*Lynx lynx*, Bangs pers. obs.), black bears (*Ursus americanus*, Paquet and Carbyn 1986), and wolverine (*Gulo gulo*, Hatler 1989). Wolves may compete for ungulates with these and other predators or scavengers (Servheen and Knight 1990, Mattson and Knight 1992, Hornocker pers. commun.). Wolves will probably reduce the abundance of coyotes in a few localized areas but these impacts are unlikely to affect the overall distribution or abundance of coyotes in the recovery areas (Paquet 1992). Changes in coyote distribution may improve habitat for other small predators such as red fox (*Vulpes vulpes*). Wolves may cause slight but unpredictable changes in overall wildlife community structure in the core recovery areas as a result of ungulate carcass distribution and availability, competition or predation on other predators or scavengers, and changes in long term plant/ungulate/predator/scavenger relationships related to the presence of a large predator at the top of the food chain. However, it is unlikely that wolf recovery will have major adverse impacts on the numbers, distribution and habits of other predators and scavengers.

Impact of wolf recovery on other endangered species.--The following threatened or endangered species may occur in or near central Idaho: gray wolf, bald eagle, peregrine falcon, whooping crane, grizzly bear, woodland caribou, Snake River sockeye, chinook salmon, Bruneau Hot Springsnail, 1 plant species (Macfarlanes's four-o'clock), and 5 species of freshwater mollusks along the Snake River (see Appendix 7).

The following threatened or endangered species may occur in or near Yellowstone National Park (including Montana): gray wolf, grizzly bear, peregrine falcon, bald eagle, whooping crane, Wyoming toad, least tern, piping plover, pallid sturgeon, Kendall Warm Springs dace, and black-footed ferret.

Several plant and animal species are currently listed by the FWS as potential candidate species for listing as endangered or threatened. These are called Category 2 species (see Appendix 7 for complete list). Data are insufficient to support listing of these species at this time. Wolves are not expected to adversely impact populations of any of these species.

Wolves will provide and compete for ungulate carcasses with grizzly bears and bald eagles. Grizzly bears and wolves have been recorded to kill one another, but such instances are rare. Wolves have been documented to eat spawning salmon. Wolf predation, in combination with other factors, has contributed to the decline of some woodland caribou populations. If this situation was to occur in northern Idaho where about 50 endangered woodland caribou live, wolves could be moved to reduce predation pressure if such action was necessary for the survival of that caribou population. The ESA (Section 10) allows for the Secretary of the Interior to permit acts to enhance the survival of the affected species and such actions would also be permitted as part of any experimental population rule. However, wolf recovery is not likely to have a measurable adverse impact on the numbers, distribution, and habits of any endangered species of mammal, bird, amphibian, fish, or plant within the Yellowstone or central Idaho areas. For reference see Koth et al. 1990, Servheen and Knight 1990, Mattson and Knight 1992, and USFWS biological evaluation 1993 (Appendix 7).

Impact of wolf recovery on plants, invertebrates, fish, reptiles, amphibians, birds, and mammals.--Wolf recovery will have minimal impacts on other plant and animal species. However, it is unlikely that wolf recovery will have a major adverse impact on the numbers and distribution of plants and animals other than some types of large ungulates under certain circumstances. In some areas, beaver, if abundant, were an important food for wolves but wolves have not been documented to affect beaver populations. Restoration of a primary mammalian predator will cause some changes in the interrelationships within the biotic community. The relative magnitude and direction of any such changes would be extremely speculative other than to suggest that such changes will likely evolve over an extended period of time and be difficult to measure and attribute solely to wolf recolonization.

Impact of wolf recovery on diseases and parasites.-- Wolf recovery is unlikely to have a measurable impact on disease or parasite transmission. However, wolves may have a slight impact on disease and parasite transmission because they can be affected by or transmit diseases or parasites that are already common among coyotes, foxes, and domestic dogs. Canine rabies is not expected to occur in Yellowstone or central Idaho. For reference see Johnson 1992a and Johnson 1992b.

Impact of wolf recovery on private property rights.--Wolf recovery will not impact or change individual private property rights as defined by law. See summary of proposed action related to Executive Order 12630 (Appendix 6).

Impact of wolf recovery in the northern Rocky Mountains on wolf recovery in other areas.--As directed by Congress, this EIS specifically addresses wolf recovery in Yellowstone National Park and central Idaho. While the outcome of wolf recovery in the northern Rocky Mountains may impact the perceptions of people about the potential for wolf recovery in other areas or the effectiveness of the ESA, this document will not address wolf recovery in other areas or other applications of the ESA.

Impact of wolf recovery on existing wolves in the Yellowstone or central Idaho areas.--Wolf populations were extirpated from Yellowstone National Park and central Idaho around 1930. No evidence exists that wolf populations persisted in the northern Rocky Mountains of the U.S. to the present time or that the lone wild wolves occasionally reported in these areas are other than dispersing wolves from Canadian populations (Brewster and Fritts 1992, Nowak 1993). The likelihood of wolf populations persisting at a low level without evidence of pack formation in either the Yellowstone or central Idaho areas for the past 60 years is extremely remote. Although several instances have been documented or reported where wolves or wolf/dog hybrids have escaped or been released from captivity, these types of animals have not successfully survived or reproduced in the wild. However, the FWS and its cooperators continue to actively search for and monitor wolf activity throughout the northern Rocky Mountains. Any wolves located would be examined to determine, among other things, characteristics that would indicate they were different from the wolves recolonizing northwestern Montana. Recent investigations indicate there is little genetic difference among North American wolves (see Brewster and Fritts 1992), but any wild wolf population that was discovered and believed to represent a unique genetic subspecies would be thoroughly investigated and would be managed to recovery without competition from wolves reintroduced from elsewhere. Prior to implementation of any alternative requiring reintroduction, the FWS wolf monitoring program would likely have detected any existing wolf population.

Impact of wolf recovery on existing wolves in northwestern Montana.--Wolf recovery in Yellowstone National Park and central Idaho will not have an adverse impact on the natural recolonization of wolves in northwestern Montana. Dispersing wolves from the Yellowstone and central Idaho areas may eventually supplement natural recovery and add to the genetic diversity of wolves throughout the northern Rocky Mountains, including northwestern Montana. However, such movements into Montana would not be significant to establishing 10 breeding pairs there. By the time any decision on wolf recovery in the Yellowstone or central Idaho areas is made and significantly implemented, the Montana wolf population may be approaching 10 breeding pairs. The dispersal of wolves from Canada and Montana could impact wolf management strategies related to any experimental area designation in the Yellowstone and central Idaho areas and might assist population recovery in those areas.

Impact of wolf recovery on wolf subspecies.--All subspecies of gray wolves (*Canis lupus*) are listed and protected by the Act as amended, in the lower 48 states. Wolf recovery will not impact the ongoing scientific inquiry regarding the number or distribution of wolf subspecies in North America. Current scientific investigations indicate there are 5 or fewer potential subspecies of wolves in North America and the "subspecies" of wolves that were previously classified as being just in the northern Rocky Mountains were much less distinct than previously believed. For reference see Brewster and Fritts 1993, Nowak 1993, and Wayne et al. 1993.

Impact of wolf recovery on wolf/dog/coyote hybridization.--Wolf recovery will not result in a major impact to the number of wild wolf/dog hybrids or wolf/coyote hybrids living in the northern Rocky Mountains of the U.S. Although documented occasionally in Europe (Ciucci and Boitani 1991), hybridization apparently rarely occurs between wild wolves and domestic dogs and is apparently rare in North America. Wolf/dog hybrids apparently rarely survive to reproduce in the wild. There are an estimated 300,000 wolf/dog hybrids in captivity in North America and there is no documentation that these or other domestic dogs live and reproduce entirely in the wild in northern latitudes. Information suggests some feral dogs have successfully lived in the wild in the southeastern U.S.

Instances of potential coyote/wolf hybridization have been documented in the northeastern U.S. and southeastern Canada, but have not been documented in the western U.S., elsewhere in Canada or Alaska and have not affected gray wolf populations anywhere.

Wolf hybridization is not a major factor in gray wolf (*Canis lupus*) survival or population viability in North America where the range of wild gray wolves, coyotes, and domestic dogs overlaps. Despite the annual harvest of thousands of coyotes and hundreds of wolves and the examination of hundreds of wolves and coyotes over the past twenty years during wildlife research from areas where these 2 species overlap, few, if any, specimens with hybrid physical characteristics have been documented. This suggests that such hybridizations rarely occur and do not affect either coyote or wolf populations. See Lehman et al. 1991, and Wayne et al. 1992.

Impact of wolf recovery on the need for research.--Wolves are one of the most intensively studied predators in North America, and any wolf reintroduction would be evaluated and improved using modern scientific techniques. In addition, a 3-phase interagency wolf monitoring program has already been implemented in Montana, Idaho, and Wyoming to document wolf activity and recovery. Wolf recovery has been investigated in Glacier National Park since it began in 1979 (Ream et al. 1991) and recovering wolf populations have been studied elsewhere. The issue of more research is not an impact of wolf recovery, and it is not specifically dealt with as a major issue in any alternative. See Wolf Studies Task Force 1987, Tucker 1988, and Ream et al. 1991.

ALTERNATIVE SCOPING

Resource Inventory and Analysis

Information on various issues had to be compiled to objectively address the potential impact of wolf recovery. During and after scoping, efforts were made to identify and collect the types of information needed for planning wolf recovery strategies and analyzing the potential impacts of wolves on the environment. Information on wolf biology, livestock numbers and losses, land ownership, status, and management, ungulate (mule deer, white-tailed deer, elk, moose, bison, bighorn sheep, mountain goats, and pronghorn antelope) biology and management, other wildlife (grizzly bears, mountain lions, small mammals), economics, and use of public land was gathered from resource agency files, standard technical references, and current scientific literature. This information was used to classify and describe resources and uses so the potential impacts of wolf recovery on those resources could be identified and analyzed systematically. This information was also used to help formulate wolf management alternatives.

Development and Evaluation of Alternatives

After the resource information was analyzed, and the public participation process identified a range of various issues and alternatives, it became necessary to describe wolf management strategies (alternatives, including a proposed action). As a first step toward developing wolf reintroduction alternatives, the issues of concern to the public were compared to the wolf management alternatives already identified by the public or other groups that had already examined this subject. Those alternatives included an option where wolves would not be allowed to recover (No Wolf), another where special legislation would be passed by Congress (Wolf Management Committee recommendation), the management strategy being implemented in northwestern Montana (Natural Recovery), and a reintroduction of wolves under an experimental population rule into Yellowstone National Park (1987 Northern Rocky Mountain Wolf Recovery Plan). Each of the various issues identified by the public during issue scoping were addressed in different ways in these alternatives. To address other public concerns about maximum wolf protection, another alternative (Accelerated Wolf Recovery) was developed. The basic concepts behind those 5 alternatives were then summarized in an alternative scoping brochure that requested other ideas and comments from the public.

Based upon the nearly 5,000 public comments received during alternative scoping, at least 28 different combinations of those alternatives were recommended, and 4 alternatives addressing new concepts were identified. Based upon the issues and concerns raised by the public, and comments offered during alternative scoping, 5 alternatives, including 1 proposed by the FWS, were developed and are described in detail in the DEIS. (See Chapter 5, Development of the Proposal, for additional information.) Those alternatives represent a broad range of distinct approaches to wolf reintroduction in Yellowstone National Park and central Idaho.

The effects of implementing each of the alternatives upon the physical, biological, and human environments were then assessed. The alternatives were also evaluated on their potential to achieve wolf recovery and resolve the concerns and issues expressed by the public. Based upon this evaluation, a proposed alternative, Reintroduction of Experimental Populations, was identified.

After review of this DEIS by government agencies, tribes, tribal agencies, special interest groups, and the general public, the FWS will revise the alternatives if necessary and adopt 1 for implementation. This alternative will become the management plan for wolf recovery into Yellowstone National Park and central Idaho.

Alternatives Identified During Scoping, but not Evaluated Further

Six alternatives were either beyond the legal authority of this DEIS or were incorporated into the 5 alternatives chosen for analysis in the DEIS. Those were the (1) No Cow, (2) Delisting with State Management, (3) 1987 Wolf Recovery Plan, (4) State Management of Nonessential Experimental Populations, (5) Recovery of Existing Wolves, and (6) Accelerated Wolf Recovery Alternatives. An explanation of how the concerns they represented were addressed and why they are not being considered further are listed below.

1. The No Cow or Bison-based Sustained-Subsistence Economy Alternative recommended that livestock growing be eliminated throughout the region, all fencing be removed, animal damage control activity stopped, and bison and wolves be reintroduced. Implementing this alternative requires actions that are far beyond the scope of the DEIS and federal and state law. Implementation of this alternative would dramatically affect private property and management practices as dictated by federal and state law and agency policy on public lands. This alternative was not a reasonable option for further consideration because such drastic measures are not required for the recovery of a viable wolf population in the northern Rocky Mountains of the U.S., and it would not be reasonably consistent with current federal and state law.

2. The Delisting with State Management Alternative would require that wolves be immediately removed from protection of the ESA and that any recovery would be managed by the respective states solely under state laws. There would be no reintroductions. In Montana wolves are currently protected by state law. If wolves were removed from federal protection and state law remained unchanged, they would likely be managed as other resident wildlife (in much the same manner as a combination of the Wolf Management Committee and Natural Recovery Alternatives). Wolf populations in northwestern Montana would probably recover through natural dispersal. In Idaho wolves are also protected by state law, but other state law prohibits the IDFG from any management, except control, without the expressed permission of the state legislature. If wolves were removed from federal protection and state law did not change, wolves would not be actively managed. Wolf populations might eventually recover through natural dispersal. In Wyoming, wolves are listed as predators and are not under the legal authority of the WGFD so take would not be restricted. Because Yellowstone National Park is partially in Idaho and Montana and would be the portion of Wyoming nearest to wolf populations in Montana and Idaho, wolves would probably eventually live in Yellowstone Park and the surrounding wilderness areas, but would not persist elsewhere in Wyoming because of a high level of human persecution. If wolves were removed from federal protection and state laws remained unchanged, this alternative would be similar to natural recovery in Montana and Idaho and the no wolf option in Wyoming. Under this alternative there would be no federal oversight of recovery or the direction of changes in state law, but it is likely that wolf populations would eventually recover in all 3 wolf recovery areas. This alternative was not considered further because: (1) the management concerns it resolved are also addressed through the Wolf Management Committee and Natural Recovery Alternatives, (2) it would not be consistent with existing federal and some state laws and Congressional direction, (3) the conflicting intent of current state laws and, (4) the uncertain direction, future authorization, and/or implementation of state laws.

3. The 1987 Wolf Recovery Plan Alternative recommended reintroduction of a nonessential experimental population of wolves into Yellowstone National Park and monitoring of natural wolf recovery for 5 years in central Idaho. If 2 breeding pairs had not been

documented in central Idaho within 5 years, other conservation measures were to be considered. Breeding wolves have not been documented in Idaho, and consequently other conservation measures are being considered through this DEIS. The 1987 Wolf Recovery Plan represented a combination of an experimental population reintroduction in Yellowstone National Park, and natural recovery in central Idaho. In the DEIS, the 5 different approaches to wolf recovery are being equally considered in both the Yellowstone and central Idaho areas to comply with directions from Congress that "a broad range alternatives be considered." Also there is no evidence of wolf populations in either the Yellowstone or central Idaho areas. This mix of natural recovery and reintroduction of an experimental population is not being considered further as a separate alternative because of the absence of natural recovery in Idaho, and because the concerns expressed in the 1987 Wolf Recovery Plan are fully but separately addressed by the Reintroduction of Experimental Populations and Natural Recovery Alternatives.

4. The State Management of Nonessential Experimental Populations Alternative recommended a state implemented nonessential experimental population rule, with wolf reintroduction into Yellowstone National Park and central Idaho. This alternative, except for the provision establishing a one-time federal trust to fund a wolf compensation and depredation program, was incorporated into the Reintroduction of Nonessential Experimental Populations Alternative. The recommendation that a federal trust be established is addressed in the Wolf Management Committee Alternative. This alternative also mandated enhancement of prey populations. That concept is addressed in the Wolf Management Committee and Reintroduction of Nonexperimental Wolves Alternatives. This alternative is not being considered further as a separate alternative because all the other issues and concerns it expressed are being fully addressed in the Reintroduction of Experimental Populations Alternative.

5. The Recovery of Existing Wolves Alternative is based upon a belief by some people that wolves were never extirpated from the Yellowstone ecosystem and that remaining wolves are genetically unique wolves that should be recovered without their gene pool being diluted by reintroduction of wolves from other areas. The general concerns expressed in this alternative are being addressed by continuation of an intensive monitoring effort that should detect the presence of a wolf population before any reintroduction might be conducted. Furthermore, recent scientific investigation into the taxonomic status of wolves in North America indicates that the wolves that once occupied the Yellowstone or central Idaho areas were not a separate subspecies and had a much wider distribution than was previously believed. Also, with the listing of all wolves (*Canis lupus*) in 1978, regardless of subspecies, any past or potential future subspecies designation is not relevant to wolf recovery in the western United States at this time. Although it is extremely unlikely that a distinct population of wolves has persisted since 1926 (when the last wolf pack was documented in the Yellowstone area), if wild reproducing unique wolves had initiated population recovery (2 breeding pairs successfully raising 2 young for 2 consecutive years in a recovery area),

they would be encouraged to increase and recover through natural processes. Reintroduction would not occur. This alternative will not be considered further because scientific evidence does not suggest that a population of distinct wolves persisted or currently exists in the Yellowstone or central Idaho areas.

6. The Accelerated Wolf Recovery Alternative recommended rapid wolf recovery through reintroductions and a wide variety of land use restrictions over a broad area to accomplish wolf recovery as soon as possible. However, several of the recommended land use restrictions and their broad application and the recommendation for no private compensation were in conflict with private property and free speech rights and were beyond any reasonable extension of federal authority and land management agency policy. These recommendations are believed to be excessively restrictive and included a larger land area than was reasonable so they were not considered further. In addition many of the land use restrictions conflicted with various laws, agency policies, and enabling legislation and were far more severe than reasonably needed for the recovery of wolf populations. While this alternative is not being evaluated further, the general philosophy of fully protecting and quickly recovering wolves was incorporated into the Reintroduction of Nonexperimental Wolves Alternative.

Alternatives Addressed in the DEIS

Five alternatives that represented different approaches to wolf recovery were chosen for analysis in the DEIS because they encompassed most of the concerns raised during scoping. These alternatives reflect public comments and suggestions identified through issue and alternative scoping. These alternatives are discussed in detail in Chapter 2.

These alternatives are:

1. Reintroduction of Experimental Populations (incorporating most of the state implemented nonessential reintroduction alternative with parts of the 1987 Recovery Plan)

2. Natural Recovery (with limited land use restrictions in anticipation of some illegal killing of wolves)

3. No Wolf (as proposed in alternative scoping)

4. Wolf Management Committee (as proposed to Congress)

5. Reintroduction of Nonexperimental Wolves (incorporating the accelerated wolf recovery alternative but with fewer land use restrictions)

CHAPTER II

ALTERNATIVES INCLUDING THE PROPOSED ACTION

INTRODUCTION

This chapter describes the alternatives developed to respond to the issues/impacts previously identified. The proposed action is identified. Summary tables of the alternatives and impacts and a comparison of the alternatives are also included.

ALTERNATIVES CONSIDERED IN DETAIL IN THE ENVIRONMENTAL ANALYSIS

Introduction

During early planning, the FWS developed an array of alternatives to respond to the primary goal of the DEIS as directed by Congress "to provide a broad range of alternatives related to wolf reintroduction in Yellowstone National Park and central Idaho." These 5 alternatives were also selected to respond to the public's concerns expressed about issues. Those issues/impacts and concerns were discussed in Chapter 1.

The alternatives for wolf reintroduction in Yellowstone National Park and central Idaho considered in detail in the DEIS are:

1. Reintroduction of Experimental Populations Alternative (Proposed Action)

2. Natural Recovery (No Action) Alternative

3. No Wolf Alternative

4. 1991 Wolf Management Committee Alternative

5. Reintroduction of Nonexperimental Wolves Alternative

ALTERNATIVE 1. REINTRODUCTION OF EXPERIMENTAL POPULATIONS ALTERNATIVE (THE PROPOSAL)

Background

The designation "experimental population" had its origin in a 1982 amendment, Section 10(j), to the ESA. Before that, the FWS could introduce threatened and endangered species into unoccupied historic range, but attempts to do so were often met with fervent resistance. One reason was that the FWS could not promise private landowners, other federal agencies, and state and local government that the transplanted population would not disrupt future land management options. The "experimental population" designation gives the FWS more flexibility because such populations can be treated as "a species proposed to be listed" or "threatened" rather than "endangered." Congress provided the amendment to make more reintroductions possible, by allowing more management, if necessary, where such management is consistent with conservation of the experimental population. If a reintroduced population of wolves is designated "experimental" and "nonessential" (not necessary for the survival of the species in the wild) under the ESA amendment, other federal agencies are required only to confer with the FWS on activities that might jeopardize the species. Exceptions would be in national parks and national wildlife refuges, where formal consultations with the FWS would still have to occur. Management of a nonessential experimental population can thus be tailored by specific areas and specific local conditions, including local opposition. The experimental population rule has been successfully used to reintroduce red wolves to Alligator River National Wildlife Refuge in North Carolina and Great Smoky Mountains National Park and black-footed ferret to Wyoming. The 1987 Northern Rocky Mountain Wolf Recovery Plan recommended using the experimental population rule provision to achieve wolf recovery in the Yellowstone recovery area.

Reintroduction of Experimental Populations Alternative.--The purpose of this alternative is to accomplish wolf recovery by reintroducing wolves designated as nonessential experimental populations to Yellowstone National Park and central Idaho and implementing provisions within Section 10(j) of the ESA to conduct special management to address local concerns. The states and tribes would be encouraged to implement the special rules for wolf management outside national parks and national wildlife refuges.

Summary

Two experimental population areas, one including all of Wyoming and parts of Montana and Idaho (south of Highway 12 and east of Interstate 15) around Yellowstone National Park and another including most of central Idaho and part of Montana (south of Interstate 90 and west of Interstate 15) would be established through regulation by the FWS under section 10(j) of the ESA, as amended. The ongoing wolf monitoring efforts would continue. Prior to any reintroduction, the FWS would make a determination of the status of any naturally occurring wolf population in those 2 areas. Wolves would be reintroduced into either or both the Yellowstone National Park and central Idaho recovery areas unless a wolf population (defined as 2 breeding pairs, each successfully raising 2 or more young for 2 consecutive years in a recovery area) had been documented. Wolves outside national parks would be managed by the states and tribes under special federal regulations for each population. If the states and tribes did not assume wolf management, the FWS would do so. Management would allow wolves to be killed or moved under some conditions by federal, state, and tribal agencies for domestic animal depredations and excessive predation on big game populations. Under some conditions, the public could harass and kill wolves attacking livestock (cattle, sheep, horses, and mules). There would be no federal compensation program, but compensation from existing private funding sources would be encouraged. There would be no land use restrictions applied or critical habitat designated. Enhancement of prey populations would be encouraged. Use of toxicants lethal to wolves in areas occupied by wolves would still be prohibited by existing ADC policy and EPA labeling restrictions.

Note.--If a wolf population (see above definition) was discovered in either the Yellowstone and/or central Idaho areas, reintroduction under an experimental population rule would not occur and any wolf population would be managed as a natural recovering population (see Alternative 2) in that area until a decision maker decided otherwise.

Note.--The proposed boundaries of the experimental population areas were established by considering the combination of the current southern expansion of naturally formed wolf packs in Montana, location of high quality wolf habitat and potential wolf release sites, and the likelihood of any wolf pack documented inside the northern border of experimental area resulting from reintroduction into central Idaho or Yellowstone National Park rather than from natural dispersal from Canada or northwestern Montana. Therefore, the boundaries of the proposed experimental population areas could be affected by formation of new wolf packs by naturally dispersing wolves from Canada or Montana before any decision (at the earliest 1994) about implementing a nonessential experimental population rule and wolf reintroduction is made.

Implementing this alternative would involve:
The FWS would develop and publish 2 nonessential experimental population rules, under Section 10(j) of the ESA, in the Federal Register:

-One rule would designate much of Idaho and part of Montana (south of Interstate 90 and west of Interstate 15) an experimental area for a wolf reintroduction into central Idaho (Figure 2-1).

-Another rule would designate a small portion of Idaho (east of Interstate 15) and Montana (east of Interstate 15 and south of Highway 12) and all of Wyoming an experimental population area for wolf reintroduction into Yellowstone National Park (Figure 2-1).

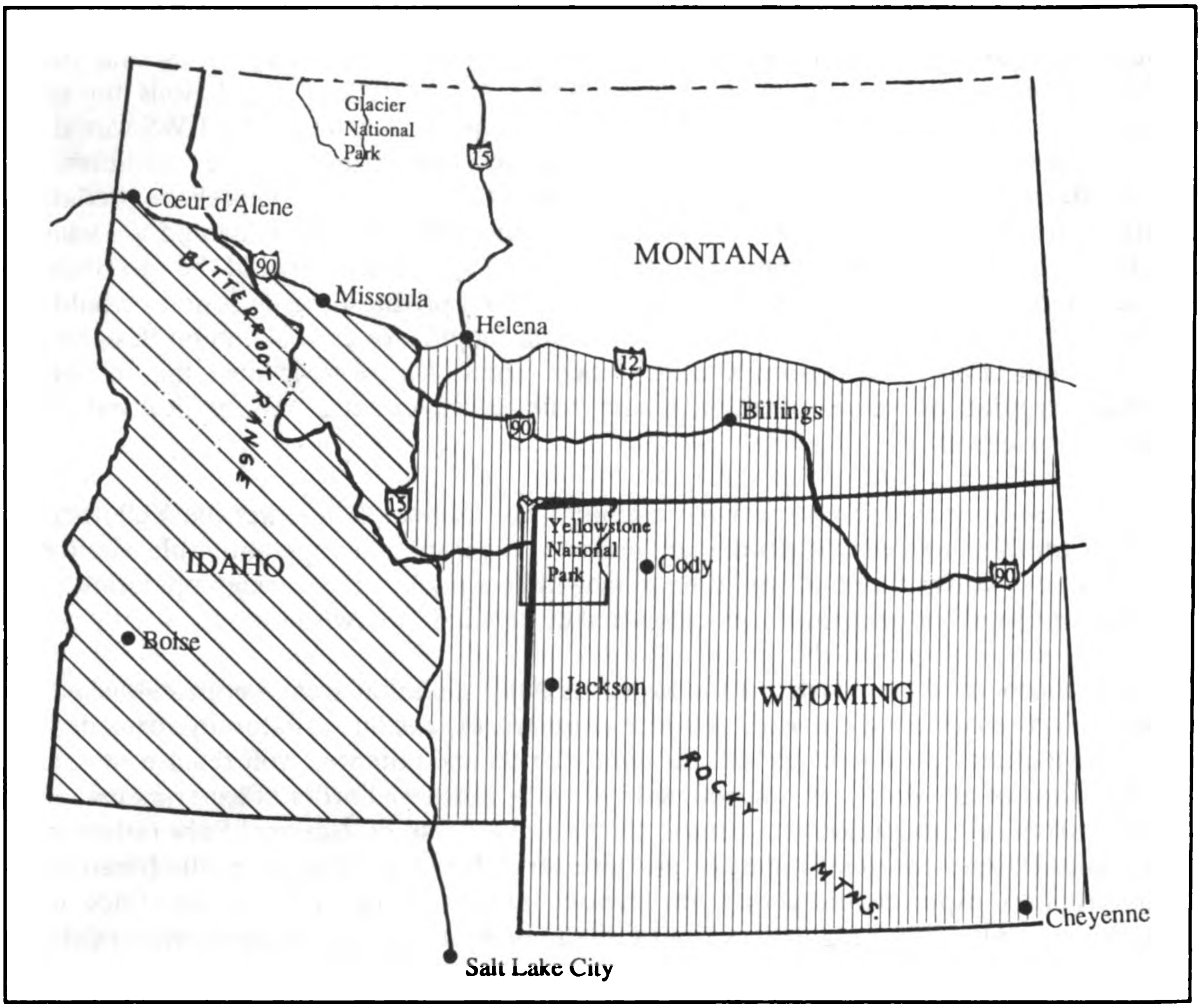

Figure 2-1. The location of proposed experimental population areas in central Idaho (south of Interstate 90 and west of Interstate 15) and Yellowstone National Park (south of Highway 12 and east of Interstate 15).

Each rule would:

-Define the minimum criteria for a "wolf population" for purposes of each experimental rule as "two breeding pairs of wild wolves successfully raising at least two young each (until December 31 of the year of their birth), for two consecutive years in a experimental area." If a wolf population was documented, reintroduction and implementation of an experimental rule in that area would not occur. That wolf population would then be managed as a naturally recovering population until a decision maker decided otherwise.

-Establish the experimental population area(s) and designate all wolves in such area(s) as members of the experimental population. Wolves would be moved as required to enhance population recovery.

-Encourage and if they so choose, designate the states and tribes to be the primary agencies to implement the experimental rule, with federal assistance through cooperative agreements.

-Allow private landowners on their private land and livestock (cattle, sheep, horses, and mules) producers on their public land grazing leases to harass wolves in an opportunistic, noninjurious manner at any time. Such incidents must be reported within 14 days.

-Allow livestock producers on their private land to take wolves in the act of killing livestock. Such incidents must be reported within 24 hours and livestock freshly wounded/or killed by wolves must be evident.

-Allow livestock producers with allotments on public land to receive a permit to take depredating wolves after ADC, or other authorized agency, has confirmed livestock losses have been caused by wolves and has unsuccessfully attempted to resolve the problem and other losses are documented.

-Allow the states to move wolves that are having unacceptable impacts on ungulate populations which may inhibit wolf recovery. Two examples, although unlikely, are where wolf predation is dramatically affecting prey availability because of unusual habitat or weather conditions (i.e. bighorn sheep in areas with marginal escape habitat) or where wolves cause prey to move onto private property and mix with livestock increasing potential conflicts with private property.

-Assure that no private or public land use restrictions are developed solely for wolf recovery except at release sites during reintroduction.

-Allow ADC, FWS, states, and tribes to control wolves that attack livestock (cattle, sheep, horses, and mules) by moving wolves when 5 or fewer breeding pairs are established, and killing wolves after 6 or more breeding pair are established in a given recovery area. Prior to October 1, depredating females and their young would be released on site. Wolves that attack other domestic animals and pets on private land 3 times in a calendar year would be moved. Chronic problem wolves would be removed from the wild.

The FWS in cooperation with state, federal, and tribal agencies and appropriate Canadian governments, would reintroduce wolves into Yellowstone National Park (soft release) and central Idaho (hard release) for 4 consecutive years (possibly 3-5 depending upon program progress). Procedures would include:

-Obtaining any permits, agreements, and archeological site clearances and conducting activities for a scientifically based wolf reintroduction program.

-Capturing, radio collaring, and releasing 1-3 wolves from 8 separate wolf packs in Canada, in June-August, in cooperation with Canadian governments.

-Radio telemetry monitoring of 8 wolf packs suitable for capture in Canada to provide pack members for reintroduction. Wolves would likely be captured in October by darting from helicopters or by capture collars so they could be moved to the holding facilities or release sites within a short time span.

-Constructing 3 temporary holding facilities (each 1 acre; 0.4 ha) and nearby temporary housing (tent or trailer) at 3 release sites in Yellowstone National Park. These sites would be vehicle accessible, at sites that are already disturbed if at all possible, and secured from the general public while wolves are being held in these facilities (October-December).

-Obtaining up to 8,000 pounds of ungulate carrion (roughly 40 deer or 10 elk) (road kills, law enforcement seizures, etc.) to feed these wolves (6 adults and an estimated 12 pups) from October through January. An additional 2,400 pounds of ungulates (16 deer or 4 elk) could be placed near the release sites if the adults were not successful at killing ungulates or caring for their pups.

-Obtaining, caring for, and transporting up to 30 (even sex ratio, if possible) wolves from areas in Canada in October-November each year for 4 years. Transporting 3 wolf pairs and their pups to 3 separate release sites in Yellowstone National Park for 4 years. Transporting and releasing 15 young adult wolves in central Idaho for 4 years.

For specific information on how a wolf reintroduction program would be conducted, please see Appendix 4 "Scientific techniques for the reintroduction of wild wolves."

How would wolf populations respond to this alternative?
The following scenario and Table 2-1 portrays how wolf population growth might respond to implementation of the Reintroduction of Experimental Populations Alternative in each area. It incorporates the key components of this alternative, including reintroduction of wolves in Yellowstone National Park and central Idaho for 3-5 consecutive years, beginning in 1994, moderate mortality of wolves in areas with livestock, and no land use restrictions. Moving wolves to protect critical ungulate populations appears unlikely, particularly early

Table 2-1. Estimated wolf population growth in each area under implementation of the Reintroduction of Experimental Population Alternative.

	1994	1995	1996	1997	1998	1999	2000	2001	2002
No. reintroduced[a]	10	10	10	10	0	0	0	0	0
Surviving	0	8	14	27	45	56	68	83	101
Pups born	0	0	10[b]	20	25	35	40	50	60
10% control loss	1	2	3	6	7	9	11	12	16
10% mortality loss	1	2	4	6	7	9	11	13	16
Total wolves	8	14	27	45	56	68[c]	83	101	129
Packs	0	0	2-4	5-7	6-8	7-10	8-12	10-14	13-18
Area occupied 100 mi^2	0	0	9	18	21	24	30	36	45

[a] Number actually contributing to wolf population growth. Fifteen annually released.
[b] Average 5 pups per pack.
[c] Beginning of population growth at 22% per year.

in recovery and any loss to the wolf population is unlikely to affect population growth in the later stages of recovery. This scenario is intended to be representative of wolf population growth under this alternative rather than a predication of the exact impact of its implementation.

About 15 wolves would be reintroduced annually to both Yellowstone National Park and central Idaho beginning in 1994. Approximately 1/3 of these individuals are not expected to contribute to wolf population growth because of mortality, dispersal, disappearance, unexpected events, etc. Techniques for wolf reintroduction are the same under all alternatives and 10 individuals would be successfully established in the wild (out of 15 released annually) for 4 consecutive years (40 individuals). Approximately 10% of the wolves would be killed or removed annually because of conflicts with livestock. Another 10% would disappear, or die from natural causes or illegal killing. Wolf population growth would occur relatively quickly (42% overall annual increase) because of low to moderate wolf mortality and reintroduction of 40 wolves that survive and contribute to wolf recovery in 2 areas. All 3 recovery areas would likely reach wolf population recovery levels (10 breeding pairs for 3 consecutive years) at the same time, about 2002. Recovered wolf populations would be delisted (removed from protection of the ESA) according to procedures outlined in the ESA, and managed solely by the states. The ESA also requires that wolf populations be monitored for 5 years after delisting to ensure that populations remain viable without federal protection.

Alternative 1

How does this alternative address the major issues and concerns of the public?

1. How will depredations on domestic animals be controlled?

Reports of wolves attacking domestic animals would be investigated by ADC, FWS, or the appropriate state or tribal wildlife agency under guidelines of special regulations. Wolves that attacked livestock (cattle, sheep, horses, and mules) would be live-captured and translocated when there were 5 or fewer packs, and killed or placed in captivity when 6 or more packs were present in a recovery area. Prior to October 1, females with young would be released on site if depredations occurred on public land, but translocated if depredations occurred on private land. Chronic problem wolves (depredating after relocation) would be removed from the wild.

Although a remote possibility, wolves that repeatedly (3 times in a calendar year) attacked pets, working animals, or other types of livestock (fowl, hogs, goats, etc.) on private land would be moved by management agencies. Chronic problem wolves (depredation after relocation) would be removed from the wild.

Private landowners or their designated agents could harass wolves in a non-injurious, opportunistic manner (wolves could not be searched out then harassed) on their private land at any time. Livestock producers and their designated agents with grazing allotments on public land could harass any wolves near their livestock, in a noninjurious manner. Such harassment may "teach" wolves to avoid areas where conflicts with livestock or people may be highest. Any harassment must be reported to authorized authorities within 14 days.

Livestock producers or their designated agents on private land could injure or kill any wolf in the act of wounding or killing livestock (only cattle, sheep, horses, or mules). Such acts must be reported to authorized authorities within 24 hours. Physical evidence of livestock that have been freshly wounded or killed by wolves must be present.

Livestock producers or their designated agents with livestock on grazing allotments on public land could be issued a 30 day permit to injure or kill wolves in the act of wounding or killing livestock after Animal Damage Control or designated State or Tribal authorities had confirmed that wolves were responsible for the attacks and agency wolf control efforts were unsuccessful at resolving the problem (defined as livestock being attacked again by wolves within 30 days of control actions ending.) Physical evidence of livestock freshly killed or wounded by wolves must be evident to agency investigators.

2. How will livestock producers be compensated for losses?

There would be no federal compensation program for wolf-caused losses to domestic animals. The federal government would encourage livestock producers incurring losses caused by wolves to seek compensation from programs that have been established by private groups. Wyoming currently compensates for livestock losses caused by trophy and game animals but the current classification of the wolf as a "predator" by Wyoming law would preclude any compensation for wolf-related losses. Idaho currently compensates for livestock losses from mountain lions and bears that exceed $5,000 dollars/individual. Montana does not compensate for game damage. It is unknown whether the states would compensate for wolf-caused damage.

3. How will potential impacts on big game populations be managed?
If wolves were determined to be causing unacceptable impacts on other listed species, or on specific ungulate populations that may have a negative effect on wolf recovery outside national parks and national wildlife refuges, wolves could be captured and moved from localized areas to resolve those conflicts. Wolves would not be deliberately killed to address ungulate/wolf conflicts. These unacceptable impacts must be identified in state ungulate management plans and developed in consultation with the FWS.

Land management agencies would be encouraged to implement land use guidelines that enhance ungulate habitat. Ungulate management by state and federal agencies would otherwise be unaffected. The FWS would not implement additional special programs to monitor or enhance ungulate populations solely because of wolves. States and federal land management agencies would be strongly encouraged and may elect to monitor or enhance ungulate populations to assist wolf recovery and minimize potential impacts.

4. Who will manage wolves?
The states and tribes, under cooperative agreements with the FWS, would be primarily responsible for implementing wolf recovery, monitoring, and management within the framework of federal law. The states would be encouraged to develop state wolf management plans with local public involvement. The FWS would retain ultimate management responsibility for program oversight and achievement of wolf recovery. Control of wolves would primarily be the responsibility of ADC, FWS, the states, or tribes. Wolf reintroduction to Yellowstone National Park and central Idaho would be the cooperative responsibility of the respective states, FWS, National Park Service, USDA Forest Service, tribes, and Canadian agencies.

5. What kind of land use restrictions will occur?
There would be no new land use restrictions required to implement this alternative. Some predator control activities (almost exclusively M-44 use on coyotes) by ADC would be affected by wolf recolonization. The current EPA registration restricts use of predator toxicants in areas occupied by listed species. Toxicants are already precluded from most areas where wolf recovery would be encouraged because of existing conditions. Other predator control activities (aerial and ground shooting, foot-hold trapping, snaring with modified snares, and denning) would not be affected.

After such incidents were thoroughly investigated, unavoidable and unintentional take of wolves (killing or injuring) during legal activities (trapping, hunting, or vehicle collisions) would not be considered take. Such incidents must be reported in less than 24 hours. Other take of wolves will be referred to the appropriate authorities for prosecution.

6. Where will wolf populations be recovered?
Wolves would primarily occur throughout the mountainous portions of western Montana, northwestern Wyoming, and central and northern Idaho. The majority of wolf pack territories would occur on public land in and around national parks, national wildlife refuges, and forest service lands around Yellowstone National Park (17,270 mi^2; 44,731 km^2). Wolf packs in central Idaho would primarily occur on contiguous national forests (20,310 mi^2; 52,600 km^2). Some wolves may also utilize private lands near these areas. Lone wolves would occasionally occur throughout most of the 3 states but rarely beyond.

7. When will wolf populations recover?
The standard FWS-led wolf monitoring program would continue to assess the status of any suspected naturally occurring wolf packs. The earliest a reintroduction of an experimental population could occur would be the fall of 1994. If three groups of wolves were introduced into each area for 4 years (40 wolves), recovery (10 breeding pairs in 3 areas for 3 consecutive years) could be achieved by about 2002.

8. How much will wolf recovery cost?
Implementing this alternative would cost about $667,600 per year. The total cost of this alternative through the year 2002, when wolves are expected to be recovered and delisted, is expected to be $6,008,750 (1992 dollars, see Appendix 5 for description of cost estimates).

9. Are changes in current state or federal law required?
No. Wolves would remain under protection of the federal ESA until recovered but would be managed under special regulations as provided by Section 10(j). Wolves in all of Wyoming and much of Idaho and Montana (except in parks and refuges) would be managed as species proposed for listing under the ESA. States and tribes would be the primary agencies implementing the management programs in the experimental population areas, if they chose to do so, and after Idaho, Montana, and Wyoming state laws allowed state resource agencies to assume management or resource agencies established cooperative agreements with the FWS. There would be FWS oversight of state or tribal management.

The states and tribes would be encouraged to develop specific state wolf management plans, utilizing local public participation, that ensure that state and tribal management while under the general conditions set forth by federal laws, addressed the needs of local residents.

Wolves outside of the experimental area(s) would be managed as a naturally recovering, fully endangered population, but management of naturally recovering wolves could also be conducted by the states or tribes under a cooperative agreement with the FWS.

ALTERNATIVE 2. NATURAL RECOVERY ALTERNATIVE --THE NO ACTION ALTERNATIVE

Background

Currently about 40 wolves (excluding 1993 pups) are known to occupy extreme northwestern Montana (Figure 2-2). The only persistent packs are those in and adjacent to Glacier National Park. In 1988, a formal interagency program was funded and staffed to enhance recovery of these naturally recolonizing wolves. The program monitors wolves to determine their distribution and numbers, promotes and provides funding for research to obtain accurate information about wolves and their prey, controls (moves or kills) wolves that depredate on livestock, and conducts an aggressive education and information program to provide scientifically based current information about wolves and wolf recovery.

Natural Recovery Alternative (No Action Alternative).--The purpose of this alternative is to encourage the natural recovery of wolves from Canada and Montana to expand to other areas, eventually reaching central Idaho and Yellowstone National Park.

Summary

Wolves would remain listed as endangered under the ESA throughout the northern Rocky Mountains and no reintroductions would occur. Management programs similar to the one in Montana would be established in Idaho and Wyoming. Wolves would be encouraged to naturally expand their ranges into any area they choose, eventually into the central Idaho and Yellowstone areas. Wolves would eventually recolonize the recovery areas, but would also recolonize other areas throughout the northern Rocky Mountains and would be allowed to remain there if few conflicts occurred and wolf recovery was not precluded by their removal. Because wolves would settle in some areas where their presence was not desirable, there would be occasional conflicts, particularly with livestock. Depredating wolves would be controlled by agencies as long as control did not preclude wolf population recovery. There would be no federal compensation program, although a private fund does exist and its use by livestock producers would be encouraged. Whether this private program would continue is unknown. Wolves would not be controlled if there were conflicts with pets or state big game management objectives. There would be some land use restrictions primarily around active den sites and on some ADC activities in occupied wolf habitat. Illegal killing or control at a level that precludes or severely inhibits recovery would result in additional land use restrictions primarily, a reduction in the number of roads open to motorized vehicles and locations of livestock grazing on public land. Wolf recovery is unpredictable but would take several decades.

Implementing this alternative would involve:
The FWS would fund wolf recovery programs in Idaho and Wyoming similar to the one currently being conducted in northwestern Montana. The FWS would:

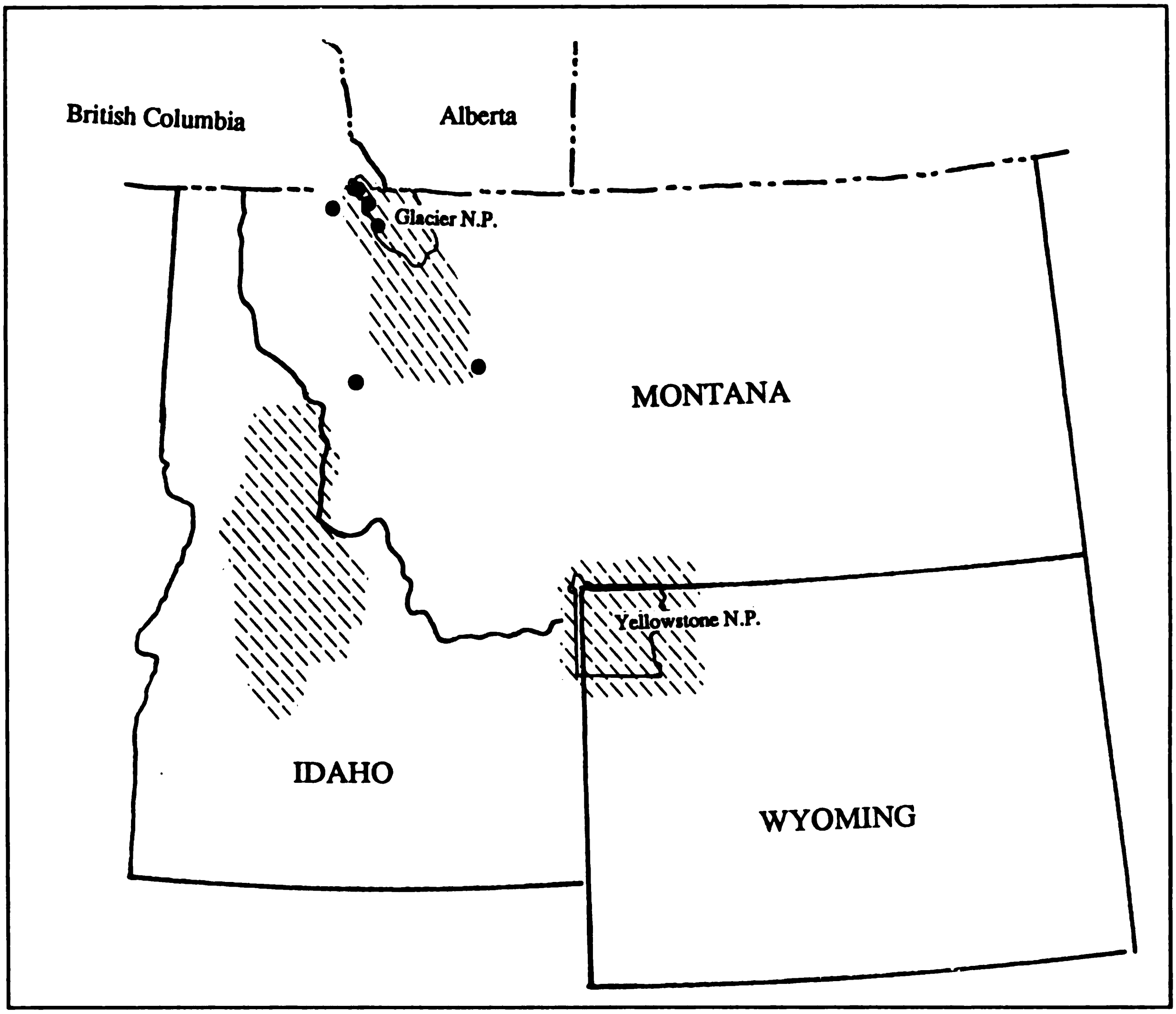

Figure 2-2. Northwestern U.S. showing 3 wolf recovery areas that were identified in the Northern Rocky Mountain Wolf Recovery Plan (crosshatching). Locations where wolf packs lived in 1993 indicated by dots.

-Search for wolves by (1) asking the public and agencies to report wolf sightings, (2) conducting surveys to search for wolf pack activity in areas identified through public and agency reports, and (3) capturing, radio collaring, and monitoring wolf packs.

-Conduct an extensive and objective public education and information program to inform the public about wolves and wolf management under the ESA.

-Fund scientific research to obtain current information on wolf biology and the relationship of wolves to their prey and land use practices.

-Permit ADC to control wolves that attack livestock by moving wolves when less than 6 packs are in a recovery area, removing wolves that repeatedly attack livestock, and releasing females and their young on site prior to August 1. Wolves would be controlled within recovery areas only if they were not attracted to the area by inappropriate livestock husbandry practices (inappropriate carcass disposal) or were not in areas critical to wolves (ungulate wintering areas, den sites). Wolf control would be permitted only if it occurred at a level that would not preclude wolf recovery.

-Implement land use restrictions when necessary if illegal killing threatens wolf recovery. Active den sites would continue to be protected from high levels of human disturbance within 1 mile (1.6 km) of the den between March 15 and July 1.

How would wolf populations respond to this alternative?
The following scenario and Table 2-2 portrays how wolf population growth may respond to implementation of the Natural Recovery Alternative. The key components of this alternative includes no reintroduction and wolves preying on livestock would be controlled as long as control did not prevent wolf population recovery. Wolves would be allowed to naturally expand their ranges southward as they have done in southern Alberta, British Columbia, and northwestern Montana over the past 40 years. The rate of population growth and distribution of wolves would be unpredictable but may proceed at the same average rate observed in Montana since 1985 (about 22% annually). However, if wolf populations increased at an overall rate similar to that of the naturally recovering wolf population in Minnesota (3% annual increase) then recovery would take many times longer. As in the past, it is likely that some of the initial wolves or packs that try to establish will be removed by control actions to protect livestock or by illegal killing, so wolves, even breeding pairs, may show up and then die out multiple times before a population becomes established. However, eventually wolves would become more firmly established and recolonize central Idaho and the Yellowstone area. It is estimated that about 20% of the wolf population would be removed each year, either through control actions to resolve conflicts with livestock, illegal killing, vehicle strikes, or natural mortality. Natural recovery would occur in stages, with Montana reaching recovery levels about 2002, Idaho about 2015, and Yellowstone 2025. This scenario is intended to be a general representation of this alternative rather than a predication of the exact impact of its implementation.

Under this alternative it is likely that wolf populations in Montana and possibly Idaho will have reached 10 breeding pairs and delisting considered prior to any wolf pack establishment in the Yellowstone area. If wolves could not be delisted by individual recovery areas at 10 breeding pairs, Montana would have wolf populations above recovery levels before delisting could occur, as has happened in Minnesota with delisting of the eastern timber wolf. For the purposes of this alternative, it is assumed that state management, if it occurred before all 3 areas reached recovery levels, would not affect the

Table 2-2. Estimated wolf population growth under implementation of the Natural Recovery Alternative--The No Action Alternative (22% increase per year).

	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Mont.	40	49	60	73	89	108	132	161	196	239	292	——>		?																
								Montana State Management																						
Idaho[a]	|--pair start and fail--|					pair start- - - - - - - - - - - - - - - - - - - -							40	49	60	73	89	108	132	161	196	239	292	——>		?				
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Wyo.				|- - - -one or more pair start and fail?- - - - - - - - - - - - - - - -|														pair start- - - - - - - - - - - - - - - - - -							40	49	60	73	89	108

[a] Montana wolf population took 1986-1993 to reach 40 wolves after first den (8 years).
[b] Assume pairs form in next recovery area when nearest recovery area reaches 100 wolves. Natural recovery is unpredictable because wolf population establishment and persistence are highly variable.

rate of wolf dispersal into the Idaho or Yellowstone areas. This alternative is highly unpredictable because wolves interacting with several variables, including illegal killing and level of conflict with livestock, would determine the actual rate of recovery. Several parts of the management strategy are allowed (control for livestock conflict, minimal land use restrictions) only if they do not preclude wolf recovery.

How does this alternative address the major issues and concerns of the public?
1. How will depredations on domestic animals be controlled?
Since 1988, wolf control in Montana, Wyoming, and Idaho has been conducted by ADC and the FWS under the Interim Wolf Control Plan. Reports of livestock depredations are investigated by ADC. Special funding from Congress in 1991 established an ADC wolf management specialist position to effectively and professionally address wolf/livestock conflicts. Wolves that have attacked livestock and are likely to do so again (except females and young before August 1 which are released on site) are moved after the first depredation, and after being moved, are killed or removed from the wild on the second offense. Control of wolves is not conducted because of depredations on pets or in situations where wolves were attracted to the area by inappropriate livestock husbandry practices or in times and areas critical to wolves.

2. How will livestock producers be compensated for losses?
There is no federal or state compensation program to reimburse livestock producers for property damage caused by wolves. A private group has established a program that provides 100% fair market compensation to producers for livestock losses confirmed caused by wolves and 50% compensation for livestock losses possibly caused by wolves. The program does not compensate for pet losses.

ADC examination of evidence at the depredation site determines if control should be initiated, and the private group uses that information to decide if compensation is warranted. It is unknown if this program would continue if this alternative is selected.

3. How will potential impacts on big game populations be managed?
Wolves are not controlled to address potential conflicts with state big game objectives. Such control, only by moving wolves in very limited circumstances, could occur through state or tribal/federal cooperative agreements, but such agreements would have to be developed.

The USDA Forest Service and Bureau of Land Management are encouraged, but not required, to implement good ungulate management policy to foster wolf recovery. No specific programs are being implemented to improve ungulate habitat solely for wolves or to monitor ungulates because of the potential effect of wolf predation.

Wolf and ungulate research funded by the Montana Wolf Recovery Program has led to a greater understanding of ungulate ecology and habitat use and how other predators, in addition to wolves, might affect ungulate populations and hunter harvest. Such research would continue and be encouraged elsewhere.

4. Who will manage wolves?
Wolves in the northern Rocky Mountains are being managed by the federal government using funding appropriated by Congress with cooperation from other agencies and tribes. While all federal agencies have the responsibility to "utilize their authorities in furtherance of the purposes of this Act (ESA) by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act," the FWS has primary authority for endangered species recovery.

ADC is authorized by permit from the FWS to control depredating wolves. ADC has established a wolf management specialist position to investigate reports of wolf damage, control problem wolves, and provide objective information to livestock producers and the public about wolf/livestock conflict and management.

Montana Department of Fish, Wildlife and Parks is not actively involved in wolf recovery in Montana. Idaho Department of Fish and Game is not authorized "to expend funds, transfer assets, or enter into a cooperative agreement with any agency, department, or entity of the United States government concerning wolves unless expressly authorized by State statute, except that the department is authorized to provide a representative to participate on the northern Rocky Mountain wolf recovery team and to participate in activities regarding nuisance wolves." In 1992 the Idaho legislature permitted the department to participate in development of this Gray Wolf EIS. Wyoming Game and Fish Department has no authority to regulate take or manage wolves while they are listed as predators in Wyoming. All 3 agencies are participating in formally reviewing the DEIS.

The public can not attempt to harass, harm, take, or kill wolves except in defense of human life or safety. Wolves may not be legally harassed or harmed to protect personal property.

5. What kind of land use restrictions will occur?
To date only 2 land use restrictions are recommended to enhance wolf recovery in the northern Rocky Mountains: (1) Between March 15 and July 1, it is recommended that land management agencies limit high levels of human activity that may result in den abandonment or pup mortality within 1 mile (1.6 km) of active wolf dens; (2) ADC may not use toxicants (M-44 for coyotes) or other nonselective predator control tools that may accidently kill wolves (snares without breakaway locks or large foot hold traps near den sites).

If illegal killing or legal taking (control) of wolves appears to be preventing recovery, other land use restrictions would be contemplated. To protect wolves and enhance recovery on public lands in other areas of the U.S., motorized transportation on open roads has been restricted to levels below 1 mile of open road per 1 square mile (0.6 km/km^2) of habitat in a few areas in Wisconsin, Minnesota, and Michigan. Some den areas have been temporarily closed to hiking in Denali National Park, Alaska. Coyote hunting in some areas has been closed during the big game hunting season in Wisconsin and Washington. Control of wolves depredating on livestock is not allowed in extreme northeastern Minnesota. Also, on some national forests in Minnesota, Michigan, and Wisconsin, timber harvest or other management practices have been used to enhance habitat for wolf prey populations. At this time it does not appear these types of restrictions or habitat improvements are necessary in the northern Rocky Mountains, but such management practices could become necessary if illegal killing begins to prevent wolf recovery or if prey populations decline dramatically. Illegal killing could result in restrictions affecting more than 35 mi^2 (91 km^2) (<0.1%) of national forests lands not designated as wilderness in each recovery area.

6. Where will wolf populations be recovered?
Wolves could show up anywhere in the northern Rocky Mountains, including private lands, and would be allowed to stay if repeated conflicts with livestock did not occur. Wolf packs would likely establish primarily on national forests, national parks, and national wildlife refuges in the 17 county area surrounding Yellowstone National Park (22,900 mi^2; 59,200 km^2). Wolf packs would likely become established primarily on national forests in central and northern Idaho (23,400 mi^2; 60,700 km^2).

7. When will wolf populations recover?
Because wolf colonization under natural recovery would likely start with a single pair, recovery would be tenuous and prolonged. It is possible that isolated packs could form and then disappear in both the Yellowstone and Idaho areas any number of times before a wolf population would become established and grow to recovery levels.

Wolves would slowly disperse into the recovery areas. After several packs began to successfully produce pups in a recovery area, recovery could be achieved in that area within 15 years. The rate of natural dispersal into Idaho and Yellowstone is unpredictable, but the initiation of a wolf population appears unlikely (particularly in Yellowstone) in the next 10 years. Recovery in all 3 areas may not occur for 30 years.

8. How much will wolf recovery cost?
The Montana wolf recovery program was designed to cost an average of about $250,000 per year (including control). It is likely that similar costs will be required to fully implement similar programs to enhance natural wolf recovery in Idaho and Wyoming. These costs fund salary, travel, research, education and information, administration, control, translocation, and monitoring. ADC funding of the wolf management specialist position for the northern Rocky Mountains costs are $50,000/year. Total program costs to gray wolf population recovery and control (up to 30 years) in the central Idaho and Yellowstone areas under this alternative would be about $15,000,000 (1992 dollars). If natural recovery programs were

not funded until wolf pairs became established and were discontinued in each recovery area as each wolf population reached recovery levels, total costs would be about $10,000,000 (Appendix 5).

9. Are changes in current state and federal law required?
No. Wolves would continue to be fully protected (the only exception is for protection of human health and safety) as endangered species by the federal ESA and managed by the FWS. Wolves in Montana and Idaho are also listed as state endangered species and are protected except to protect human life, livestock, or property. In Wyoming, wolves are listed as predators by state law and may be taken at any time without limit. However, federal law still fully protects wolves in Wyoming. States and tribes could implement management of wolves under cooperative agreements with the FWS, if they so chose.

ALTERNATIVE 3. NO WOLF ALTERNATIVE

Background

In fiscal year 1993 appropriations language, Congress provided funding to complete the EIS and requested that the final EIS be completed by January 1994. Congress further "expects that the preferred alternative be consistent with existing law." The No Wolf Alternative is not consistent with existing law and would require changes in both the ESA and state law in Montana and Idaho. Changes in state law are beyond the scope of federal authority. Based upon the guidance given by Congress and the scope of federal authority, this alternative is not a reasonable or viable option to the proposed action. However, because Congressional direction at the start of the EIS process in December 1991 stated "...the EIS should consider a broad range of alternatives" and because many people have expressed support for the No Wolf Alternative during scoping, it is included for detailed analysis in the DEIS so the impacts of wolf recovery can be accurately compared to the situation of not having wolf populations in either the central Idaho or Yellowstone areas.

No Wolf Alternative.--The purpose of this alternative is to prevent wolf recovery in Yellowstone National Park and central Idaho.

Summary

Congress would pass legislation to remove wolves in Montana, Wyoming, and Idaho from the list of Endangered Species. The FWS would stop all funding and management activity towards wolf monitoring, education, research, and control in the northern Rocky Mountains. Furthermore, the States of Montana and Idaho would remove wolves from the protection of state law. Unregulated killing by the public would likely prevent wolf recovery in these areas. ADC activity would remove any wolves threatening livestock.

Implementing this alternative would involve:

-Passing federal legislation to remove wolves from the list of endangered species.

-Passing state legislation to remove wolves from the protection of Montana and Idaho state law.

-Allowing people to kill all wolves at any time, without restriction which would prevent wolf population recovery.

-Allowing ADC to kill any wolves posing potential conflicts with livestock.

How would wolf populations respond to this alternative?

Without legal protection from human persecution, lone wolves would continue to occasionally be documented and killed throughout the northern Rocky Mountains. However, wolf population recovery would not occur in these areas and wolves would be rare or absent for the foreseeable future. Wolf populations in the southern Rocky Mountains in Canada would be less viable as a result of this alternative because few, if any, wolves would move from the U.S. to southern Alberta and British Columbia.

How does this alternative address the major issues and concerns of the public?

1. How will depredations on domestic animals be controlled?
The public and all agencies could harass and kill wolves at any time so there would be few if any wolves at any one time. Furthermore, ADC would kill any wolves that threatened livestock.

2. How will livestock producers be compensated for losses?
There would be no government program to compensate livestock producers for losses. The current private compensation program would likely be discontinued under this alternative.

3. How will potential impacts on big game populations be managed?
The public and all agencies could harass or kill wolves at any time so there would be few if any wolves preying on big game populations. There would continue to be occasional severe winter starvation of ungulates in and around Yellowstone National Park.

4. Who will manage wolves?
Wolves would not be managed for recovery by any agency. The public and all agencies could kill wolves at any time for any reason. ADC would kill wolves that attacked or threatened livestock.

5. What kind of land use restrictions will occur?
There would be no land use restrictions because of wolves.

6. Where will wolf populations be recovered?
Wolf populations would not recover in the central Idaho or Yellowstone areas. Other than a few wolf packs in Glacier National Park and occasional lone wolves, wolves would not occur in Montana, Wyoming, or Idaho.

7. When will wolf populations recover?
Wolf populations would not be allowed to recover in the study areas.

8. How much will this alternative cost?
It would cost at least $100,000 to change laws and regulations so that this alternative could be implemented. (Appendix 5 for description of cost estimates). Wolves would be so uncommon that additional ADC expenditures would not be significant.

9. Are changes in current state or federal law required?
Yes. The ESA would be amended or special legislation would be passed by Congress to remove wolves from the list of endangered species in the northern Rocky Mountains. The state legislatures of Montana and Idaho would have to change state laws to implement this alternative.

ALTERNATIVE 4. WOLF MANAGEMENT COMMITTEE ALTERNATIVE

Background

The Wolf Management Committee Alternative resulted from a 1991 Congressionally established Committee that represented a diversity of federal, state, and special interest group views about wolf recovery in central Idaho and Yellowstone National Park. The Committee's recommendation proposed that current federal law be amended and a nonessential experimental population under state management be established in Yellowstone and natural recovery in Idaho be monitored for an additional 5 years. This recommendation, supported by a majority of committee members, was provided to Congress in May 1991, but Congress has not enacted any of its recommendations to date. Instead Congress requested that work on a DEIS (this document) begin. This alternative is presented as proposed to Congress.

Wolf Management Committee.--The purpose of this alternative is to let the States of Wyoming, Montana, and Idaho manage and accomplish wolf recovery as a nonessential experimental population under state law and special regulations that are more liberal than currently allowed under the ESA.

Summary

Congress would be requested to immediately either amend the ESA or pass special legislation to designate wolves throughout Wyoming, Montana, and Idaho (except in and near Glacier National Park) as a special State-managed nonessential experimental population. The states would develop plans to recover wolves in northwestern Montana, central Idaho, and Yellowstone National Park. Wolves would be recovered through natural dispersal in northwestern Montana and central Idaho and would be reintroduced in Yellowstone National Park. Wolves attacking or harassing livestock, working animals, or pets could be controlled by the public and state, tribal, and federal agencies. Compensation would be paid from a federal trust fund (federal appropriated funds, assessment on selected national park entrance fees, and other sources). There would be few land use restrictions. Wolves would be moved to address state big game management goals.

Implementing this alternative would involve:

-The FWS would continue to manage wolves in and adjacent to Glacier National Park (see Natural Recovery Alternative for details of management, Figure 2-3).

-Congress would amend the ESA or pass special legislation to designate wolves in all of Wyoming and Idaho and most of Montana as a nonessential experimental population managed by the states of Wyoming, Idaho, and Montana (Figure 2-3).

-Congress would establish an interagency committee and a federal trust to fund all wolf recovery, livestock compensation, and ungulate enhancement.

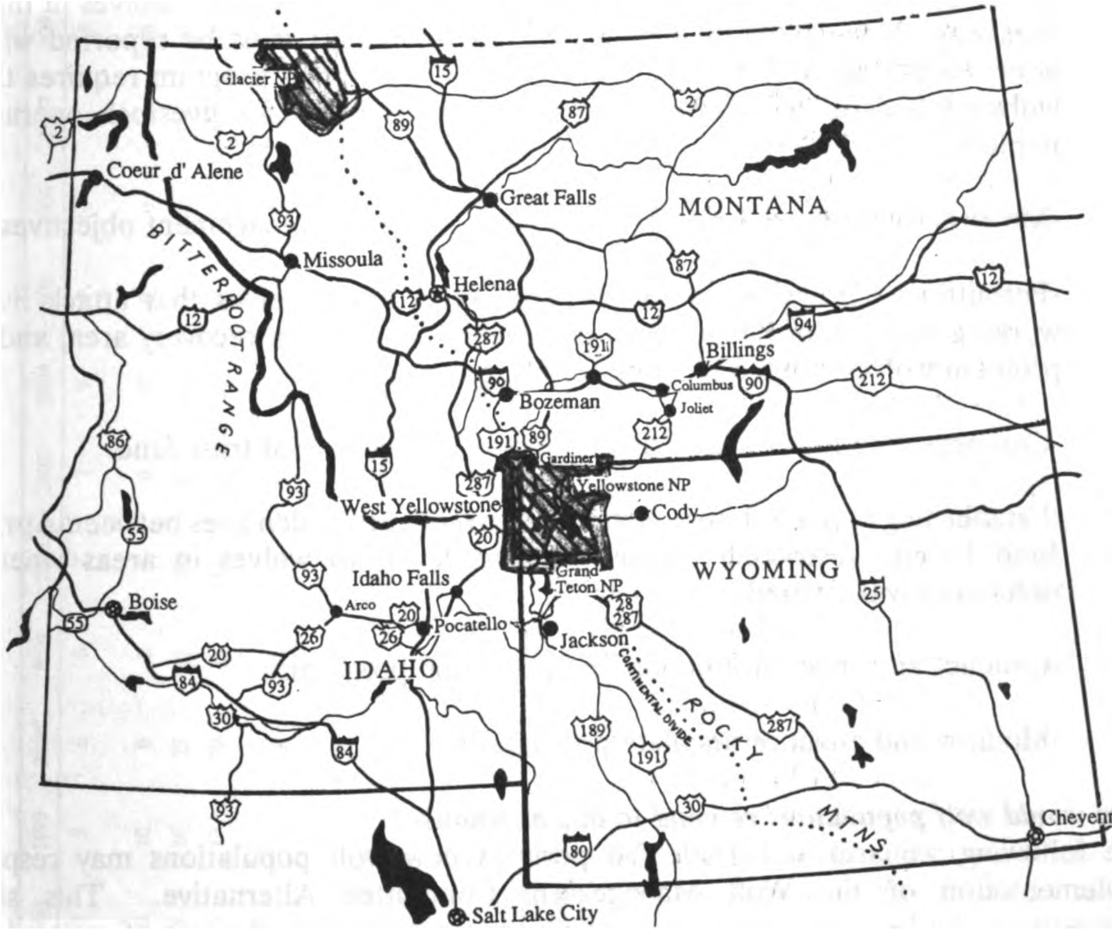

Figure 2-3. The Wolf Management Committee experimental population area. Shaded areas include the northwest Montana wolf population and Yellowstone National Park and are not included in the state managed experimental population area.

-States would develop wolf management plans and state regulations within 2 years to achieve wolf recovery and management, including:

-Reintroducing wolves into Yellowstone National Park (see techniques for reintroduction under experimental population reintroduction alternative).

-Possibly reintroducing wolves into central Idaho if 2 breeding pairs are not documented by 2000.

-Allowing owners of livestock, working animals, and pets to kill wolves in the act of harassing or attacking their animals. Such incidents must be reported within 48 hours on private land and 14 days on public land. This program requires that any wolves killed be replaced and an education program for livestock operators be implemented.

-Moving wolves if predation affected state big game management objectives.

-Permitting ADC, state, or tribal agencies to move wolves that attack livestock, working animals, or pets when 5 or fewer packs are in a recovery area, and to kill problem wolves when 6 or more packs are present.

-Compensating for domestic animal losses from a federal trust fund.

-Establishing public land use restrictions around active den sites between April 1 and June 15 and restricting use of toxicants lethal to wolves in areas where wolf occupancy was desired.

-Conduct an active information and education program.

-Monitor and enhance ungulate populations.

How would wolf populations respond to this alternative?
The following scenario and Table 2-3 portrays how wolf populations may respond to implementation of the Wolf Management Committee Alternative. This scenario incorporates the key components of that alternative including: 2 years of state planning; reintroduction of wolves in Yellowstone National Park and, after a 5-year waiting period, possibly central Idaho; replacement of wolves killed in control actions or illegally; high mortality of wolves in areas with livestock. This scenario is intended to be a representation of this alternative rather than a prediction of the exact impact of its implementation.

After a 2-year planning period wolves would be reintroduced into Yellowstone National Park in 1996. Techniques for wolf reintroduction are the same under all alternatives and 10 individuals would be released and successfully established in the wild (out of 15 total that were annually released) for 4 consecutive years (40 individuals). Reproduction by

Table 2-3. Estimated wolf population growth under implementation of the Wolf Management Committee Alternative.

	1996[a]	1997	1998	1999	2000[b]	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
No. replaced	0	1	3	5	6	6	7	7	9	9	10	13	15	16	18	22
No. reintroduced	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0
Surviving	0	6	11	16	25	25	29	31	35	40	46	53	58	65	83	93
Pups born	0	0	5	10	10	15	15	20	20	25	30	30	35	40	50	50
30% loss control[c]	3	6	9	12	12	13	15	18	18	21	25	29	33	36	45	48
10% loss mortality	1	2	3	4	4	4	5	5	6	7	8	9	10	12	15	16
Total wolves	6	11	16	25	25	29	31	35	40	46	53	58	65	83	93	101
Packs	0	0	1	2	3	3	4	4	5	6	6	7	8	10	10	10
Area occupied 100 mi^2	0	0	3	6	9	9	12	12	15	18	18	21	24	30	30	30

[a] Start Yellowstone reintroduction–recovery 2010.
[b] Start Idaho reintroduction–recovery 2015.
[c] If control losses were only 20%/year wolf population recovery in Yellowstone and Idaho would occur 3 years earlier, 2007 and 2012.

reintroduced wolves would likely not occur until 2 years after release. Approximately 30% of the wolves would be killed near livestock or be removed in livestock or ungulate control actions per year. Another 10% would die from natural causes or illegal killing. Approximately 50% of those removed in response to livestock protection would be replaced the following year. The number is 50% because some wolves injured or killed would not be discovered, some mortality would result in dispersal, loss of pups, or pack disintegration, etc. Not all losses would be effectively replaced through subsequent reintroductions. Because of the constant removals and subsequently reintroductions, and delays in having the subsequent reintroduced wolves contribute to breeding, overall wolf population growth would likely be slow and similar to the rate of natural recovery (starting at 2 wolves through recovery levels, about 16 years). High human-caused mortality would confine wolf recovery to areas with few livestock. Wolf recovery would occur in the Yellowstone area a few years before central Idaho because of the delay of reintroduction into central Idaho. Wolf populations would reach recovery levels in each recovery area (10 breeding pairs for 3 consecutive years) at different times, prolonging the delisting of gray wolves in the northern Rocky Mountains. All 3 recovery areas would meet wolf population delisting criteria about 2015. If wolf deaths are lower than predicted, recovery would occur sooner.

How does this alternative address the major issues and concerns of the public?

1. How will depredations on domestic animals be controlled?

Any wolves harassing or attacking livestock, working animals, or pets could be killed by the public on private and public lands. All wolves killed by the public or by agencies would be replaced through reintroduction. Such incidents would have to be reported within 48 hours on private land and 14 days on public land.

All wolves that attacked livestock, working animals, and/or pets would be controlled by the agencies. Prior to 6 wolf packs being established in a recovery area, wolves would be translocated on the first depredation and removed on the second offense. After 6 wolf packs become established in a recovery area, problem wolves would be removed on the first offense in that recovery area.

2. How will livestock producers be compensated for losses?

Compensation for livestock losses would be administered by ADC and funding made available through the federal trust fund as identified for wolf management. An interagency committee (one representative each from the following NPS, FWS, FS, ADC, IDFG, MDFWP, WGFD) would oversee fund collections and disbursements.

3. How will potential impacts on big game populations be managed?

If wolf predation were affecting state big game management objectives in a specific area, those wolves could be moved elsewhere.

A special federal trust would be established that the states would use (1) to enhance ungulate populations and their habitat to compensate for any potential losses from wolf predation and (2) to closely monitor ungulate populations.

4. Who will manage wolves?
Outside the nonessential experimental population area and on national wildlife refuges, the FWS would manage wolf recovery. The National Park Service would manage wolves inside national parks.

Inside the experimental population area, the states and respective tribes would manage wolf recovery. Owners of livestock, working animals, and pets could kill any wolf they believed was harassing or attacking such animals.

5. What kind of land use restrictions will occur?
There would be seasonal closures of up to 1 mile (1.6 km) around active den sites from April 1 to June 15 in the early stages of population establishment to preclude harassment or illegal killing. Normal wildlife standards and guidelines being applied by state agencies and federal land managers would apply. No toxicants lethal to wolves would be used in areas where wolf occupancy is a management objective.

6. Where will wolf populations be recovered?
The nonessential experimental population area would include all of Wyoming, all of Idaho, and all of Montana except that area bounded by Glacier National Park, highway 93 on the west and highway 2 on the south. In the experimental population area, wolf distribution would be determined by state processes but would most likely occur in areas in and near Yellowstone National Park and central Idaho not grazed by livestock (18,400 mi^2; 47,700 km^2).

Based upon previous plans, the core wolf population would likely be confined to areas recommended in the 1987 Wolf Recovery Plan, with minimal potential for conflicts with livestock growers or with hunters in heavily harvested big game populations. Such areas would likely be Glacier National Park and the Bob Marshall Wilderness complex in Montana; Wilderness and non-livestock areas in central Idaho (9,300 mi^2; 24,000 km^2); and Yellowstone National Park and associated Wilderness areas in northwestern Wyoming (approx. 11,800 mi^2; 30,660 km^2). Lone wolves would occur outside these areas, but it is likely packs would not. Wolf packs would continue to persist in the area managed by the FWS, in and near Glacier National Park, Montana.

7. When will wolf populations recover?
The states would develop their wolf management programs by 1996. Recovery in northwestern Montana would proceed at a slower rate than present with recovery achieved by about 2005. Natural dispersal into Idaho or reintroduction in 2000 would result in

recovery by 2015. With a reintroduction, recovery in the Yellowstone area would occur by 2010. Gray wolf populations would likely be recovered (3 areas, 10 breeding pairs, for 3 consecutive years) by about 2015.

8. How much will wolf recovery cost?
This alternative would cost about $39,044,000 ($5,577,714 dollars per year) during the first 7 years of implementation. In addition, annual costs beyond the first 7 years were inferred to be about $6,000,000. This would result in total program costs for gray wolf population recovery (by year 2015) of about $129,000,000. Costs are high because of the intensive level of management and monitoring of wolves and ungulates, and habitat enhancement (Appendix 5).

9. Are changes in current state or federal law required?
Congress would pass legislation and declare the wolf population "nonessential experimental" in all of Idaho, Montana, and Wyoming except in Yellowstone National Park, national wildlife refuges, and the existing breeding wolf population located in the area west of the eastern boundary of Glacier National Park, north of Highway 2 and east of Highway 93 north to the Canada-U.S. border. Wolves there would remain under FWS management as an endangered species. This experimental classification would remain in effect from the date of congressional action for 2 years.

Individual state legislative and commission action would be initiated to ensure classification of the wolf in each state is consistent with wolf recovery, and ensure the ability of involved states to manage wolves and their unacceptable impacts on livestock, big game resources, multiple land uses, and responsibility to pursue wolf recovery. Wolves in Montana would be classified under the State Nongame and Endangered Species Conservation Act (87-5-109) and would require no changes. Wolves in Idaho are listed as a state endangered species but the Idaho Department of Fish and Game would have to be permitted to participate in wolf recovery by the legislature. Wolves in Wyoming are now listed as predators but would have to be classified as a state trophy game animal or similar classification.

The FWS would conduct the rule-making on this plan while the states were developing their management plans that would include all necessary actions to implement this alternative, and for reintroduction of wolves into Yellowstone National Park and, if needed after 5 years, possibly central Idaho.

ALTERNATIVE 5. REINTRODUCTION OF NONEXPERIMENTAL WOLVES ALTERNATIVE

Background

Wolves would be reintroduced into the central Idaho and Yellowstone areas without an experimental population rule and would be fully protected by all provisions of the ESA until recovery was achieved. Wolves would be quickly restored and recovered in the northern Rocky Mountains under the most protective measures in the ESA. Wolf recovery would be the responsibility of the FWS, with active participation of other federal agencies and possibly tribes and states. Wolves would be reintroduced to central Idaho and the Yellowstone area, and possibly even to some areas already occupied by wolves. All management decisions on federal lands would emphasize rapid wolf recovery. Land use restrictions, including reducing the number of open roads, spring, summer, and fall restrictions near important den and rendezvous sites, and on livestock grazing when in conflict with wolf recovery would be applied to about 35 mi^2 (91 km^2) of national forest lands not designated as wilderness. Habitat for wolves would be enhanced by purchase or easement. Wolves that attack livestock would not be controlled, and on public land livestock would be removed to resolve conflicts. Wolves would not be controlled if they affected state big game management objectives. No federal or state compensation would be available. Private compensation could be obtained, if that program continues.

Reintroduction of Nonexperimental Wolves Alternative.--The purpose of the Reintroduction of Nonexperimental Wolves Alternative is to achieve wolf recovery quickly using extensive reintroductions and habitat enhancement to assist natural recovery.

Summary

Wolves would be reintroduced into areas in and near central Idaho and Yellowstone National Park until 10 breeding pairs were established. They would not be designated an experimental population. Wolf recovery would be a high priority on all surrounding federal lands. If required, land management restrictions such as road and trail closures, redistribution of grazing allotments and protection of key wolf habitats would be promoted. Wolf populations would likely recover rapidly. If wolves depredated on livestock on public land or impacted ungulate populations, no control would occur. Livestock would either be removed from the area or losses absorbed by the grazing allotment permittee. If repeated chronic losses occurred on nearby private lands, wolves would be moved. Habitat for ungulates and wolf security would be enhanced to provide abundant prey.

Implementing this alternative would involve:

-The FWS would establish proactive wolf recovery programs in Wyoming and Idaho (see Alternative 2 for specifics) to conduct monitoring, research, and education and information programs.

Alternative 5

-The FWS would reintroduce wolves into 3 suitable sites in and near each of the central Idaho and Yellowstone areas regardless if other wolves were documented (see Alternative 1 for specifics) until the recovery goal of 10 breeding pairs was achieved.

-The FWS, in cooperation with the states, tribes, and private groups would use federal funding to aggressively enhance ungulate and wolf habitat through acquisitions and easements.

-Within the primary wolf recovery analysis area (Figure 1-1), the USDA Forest Service and Bureau of Land Management would use road closures and habitat management to further enhance ungulate and wolf habitat on at least 35 mi^2 (91 km^2) of lands they administer outside of wilderness areas.

-Wolves would not be controlled for conflicts with domestic animals except in chronic problem areas, and then only by moving wolves. Wolves would not be controlled for conflicts with ungulate populations.

How would wolf populations respond to this alternative?
The following scenario and Table 2-4 portrays how wolf population growth may respond to implementation of the Reintroduction of Nonexperimental Wolves Alternative. It incorporates the key components of this alternative including: wolves would be reintroduced into areas in and near central Idaho and Yellowstone National Park in 1994. Techniques for wolf reintroduction are the same under all alternatives and 10 individuals (out of 15 released annually) would be successfully established in the wild, but in this alternative wolves would continue to be released until 10 breeding pair were documented (estimated 50-60 individuals) in a recovery area. Approximately 15% of the wolves would be removed annually because of illegal killing, natural mortality, and occasional relocation of wolves to resolve chronic livestock conflicts. Recovery would proceed rapidly (average about 52% annually), because of low wolf mortality and persistent reintroduction in a variety of high quality habitats including some outside of Yellowstone National Park and Wilderness areas in central Idaho. Recovery in central Idaho and the Yellowstone areas would be achieved by about 2000, and would likely accelerate recovery in Montana so that wolf recovery population goals for all 3 recovery areas would be reached by about 2000. This scenario is intended to be a representation of this alternative rather than a predication of the exact impact of its implementation.

How does this alternative address the major issues and concerns of the public?
1. How will depredations on domestic animals be controlled?
Wolves would not be controlled unless they presented a clear danger to human life or safety. In rare instances where wolves were repeatedly depredating on domestic animals or caused other conflicts with people on private land, wolves would be moved if other methods to resolve the problem were unsuccessful.

Table 2-4. Estimated wolf population growth under implementation of the Reintroduction of Nonexperimental Wolves Alternative[a].

	1994	1995	1996	1997	1998	1999	2000
No. reintroduced	10	10	10	10	10	0	0
Surviving wolves	0	9	17	31	47	70	94
Pups born	0	0	10	15	25	40	60
15% mortality	1	2	6	9	12	16	23
Total	9	17	31	47	70	94	131
Packs	0	0	2-4	5-7	7-10	10-14	14-18
Area occupied 100 mi^2	0	0	9	18	30	36	44

[a] Virtually no control for livestock damage.

2. How will livestock producers be compensated for losses?
There would be no federal or state compensation program. A private fund may continue to compensate for livestock losses caused by wolves.

3. How will potential impacts on big game populations be managed?
Wolves would not be killed or moved for interfering with state ungulate management goals. Important ungulate habitat would be acquired through purchase and easement agreements using federal funds and through cooperation with state and other federal agencies. Conflicts with wolves would be minimized by emphasizing protection of important ungulate winter ranges on private land. These areas would be identified, prioritized, and purchased with federal funds from willing sellers. State ungulate management guidelines (road density, cover requirements, restrictions in important seasonal habitats, calving areas, winter ranges, etc.) would be encouraged to be fully incorporated into USDA Forest Service and BLM land management plans.

4. Who will manage wolves?
The FWS would be solely responsible for implementing this alternative, but other federal agencies would be expected to aggressively pursue their section 7 (a)(1) responsibilities to use their authorities by carrying out programs for the conservation of listed species. States or tribes could participate under cooperative agreements with the FWS.

Wolves could not be harassed or harmed by the public, except to protect human life or safety. Federal law enforcement capabilities would be increased in Montana, Wyoming, and Idaho to encourage compliance with the ESA and these guidelines.

Alternative 5

5. What kind of land use restrictions will occur?
A wide variety of land use restrictions would be employed over 35 mi^2 (91 km^2) to protect active wolf dens. Those include: seasonal closures near wolf den and rendezvous sites, restrictions on livestock grazing in areas frequented by wolves unless the livestock producer/permittee clearly understood that no control would be allowed in the event of depredations, and some year round road closures. ADC would not use any techniques that could accidently take wolves where they might occur or their presence was desirable.

Improvement of ungulate habitat through increased forage, cover, and security would be pursued to create high quality wolf habitat. It is estimated that these restrictions would effect up to 35 mi^2 (91 km^2) of USDA Forest Service and BLM lands not currently in Wilderness designation.

6. Where will wolf populations be recovered?
Wolves would be distributed over a broad area in the northern Rocky Mountains. The core wolf population would still probably be centered around the Yellowstone and central Idaho areas. Wolf packs would likely form on USDA Forest Service, National Park Service, national wildlife refuges, 50% of Bureau of Land Management, and high elevation tribal lands in the 17 counties surrounding Yellowstone National Park (28,600 mi^2; 74,000 km^2). Wolf packs could form on USDA Forest Service and Bureau of Land Management lands in the 10 county area in central Idaho (29,000 mi^2; 75,000 km^2). Wolf packs would also be occasionally located on private lands in the vicinity.

7. When will wolf populations recover?
Wolves would reach 10 breeding pairs in the central Idaho and Yellowstone areas within 5 years. Recovery of wolves (10 breeding pair, for 3 consecutive years, in all 3 recovery areas) would likely occur by the year 2000 because this level of wolf reintroduction in Idaho and Yellowstone would also speed up recovery in northwest Montana.

8. How much will wolf recovery cost?
Implementing this alternative would cost about $1,030,000 per year for reintroduction, increased enforcement, and management, and $3,000,000 per year for ungulate and wolf habitat enhancement. Total program cost to reach gray wolf population recovery (estimated 7 years) would be $28,209,750 (Appendix 5).

9. Are changes in current state and federal law required?
No. Wolves would remain classified as endangered species under the federal Endangered Species Act. It is unknown if the states' classification of wolves would change, but because federal law supersedes state law, wolves would remain fully protected.

A SUMMARY AND COMPARISON OF THE IMPACTS OF THESE ALTERNATIVES AND IDENTIFICATION OF THE FISH AND WILDLIFE SERVICE PROPOSED ALTERNATIVE

This section briefly describes the 5 alternatives that were considered in detail and compares them in terms of how well each one meets the FWS's recovery goal and public concerns. Tables 2-6 and 2-7 summarize the general impact of a recovered wolf population (100 wolves), under each alternative on big game, hunter harvest, domestic animals, land use restrictions, visitor use, and economics. For a more detailed analysis of the alternatives and associated effects, please see Chapter 4, Environmental Consequences.

Table 2-5. Alternatives and expected actions associated with them.

Alternatives	Control of livestock losses	Compensation for losses	Control of big game predation	Management of wolves	Land use restrictions for wolves	Where wolves would be recovered	Date of wolf recovery	Wolf mgt. cost until recovery[a]	Legislation needed to implement
Reintroduction of Experimental Population	Agencies move/kill wolves for killing livestock/pets. Public harass and control under some conditions.	Probably private funds	Wolves moved if problem documented. Encourage land agencies to enhance ungulate habitat.	By states and tribes; some federal oversight.	None for wolves	YNP 17,600 mi^2 ID 20,700 mi^2	YNP & ID 2002	$6,008,750	None but publish experimental rule in federal register.
Natural Recovery	Agencies move wolves for livestock depredations	Probably private funds	None	Federal	1 mi. around dens 35^2 mi. affected. More possible	YNP 23,300 mi^2 ID 23,900 mi^2	YNP 2025 ID 2012	$10,000,000-$15,000,000	None
No Wolf	All wolves killed	None	All wolves killed	None for recovery by agencies	None for wolves	Nowhere	Never	$100,000	Modify state (MT & ID) and federal laws.
Wolf Management Committee	Agencies move/kill wolves. Public kill wolves for harassing and attacking livestock/pets/working animals	Compensation by federal trust	Wolves moved, habitat enhanced, increased ungulate monitoring	By states. No federal oversight.	1 mi. around dens 35^2 mi. affected	YNP 12,070 mi^2 ID 9,450 mi^2	YNP 2010 ID 2015	$100,000,000-$129,000,000	Modify state and federal laws.
Reintroduction of Nonexperimental Wolves	Agencies move wolves only in chronic problem areas on private land	Probably private funds	Habitat enhanced	Federal	1 mi. around dens 35^2 mi. affected. Some roads may be closed.	YNP 29,130 mi^2 ID 29,530 mi^2	YNP & ID 2000	$28,209,750	None

[a] See Appendix 5 on how costs estimates were determined.

Table 2-6. Expected impacts of recovered wolf population (100 wolves) by alternative--Yellowstone area.

Alternatives / Impact	Reintroduction of Experimental Population	Natural Recovery (No Action)	No Wolf	Wolf Management Committee	Reintroduction of Nonexperimental Population
Impact to big game populations	Elk 5%-20% reduction, mule deer 10% reduction, bison 5%-10% reduction, others no effect. Effects over Yellowstone area.	Same as Experimental but will occur several decades later. Short term negative effect to 30% possible.	None	Similar to Experimental population with effects confined mostly to YNP and wilderness areas	Slightly higher than Experimental but wolves recover sooner.
Effects on hunter harvest	Reduced antlerless harvest 8%(range 2%-30%), no effect on antlered harvest over Yellowstone area.	Same as Experimental but will occur several decades later. Short term 30% possible.	None	Similar to Experimental population with effects confined mostly to YNP and wilderness areas	Slightly greater than Experimental (15%) but wolves recover by 2000.
Livestock depredation	Annual average 19 (range 3-32) cattle, average 68 (range 38-110) sheep.	A few (10%) more over a longer period (30 years). Losses on private land more likely.	None	Losses likely toward lower range (3 cattle & 38 sheep) of that projected for experimental population.	Losses likely from upper range (32 cattle & 110 sheep) of projected to several times that level.
Land use restrictions	None	Reduce human activity one mile around active wolf dens. 35 mi^2 more possible road closures, etc.	None	Reduce human activity one mile around active wolf dens. 35 mi^2 more possible road closures, etc.	One mile around active wolf dens. If wolves illegally killed may include road closures, removal of livestock, and limits on activities on public lands.
Visitor use	Probable 5% increase in nonresident and 10% increase in local visitation.	5%-10% increase in 2025, after wolves become established.	None	Probable increase (5%-10%) in visitation by 2010.	Probable increase (5%-10%) in visitation by 2000.
Economic effects	Net positive benefit; $7 to $10 million annually beginning by 2002.	Net positive benefit $1.4-$2.1 million by 2025.	None	Net positive benefit $3.3-$6.1 million; slightly lower than experimental population by 2010.	Net positive benefit; $3.8-$6.7 million annually beginning by 2000.

Table 2-7. Expected impacts of recovered wolf population (100 wolves) by alternative--central Idaho area.

Alternatives / Impact	Reintroduction of Experimental Population	Natural Recovery (No Action)	No Wolf	Wolf Management Committee	Reintroduction of Nonexperimental Population
Impact to big game populations	Elk 5%-10% reduction, others no effect in central Idaho area by 2002.	Same as Experimental but will occur a decade later. Bighorn sheep could decrease temporarily.	No new	Similar to experimental population with effects confined mostly to wilderness areas and later (2015).	Slightly higher than Experimental but wolves recover sooner. Bighorn sheep may be temporarily decreased.
Effects on hunter harvest	Reduced antlerless harvest (elk only) 10%-15%, no effect on antlered harvest in central Idaho area.	Same as Experimental but will occur a decade later. Some Bighorn sheep could be affected.	No new	Similar to experimental population with effects confined mostly to wilderness areas and later.	Slightly greater than Experimental (15%) during recovery but wolves recover by 2000.
Livestock depredation	Annual average 10 (range 1-19) cattle, average 57 (range 32-92) sheep.	A few more (12 cattle, 60 sheep) over a longer period (30 years). Losses on private land more likely.	No new	Losses likely toward lower range (8 cattle, 40 sheep) of that projected for experimental population.	Losses likely from upper range (14 cattle, 70 sheep) of projected to several times that level.
Land use restrictions	None	One mile around active wolf dens. 35 mi^2 impacted. More possible road closures, etc.	No new	One mile around active wolf dens. 35 mi^2 impacted.	One mile around active wolf dens. If wolves illegally killed may include road closures, removal of livestock, and limits on activities on public lands.
Visitor use	The projected effect is unclear, but 2% increase likely.	The projected effect is unclear, but likely 2% increase in 2012.	No new	The projected effect is unclear but likely to increase 2015.	The projected effect is unclear, but likely to 2% increase in 2000.
Economic effects	Net positive benefit; $5.6 to $8.4 million annually.	Net benefit $3.5 to $5.2 million.	No new	Net positive benefit $2.9 to $5.6 million; slightly lower than experimental population beginning in 2015.	Net positive benefit; $3.4 to $6.2 million annually.

CHAPTER III

AFFECTED ENVIRONMENT

YELLOWSTONE: THE REGION

The analysis area is centered around Yellowstone and Grand Teton National Parks, in northwestern Wyoming, southwestern Montana, and eastern Idaho. The area is often described generally as the Greater Yellowstone Area (GYA), which includes all or parts of 6 national forests: Gallatin to the west and north of Yellowstone National Park, Custer to the northeast, Shoshone to the east and southeast, Bridger-Teton to the south, Targhee to the southwest and west, and Beaverhead to the west. Portions of the Caribou National Forest, administered by the Targhee, to the southwest, are also sometimes included in deliberations relating to management of Greater Yellowstone. Table 3-59 (page 3-113) summarizes the Yellowstone area information.

Access

The region is served by a wide variety of federal, state, and local road systems. Five travel corridors approach Yellowstone National Park, from the north, northeast, east, south, and west. The 6 national forests, 2 national parks, and 2 national wildlife refuges have a total of 4,384 miles (7,054 km) of existing open roads, 2,313 miles (3,722 km) of motorized trails, and 4,644 miles (7,472 km) of horse and foot trails (GYCC 1987).

Human Population

The broadest definition of the GYA currently in use (Glick et al. 1991), which includes about 18 million acres (72,900 km^2) of federal, state, Native American, and private lands, contains a population of 220,000 people in all or parts of 20 counties. Population growth is rapid, estimated at an additional 150,000 people by the year 2010. Besides permanent residents, an additional 10 million recreational visits are recorded in the area annually.

Major Communities

The GYA contains many small communities--villages, crossroads, and limited developments--throughout, and a few larger communities on the edges. Yellowstone National Park contains developments of several sizes, ranging from the Old Faithful area, with more than 400 structures, to small outlying campgrounds (such as Pebble Creek or Lewis Lake) that contain a small number of campsites and other permanent facilities. Grand Teton National Park similarly contains several developments related to visitor use of the park, including Moose, Moran Junction, Colter Bay, and Jackson Lake.

Yellowstone National Park is immediately bordered by small recreational communities--Gardiner, Montana at the North Entrance, Silver Gate and Cooke City, Montana at the Northeast Entrance, and West Yellowstone, Montana at the West Entrance--and is also served by smaller developments, Pahaska and Flagg Ranch (Wyoming), near the east and south entrances, respectively.

Larger communities are located on the edges of the GYA: Bozeman, Montana (30,000 residents) to the northwest of Yellowstone Park; Livingston, Montana (7,000) to the north; Red Lodge, Montana (2,000) to the northeast; Cody, Wyoming (8,000) to the east; Lander, Wyoming (8,000) to the southeast; and Jackson, Wyoming (6,000) to the south.

Landscape

The Yellowstone Plateau is a geologically young region sitting astride the Continental Divide. Because of repeated eruptions of its 40-by-25-mile caldera, as well as countless smaller volcanic events and extended periods of glaciation, the landscape is characterized by steep, rapidly eroding mountain ranges, most of which trend north and south.

The Gallatin and Absaroka Mountain Ranges dominate the northcentral portion of the GYA on the west and east sides of the Yellowstone River Valley, respectively. The Gallatin Range, a combination of volcanic and sedimentary formations, extends southward from near Bozeman, Montana, through Gallatin National Forest and into the northwestern portion of Yellowstone National Park, while the Absaroka Range, a result of numerous widespread volcanic episodes, extends southward along the eastern side of Yellowstone.

East of the Absaroka Range, and northeast of Yellowstone, the Beartooth Plateau in Custer National Forest, contains some of the west's most spectacular scenery. West of Yellowstone Park, the Madison Range parallels the Gallatin Range, while the Centennial Range, partly in Beaverhead National Forest, forms an east-west portion of the Idaho-Montana border.

Southeast of Yellowstone National Park, the Wind River Range extends from Shoshone National Forest into the Wind River Indian Reservation. Directly south of Yellowstone, the dramatic fault-block formation of the Teton Range forms the western side of Grand Teton National Park.

Watersheds

The Continental Divide crosses Yellowstone National Park diagonally, from a few miles south of West Yellowstone, Montana to the southeast corner of the park near the Thorofare region. North and east of the Divide, numerous streams flow from the park area into the Missouri River drainage. Preeminent among these is the Yellowstone River, which heads just southeast of the park, then flows north and northwest through the park, then north into Montana and northeast to the North Dakota border, where it joins the Missouri River.

The Madison River, formed by the geothermally influenced currents of the Gibbon and Firehole Rivers, flows west from the park, then north to Three Forks, Montana, where it meets the Jefferson, coming in from the west, and the Gallatin, which rises in the Gallatin Mountain Range in northwestern Yellowstone National Park. The 3 form the Missouri River.

Streams flowing from the south and west parts of the park eventually join the Snake River, which begins just south of Yellowstone National Park in Bridger-Teton National Forest, flows into the park, and trends generally south through Grand Teton National Park. The Snake River eventually flows west and north to join the Columbia.

Climate

The climate of Yellowstone National Park, and most of the mountainous national forests, features long, cold winters, and short, cool summers. Mean monthly temperatures at Lake Station, near the center of Yellowstone National Park, average 32.3°F (O°C). Mean monthly temperatures at Jackson, near the southern end of Grand Teton National Park, average 36.8°F (2.5°C). Record high temperatures near Yellowstone and Grand Teton National Parks are 103°F (39.5°C) at Gardiner, Montana, in 1960 and 101°F (38.2°C) at Jackson, Wyoming, in 1934. Record lows for the parks are -66°F (-54°C) at West Yellowstone, Montana, and -63°F (-52.8°C) at Moran, both in 1933 (Dirks and Martner 1982).

Precipitation is least near the North Entrance of Yellowstone National Park (10 to 12 inches; 25 to 30 cm) (Despain 1987, Dirks and Martner 1982). Between 75% and 85% of precipitation in the mountainous regions of Yellowstone National Park falls as snow. In the interior plateau regions of Yellowstone National Park, 35% to 55% of precipitation falls as rain (Despain 1987).

Vegetation

Because of its great variations in elevation, soils, and climate, the region in and around Yellowstone National Park is something of a botanical crossroads, with at least 7 "distinct floras" present (Despain 1990, Glick et al. 1991), ranging from desert to alpine. About 1,700 species of plants have been identified in the region, but most of the landscape is dominated by only a few species.

Roughly 60% of the federal lands in Greater Yellowstone is covered by forest, and the majority of that area, especially in the elevations between 7,500 feet (2,300 m) and 9,000 feet (2,700 m), is dominated by lodgepole pine. Most lower elevation forests are dominated by Douglas-fir, juniper, or aspen, while whitebark pine, Engelmann spruce, and subalpine fir are the most common species above 9,000 feet (2,700 m), and the upper timberline occurs around 9,500 feet (2,900 m).

Below lower timberline, between 6,000 feet (1,800 m) and 7,000 feet (2,100 m) depending upon conditions, grasslands and shrub steppes were the native vegetation communities in river valleys, floodplains, and terraces, though many plants' distributions have been changed by cultivation.

Yellowstone Area

A much smaller set of vegetation communities occur in riparian areas bordering both moving and still waters. These communities are of extreme importance in the ecological setting because they provide high productivity, high biomass, diversity of life forms, and essential cover and erosion protection. Because of its unusual geological character, Yellowstone supports some extremely rare plant communities, perhaps most notable those in and near the park's thermal areas.

Wildlife

The Yellowstone area hosts the largest aggregation of ungulates and other large mammals in the lower 48 states. In the primary analysis area for this EIS, there are an estimated 56,100 elk, 29,500 deer, 5,800 moose, 3,900 bighorn sheep, and 3,600 bison (see Chapter 3, Ungulate Populations and Hunter Harvest). This includes herds immediately adjacent to, or associated with, summer and winter ranges in Yellowstone National Park. The Greater Yellowstone Coordinating Committee (1987), providing total wildlife numbers for the larger GYA, reported more than 93,000 elk, 87,000 mule deer, 7,000 bighorn sheep, 6,000 moose, 3,000 bison, and smaller numbers of mountain goats and white-tailed deer for this larger area (GYCC 1987). Yellowstone National Park is summer range for 8 elk herds, with a summering population of 37,800 (Singer 1991b).

Large predators include more than 3,000 black bears, a minimum of 228 grizzly bears, and a smaller number of mountain lions (GYCC 1987). Coyotes are abundant, and fox are common in some areas. Wolverines, bobcats, and lynx are uncommon.

Although ungulates, especially elk, are expected to comprise most of the diet of wolves if they are reintroduced in the Yellowstone area, small mammals can play a key role in wolf survival. Yellowstone's Northern Range hosts large populations of marmots, ground squirrels, voles, and pocket gophers (Crabtree 1992). The availability of these prey can be especially important to wolves during pup-rearing, when adult wolves are more restricted in their movements.

Fishery Resources

Though other fish species have been introduced into a few waters in the region, about 22 species are now common in Greater Yellowstone waters. Of these, 15 are native (Glick et al. 1991, Varley and Schullery 1983). The most common sportfish is the cutthroat trout, including the Yellowstone cutthroat trout, the westslope cutthroat trout, and the fine-spotted Snake River cutthroat trout. The Kendall Warm Springs dace is the only endangered fish species in Greater Yellowstone, though several other fish, including the Montana grayling, are of special concern regionally or locally.

Wolf

Historical Distribution, Extirpation, and Sightings.--Wolves were native to Yellowstone and central Idaho (Young 1944, Schullery and Whittlesey 1992). From about 1860 to the mid-

1930s, a series of events resulted in the eradication of wolves from the western United States (U.S.) and southern Canadian Provinces. These events included trapping of wolves for their pelts, elimination of bison, trapping and poisoning of wolves by "wolfers," drastic reduction of native ungulate populations by settlers and market hunters, introduction of domestic livestock, and finally, predator control by the federal government (Young and Goldman 1944, Curnow 1969, Lopez 1978, Weaver 1978). By 1925, it was unlikely that a viable population of wolves existed anywhere in Montana (Day 1981). A similar progression of events occurred in states adjacent to Montana. The last known wolf control actions in Wyoming were near Lusk (in eastern Wyoming) and in the Upper Gros Ventre River (near the western Wyoming border) in 1923 (Aulerich 1964).

In the 1950s, wolves were drastically controlled over most of Alberta, which virtually eliminated wolf immigration into Montana or Idaho. In western states, carcasses were poisoned for predators using strychnine until the mid-1950s or Compound 1080 until 1972. During this period in Idaho, Montana, and Wyoming, wolf reports were rare and scattered, with sightings comprising only 1 to 2 wolves and occasional reports of howls or tracks.

In the 1960s, the Canadian government allowed wolf populations to increase in southeastern British Columbia by temporarily reducing wolf hunting and trapping seasons. Wolf reports in Idaho, Montana, and Yellowstone National Park increased, especially in the late 1960s and early 1970s. This increase was probably due to both an increase in wolves as federal pressures on wolves decreased and an increase in backcountry use by the public (Kaminski and Hansen 1984).

Montana.--Between 1968 and 1973 sporadic wolf sightings, tracks, and howls were reported primarily in southwestern Montana in the Beaverhead-Madison area, suggesting groups of 1 or 2 animals were present (Flath 1979). In 1973, Montana changed the wolf's status from predator to endangered species.

From 1974-1977, wolf observations were analyzed and field surveys conducted in western Montana (Day 1981, Ream and Mattson 1982). During this period, patterns of increased observations centered around the Beaverhead National Forest of southwestern Montana and in northern Montana adjacent to British Columbia and Alberta. In both regions, observations, tracks, and howling generally indicated single wolves or occasional pairs. A minimum of 17 to 23 wolves possibly occurred in these areas of Montana and Idaho (Day 1981).

Possible dens were reported both in the Beaverhead National Forest (with 3 pups) in 1974, and in the Gravelly Range south of Ennis in 1975. However, wolf reports in subsequent years in southwestern Montana became increasingly scattered and group size steadily declined. Most sightings (90%) became limited to single animals and pairs (Day 1981).

Yellowstone Area

In northwestern Montana, from the Rocky Mountain front to the Kootenai area, reports of sightings, tracks, and howling suggested mostly lone wolves. These reports included a wolf killed in the Sun River drainage in 1974 and a wolf trapped in the Kootenai area in 1972 (Day 1981).

In 1976 and 1977, frequent reports came from the Badger Creek area along Highway 2, near Glacier National Park. Although production of pups was suspected by several observers (Day 1981), the frequency of reports in this area and along the Rocky Mountain front dropped precipitously through 1979.

In 1979, a lone wolf was discovered in the North Fork of the Flathead River in Canada, immediately north of Glacier National Park. That wolf was radio collared and closely monitored until June 1980 but no sign of other wolves was located. However, in 1982 a pack was located.

In the early 1980s, wolves began to recolonize the Flathead River drainage in British Columbia, adjoining Glacier National Park (Ream et al. 1991). The first denning of wolves documented in the western U.S. in over 50 years occurred when this group, the "Magic Pack," denned in Glacier National Park in the spring of 1986. By 1988, the recolonizing population expanded to 4 packs in northwestern Montana.

From 1986-1992, or 7 years after the first litter was produced in Montana, the wolf population had increased to approximately 45 (average rate of increase of 1.22 annually). The average pack contained about 10 wolves and occupied an average territory of 300 mi^2 (777 km^2). Each pack normally produced a single litter of 5 pups. Of 44 wolves known to have died, at least 77% were killed by people. A minimum of 20% of the population was lost annually. Wolves that naturally dispersed into Montana tended to select lower elevation habitats, and consequently, some conflicts with people have occurred. Of 4 wolf packs that established territories outside the Glacier National Park area, 3 depredated on livestock. Two of those packs were eliminated by control actions. Control caused 52% of known losses to the wolf population in Montana or 6% of the population annually. Disease was suspected as the greatest cause of natural mortality (primarily pups). Fifteen marked wolves dispersed, primarily northward, toward existing wolf populations in Canada. Another 40 unmarked wolves are unaccounted for; some probably dispersed and others were likely killed by people but not reported.

Idaho.--From the late 1920s through the early 1970s, wolf reports persisted. These consisted mostly of single animals or small groups in the central Idaho area. Occasionally individual wolves were killed (Kaminski and Hansen 1984). From 1972 to 1979, reports centered in the Boise National Forest in south central Idaho and the Clearwater National Forest in north central Idaho. Increased field study in Idaho during 1983 and 1984 produced evidence of only 1 to 4 lone wolves. These were believed to be dispersing animals from Canada (Kaminski and Hansen 1984, Hansen 1986).

Wyoming.--Prior to the 1880s, wolves were present throughout the GYA (Schullery and Whittlesey 1992). Poisoning of ungulate carcasses in the Yellowstone area began as early as 1877. Single wolves and small groups of wolves were recorded between 1881 and 1908, and apparently increased about 1912. During 1914-1926 a minimum of 136 wolves were killed in the park. The last known den was destroyed in 1923 near Tower Fall (Weaver 1978).

Reports of wolves, or wolf-like canids continued in the park after the period of intensive control. From 1927 to 1966, reports were few in numbers, scattered over time and area, and consisted of lone individuals or small groups. From 1930 to April 1969, observation reports were few and scattered. Cole (1971) suggested that from 1969 to 1971, possibly 2 pairs of wolves produced young. During this period, observations of wolves, tracks, and howling increased. However, reports after this period decreased significantly; bait stations with compound 1080 for coyotes were maintained outside of the park in Wyoming and Idaho and the wolf was not protected in these states.

Reports of single wolves and pairs persisted sporadically through the 1970s. During extensive field surveys conducted from 1975 to 1977, only 2 sets of tracks and 1 howl, all east of the park, were recorded that may have been wolves (Weaver 1978). From 1977 to 1986, 11 (of 106 total) wolf observations considered reliable were reported from widely separated areas of the park. These observations consisted of scattered sightings, tracks, or howls involving individuals, and in 1 observation 2 animals. No breeding, indication of persistent use, or pack formation was noted during this period (Meagher 1986).

Present Status.--Wolf observation reports from state and federal employees in the field and from the public play a major role in detecting wolves within an area, and determining if pack formation and breeding activity is likely. Although wolves are often elusive, they are also highly social and depend strongly on pack cohesion and territoriality (Mech 1970). Therefore, as breeding pairs form and territories are developed, observations of wolves, tracks, and howling increases significantly within the pair's territory. Initially, observations may be of small groups, but as packs become established the groups observed will noticeably increase. Because wolves repeatedly use areas within their territory, it is extremely likely that sightings of groups, tracks, scats, howls, and other sign will be reported repeatedly within the local area and throughout the year. This is especially true because public interest in wolves has increased and a reporting system has been developed by the FWS (USFWS 1991 Annual report). When a number of public reports are received from a given area, field surveys are conducted in the area to determine if a pack or breeding activity is present.

Yellowstone Area

Montana.--The wolf population in Montana has continued to expand. Six packs or breeding pairs currently exist, including 1 breeding pair on the eastern Rocky Mountain front. An estimated population of 45 wolves lives in northwestern Montana (USFWS 1992).

At least 4 litters (minimum of 21 pups) were produced in northwestern Montana in 1990 (USFWS 1991); and at least 2 litters with about 10 pups were born in 1991. Dispersal of wolves from northwestern Montana to areas near Banff National Park, Alberta, and vice versa, has been documented.

Idaho.--Sightings of wolves have been repeatedly reported in Idaho, but breeding has not been confirmed. In 1991, the presence of at least 2 wolves was confirmed at an elk kill in March in northern Idaho, and a black wolf was found poisoned on the Boise National Forest near the Bear Valley area north of Boise. Although previous evidence suggested possible pack activity in the Bear Valley area, no further evidence has been confirmed (USFWS, unpubl. data). Dispersal of radio-collared wolves from Glacier National Park and Banff National Park into north central Idaho was documented in 1992.

Wyoming.--In Yellowstone National Park, reports of wolves, howling, and tracks have been scattered throughout the park and adjacent areas in the past several years. Almost all observations have been of single individuals. There are no known wolf packs or breeding pairs in the GYA. August 8, 1992, a black wolf-like canid was filmed for several minutes in the Hayden Valley. This filming coincided with several reports of a black wolf observed in the area over the next several weeks.

On September 30, 1992, a male wolf was shot 3 miles (5 km) south of the park boundary in the Fox Park area of the Teton Wilderness. This was the first wolf killed close to the park since 1926. Although several coyotes were reported running with the wolf prior to its death, extensive field investigations did not reveal evidence of additional wolves. Genetic investigations verified this animal was genetically related to wolves in northwestern Montana.

Social and Cultural Environment and Economy

Population.--In 1990 the combined population of Idaho, Montana, and Wyoming was 2.26 million people. (The primary source of data in the population and economy sections is the Bureau of Economic Analysis, Regional Economic Information System, 1992.) While the population in the region grew at a rate of about 2.5% in the 1970s, it was nearly constant in the 1980s partly as a result of a decrease in demand for domestic oil and coal (Table 3-1). This region is sparsely populated. There was an average of 6.96 people per square mile ($2.69/km^2$) in 1990--compared to 70.3 people per square mile ($27.1/km^2$) in the United States as a whole. About 18% of the population in the 3 states is age 55 or older, slightly less than in the United States as a whole. This component of the population is expected to grow dramatically relative to other age groups in the United States as a result of relatively low fertility rates and longer life expectancies (U.S. Department of Commerce, Bureau of the Census 1984).

Table 3-1. Population trends in the 3 state region and primary analysis areas: 1970-1990.

Area	1970 population	1980 population	1990 population	1990 population per sq. mile	Land area (million acres)
3 state region (Idaho, Mont., Wyom.)	1,748,000	2,212,000	2,260,000	6.96	207.9
17 county Yellowstone area	219,000	270,000	288,000	5.12	36.0
10 county central Idaho area	81,800	96,700	92,400	2.60	22.5

Idaho, Montana, and Wyoming are rich in outdoor recreation opportunities; the region boasts national, and international, recognition for its national parks, extensive wilderness areas, and high quality hunting, fishing, and wildlife viewing opportunities. Not surprisingly, residents of the region value outdoor recreation highly. In a 1992 study, Duffield et al. (In 1992) found that 79% of Yellowstone area residents (people who live in the 20 counties immediately surrounding Yellowstone National park) participated in outdoor recreation activities, compared to 69% of people nationwide. Yellowstone area residents had higher rates of participation in fishing (73%, compared to 48% nationwide), viewing wildlife (90%, compared to 67%), and hunting (60%, compared to 25). Percentages reflect the proportion of respondents who said they occasionally or frequently participate in the activity. Not surprisingly, Yellowstone area residents were more likely to have hunted deer, elk, or moose, and were much more likely to have hunted these species in Idaho, Montana, or Wyoming than were residents of the U.S. as a whole. Additionally, Yellowstone area residents also had higher visitation rates to national parks; 84% said they had visited a National Park in the previous 2 years, compared to 49% of the national sample. Most of this difference was due to the frequent trips Yellowstone area residents made to Yellowstone National Park.

Economy.--Per capita personal income was $15,475 in 1990. It remained approximately constant in real dollars from the mid-1970s through the 1980s but showed some growth (nearly 5% per year) in 1989 and 1990.

Total personal income in the region was $35 billion in 1990. Farm income and agricultural services accounted for 6% of the total, declining from about 10% in the early 1970s. Livestock accounted for 52% of the value of farm products sold in the region in 1987 (U.S. Department of Commerce, Bureau of the Census. 1992). Local services have consistently generated about 40% of total personal income over the past 2 decades. Local services include local transportation and utilities, retail trade, finance, insurance, real estate, services, and state, local, and federal civilian government. Other industry accounted for about 24% in 1990, declining from about 30% in the 1970s. (Other industry includes forestry, fisheries, mining, construction, manufacturing, other transportation and freight, wholesale trade, and federal government military enterprises.) The remaining 30% is income other than earnings. This category, which includes dividends, interest, rent, transfer payments (primarily from retirement programs and medical payments), and an adjustment to wealth from changes in the value of residential housing, has steadily increased in importance over the past 2 decades from about 20% in the early 1970s to 30% in 1990. This trend reflects the increasing relative importance of "footloose income" (Power 1991) in the regional economy. This income follows people who choose where they want to live based on the perceived "quality of life" and may be positively correlated with such amenity values as the existence of healthy wildlife populations, lack of crime, clean air, etc. Because the age group to whom this income is primarily attached--55 years of age and older--is expected to grow in relative importance in the population as a whole, this trend should continue.

Tourism is an important "industry" to all 3 of the states in the region. Visitors from outside the region visit Montana, Idaho, and Wyoming in large numbers, in all seasons, in order to see parks and wilderness areas, ski, float rivers, fish, hunt, and simply enjoy scenery. These visitors spend large amounts of money when they visit the region, and these expenditures, in turn, have a large impact on incomes and employment in the region. As an example, Duffield (1992) found that visitors to Yellowstone National Park who came from outside the 3 state region spent an average of $840 in the region during their trips.

YELLOWSTONE: UNGULATE POPULATIONS AND HUNTER HARVEST

An Overview of Yellowstone Ungulate Populations and Hunter Harvests

Wild ungulates living in or near Yellowstone National Park during summer and winter occupy about 38,800 mi^2 (100,500 km^2) (Figure 3-1) in the primary analysis area. Elk, deer (primarily mule deer), moose, and bison are predicted to be the primary prey for wolves inhabiting the Yellowstone area (Koth et al. 1990, Vales and Peek 1990, Singer 1991b, Boyce and Gaillard 1992). Bighorn sheep are not predicted to be affected by wolves because of their use of escape terrain (Koth et al. 1990, Boyce and Gaillard 1992). However, some bighorn sheep populations east of Yellowstone National Park may be more vulnerable to wolves where those sheep do not inhabit steep cliffy escape terrain (J. Talbott, pers. commun., Wyoming Game and Fish Dept, Cheyenne). Wolves are not expected to significantly affect pronghorns because pronghorns have a relative low availability compared to other ungulates, they live in close proximity to human habitation near Gardiner, Montana, and they tend to winter in areas with shallow snow depths (Koth et al. 1990, Boyce and Gaillard 1992, Singer 1991b).

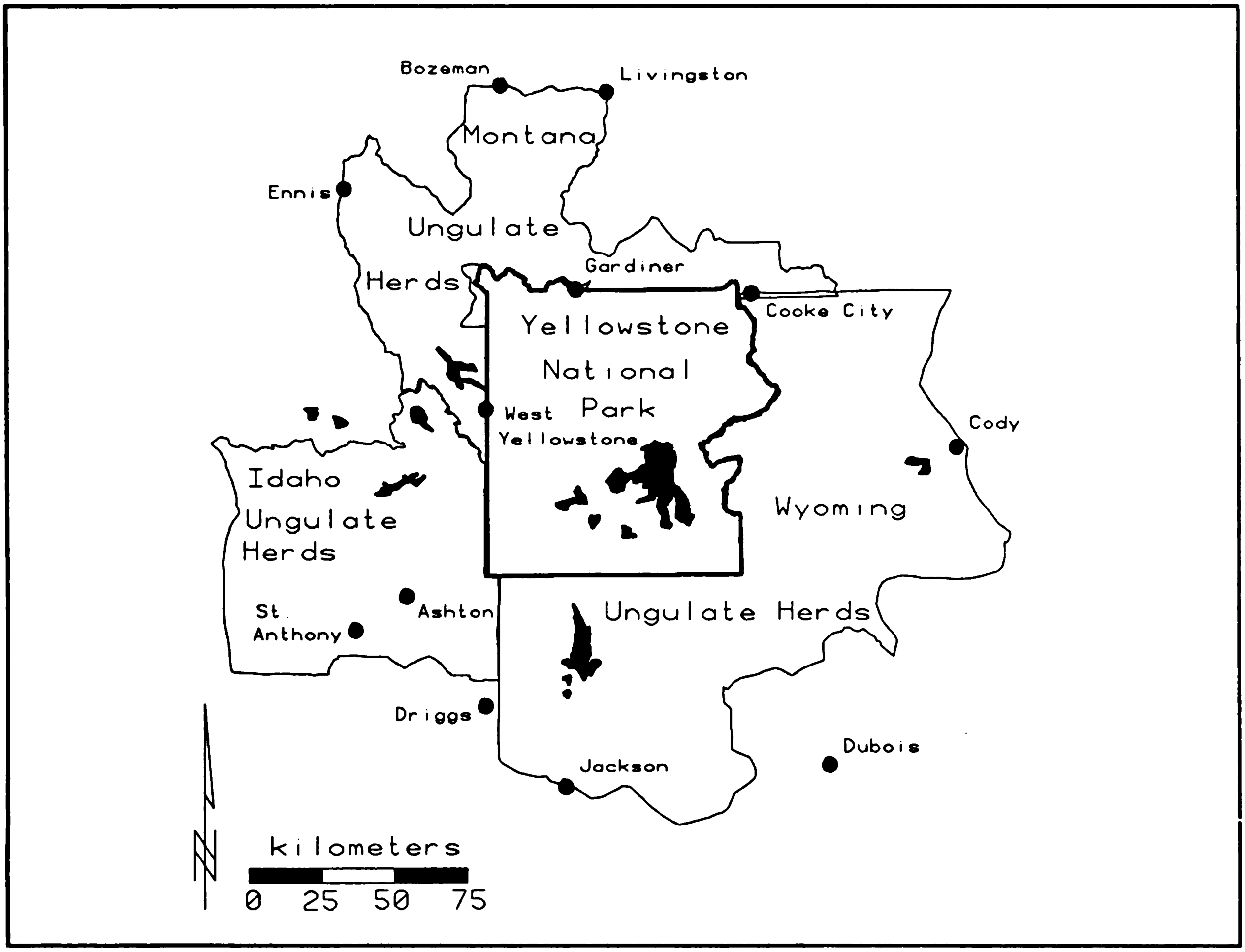

Figure 3-1. Analysis area for wild ungulates living in or near Yellowstone National Park.

Ungulate Numbers.--Approximately 56,100 elk from about 10 elk populations, 29,500 deer from about 13 populations, 5,800 moose from 13 populations, 3,600 bison from Yellowstone and Grand Teton National Parks (M. M. Meagher, pers. commun., B. Smith, pers. commun., Natl. Elk Refuge, Jackson, Wyoming), and 3,900 sheep from about 12 populations are estimated to be living in the Yellowstone area (Table 3-2). Singer (1991b) estimated at least 37,800 ungulates summered in Yellowstone National park, but it is likely many more ungulates summered in the park because mule deer, moose, and bighorn numbers summering in the park may have been significantly underestimated.

Table 3-2. Estimated population numbers and average annual harvests for big game species in the Yellowstone area[a].

	Elk		Deer		Moose		Bighorn	
State	Population	Mean harvest	Population	Mean harvest	Population	Mean harvest	Population	Mean harvest
Montana	24,800	3,044	12,200	2,564	1,400	93	400	22
Wyoming	26,300	4,281	15,700	1,702	3,600	400	3,500	108
Eastern Idaho	4,200	1,009	1,600	1,021	800	58[b]	0	0
Totals	56,100[c]	8,334	29,500	5,287	5,800	551	3,900	130

[a] Adapted from Mack et al. 1990 and Montana Dept. of Fish, Wildlife and Parks, unpublished data.
[b] Average moose harvest from 1983-1988.
[c] Includes population estimate of 800 elk from the Madison-Firehole herd inside Yellowstone National Park.

Hunting Seasons.--Hunters have a wide range of opportunities and long time periods to hunt big game in the Yellowstone area. Hunting seasons primarily occur during the fall and early winter. No hunting is allowed in Yellowstone National Park. For detailed descriptions of hunting seasons in Montana, Wyoming, and Idaho within the Yellowstone area, see Mack et al. (1990) or each state's current hunting season regulations.

Archery Seasons.--Montana, Wyoming, and Idaho all offered special archery seasons to hunt elk and deer. In Montana, archery season lasted about 1.5 months, beginning the first week in September and closing mid-October. During this time, either-sex elk or deer could be harvested. Wyoming's archery season generally lasted 2-4 weeks, beginning the end of August and closing the end of September. Depending on the hunt area, antlered elk, antlered deer, or either sex deer could be harvested during the archery season. Idaho's archery season lasted 3-4 weeks during the month of September for both elk and deer and either-sex elk or deer could be harvested.

General Rifle Seasons.--The general rifle season for elk and deer in Montana is 5 weeks long beginning the fourth week in October and ending the fourth week in November. Only antlered elk or deer could be harvested during the general season. East of Yellowstone National Park in Wyoming, the general elk season was about 3-4 weeks long, occurring during October, and antlered elk could be harvested. South of Yellowstone National Park, the general elk season was slightly longer, beginning the second week of September and ending the third or fourth week of October. Primarily, antlered elk could be harvested south of Yellowstone National Park, but some areas had general antlerless or either-sex seasons. Wyoming's general deer season east of Yellowstone National Park was about 1.5 months long, beginning the first of October and ending mid-November. Primarily, antlered bucks could be harvested east of Yellowstone National Park. South of Yellowstone National Park, either-sex deer could be harvested from mid-September through October. In Idaho, the general elk season was only 5 days long and usually began during the second week in October. Only antlered elk could be harvested during the general season. Idaho's general deer season was longer than the elk season, beginning in mid-October and ending mid-November. Antlered deer or either-sex deer could be harvested during the general season.

Special Permits.--In all 3 states, special permits were offered to harvest antlerless elk or deer during general season hunts. Special permits also provided for hunting opportunities after the general season. During the 1980s, Montana offered an average of about 1,300 special elk permits (allowing harvest of antlerless or either-sex elk) and an average of 800 special deer permits for antlerless deer harvest during the general season. About 4,000 special permits (primarily for harvesting antlerless elk) were also offered for late season elk hunts lasting from mid-December through January. No late season permits were offered for deer. In Wyoming, special permits for areas east of Yellowstone National Park provided for antlerless elk hunting in November and December (after the general season). South of Yellowstone National Park in Wyoming, an average of nearly 3,000 special either-sex permits were offered with opening dates ranging from 10 September to 25 October and closing dates ranging from 31 October to 15 December. No special deer permits were issued for deer east or south of Yellowstone National Park. In Idaho, between 800 and 1,700 special either-sex or antlerless elk permits (for controlled hunts) were issued for areas southwest of Yellowstone National Park. Seasons lasted from mid-October through December. During the 1980s, no special permits were issued for deer.

A special permit, obtained through a random drawing, was required to hunt moose in Montana, Wyoming and Idaho. In all 3 states, permits allowed harvest of antlered moose; however, a smaller number of permits allowed the harvest of antlerless moose. No special archery season was set for hunting moose in Montana or Idaho. Wyoming had a special archery season for moose lasting 2-4 weeks with opening dates as early as mid-August and closing dates the end of September. A general rifle season was set for moose in all 3 states. Montana's season lasted from mid-September through November. Wyoming's seasons lasted from mid-September to mid-November and Idaho's moose season began around the end of August and ended in mid-November.

Hunters in Montana and Wyoming must also have a special permit, primarily obtained through a random drawing, to kill bighorn sheep. In Montana, all sheep hunting districts bordering Yellowstone National Park had an unlimited number of permits (no drawing), and quotas regulated the harvest. When quotas were reached, the season closed. Seasons opened the first or second week in September and closed the first or last week in November if quotas were not reached. Some additional permits, obtained through a drawing, were also offered primarily in 1 Montana hunting district with season opening dates during the first week in November and closing dates between the end of November and mid-December.

In Wyoming, seasons for bighorn sheep east of Yellowstone National Park included a special archery season opening mid-August and closing August 31. The rifle season during the 1980s opened September 1 and closed October 31. South of Yellowstone National Park, only 1 archery season was open for bighorns in 1988 and the season was open during the last 2 weeks in August. Between 1980 and 1988, rifle season for sheep south of Yellowstone National Park opened September 1 and closed the end of October or mid-November. In Idaho, sheep populations do not exist southwest of Yellowstone National Park within hunting districts 60, 60A, 61, 62, and 62A.

Hunter Harvest.--During the 1980s, hunters harvested an average of 8,334 elk/year in the Yellowstone area. An average of 5,287 deer, 551 moose, and 130 bighorn sheep were harvested each year in the Yellowstone area during the 1980s (Table 3-2). Most elk, deer, and moose harvested were males, but in almost every hunting area some females were harvested (Mack et al. 1990). For bighorn sheep, only adult males with a 3/4 curl horn were harvested (Mack et al. 1990).

Montana Ungulate Populations

Elk

Distribution.--In Montana, 3 elk management units (EMUs) border the north and northwestern portions of Yellowstone National Park. The Gallatin EMU includes hunting districts 301, 310, and 314 (Figure 3-2). The northern Yellowstone elk herd occupies winter and summer range within Yellowstone National Park, and is associated with hunting districts 313 and 316 which is part of Montana's Emigrant EMU (Figure 3-2). Elk wintering near the northwestern corner of Yellowstone National Park are associated with the Madison EMU and are found in hunting districts 360, 361, 362, and portions of 310.

It is likely 2 subpopulations of elk occupy the Gallatin EMU. One subpopulation, known as the Gallatin herd, summers in northwestern Yellowstone National Park and winters in hunting district 310 and possibly the southern portion of hunting district 301, primarily along the Gallatin River drainage at elevations below 7,000-8,000 feet (2,100-2,450 m).

The second elk subpopulation summers in hunting district 314 in the higher elevations of this hunting district along the Gallatin Mountain Range or in the northwestern corner of Yellowstone National Park. These elk winter in the mountainous areas of hunting district 314, west of the Yellowstone River, at elevations between 5,000 and 7,000 feet (1,500-2,100 m; MDFWP unpubl. data).

In hunting district 301, most elk winter range is located along the Gallatin Face in the northern portion of the district, south of Bozeman, Montana. Small areas of winter range are also found east of Highway 191 and the Gallatin River along the southwestern portion of the hunting district. It is unknown if elk wintering in this area summer in Yellowstone National Park (MDFWP unpubl. data).

Some elk in the Madison EMU summer in Yellowstone National Park and winter in portions of hunting districts 360, 361, and 362. In hunting district 360, elk primarily winter east of the Madison River in the foothill areas of the Madison Range, generally above 6,000 feet (1,800 m). In hunting district 361, small areas of winter range exist along the western boundary of the district near Yellowstone National Park. Additional winter range exists along the mountain foothills within 1 mile (1.6 km) east of state highway 87. Elk winter range in hunting district 362 is primarily located in the northwestern portion of the hunting district between highway 287 (east of the Madison River) and the mountain foothills to the east. Additional smaller portions of winter range are found along the southern boundary of hunting district 362 in steep mountainous areas just north of highway 287 (MDFWP unpubl. data).

The northern Yellowstone elk herd summers in the northern and eastern portions of Yellowstone National Park, as far south as Yellowstone Lake, and in high elevation mountain areas north of the park boundary (Houston 1982). These elk winter in what is

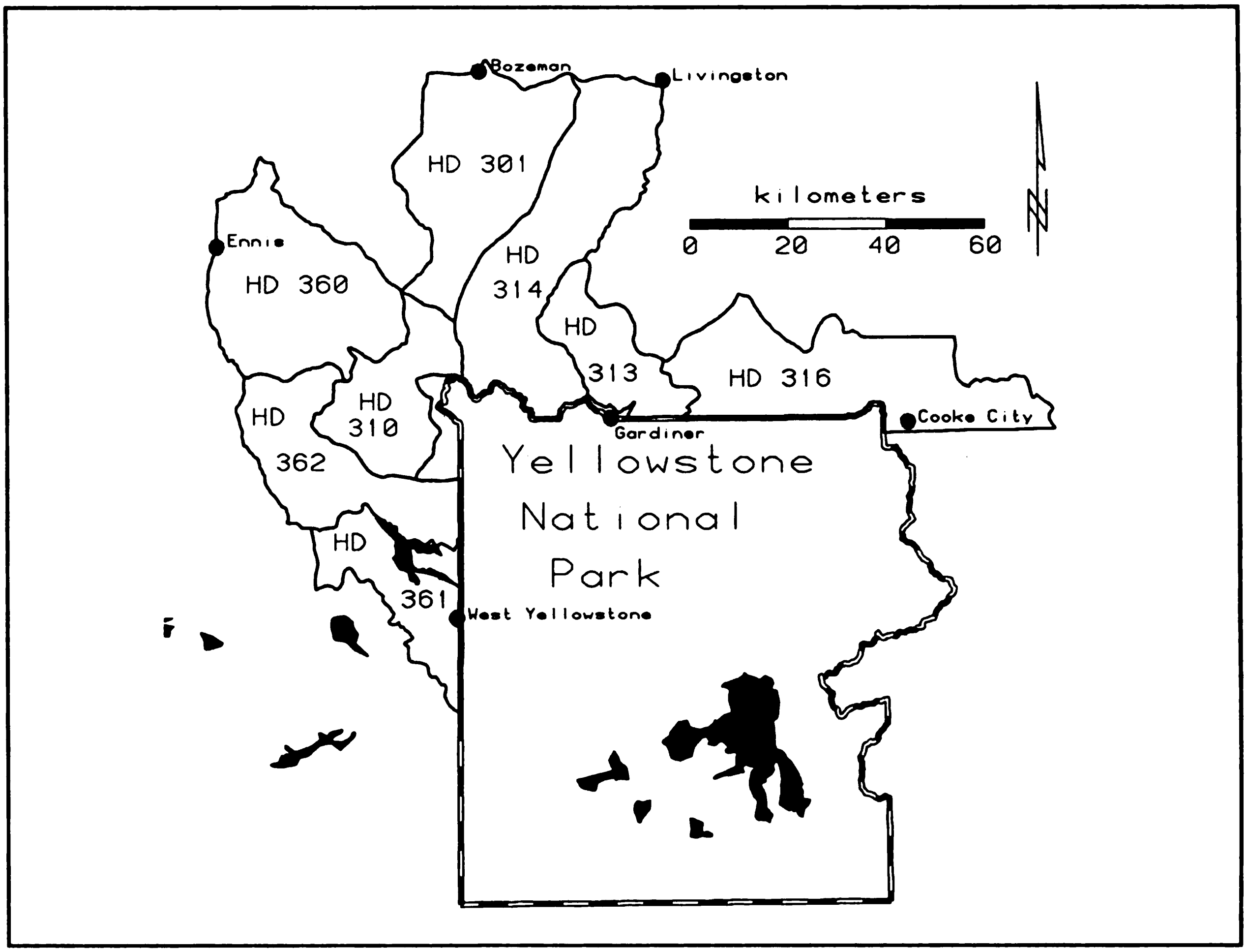

Figure 3-2. Montana hunting districts associated with elk and deer populations living in or near Yellowstone National Park.

described as the northern Yellowstone elk winter range which includes about 400 mi^2 (1,000 km^2) from the Lamar Valley in the park west and north to the Dome Mountain Wildlife Management Area outside Yellowstone National Park in hunting district 313 (Figure 3-3). Hunting district 316 is primarily high elevation summer and fall range with most elk likely migrating to the northern winter range in Yellowstone National Park.

Population Numbers.--Trend counts have been conducted sporadically for each of the hunting districts within the Gallatin EMU during the 1980s with trend counts notably absent during the late 1980s (Figure 3-4). Trend count totals have increased during the 1980s for hunting district 314 (2,912 elk in 1990) and if early 1980s averages for hunting districts 310 (1,667) and 301 (157) are presumed to reflect minimum population numbers, then the total elk population for the Gallatin EMU is about 4,700 elk (MDFWP unpubl. data).

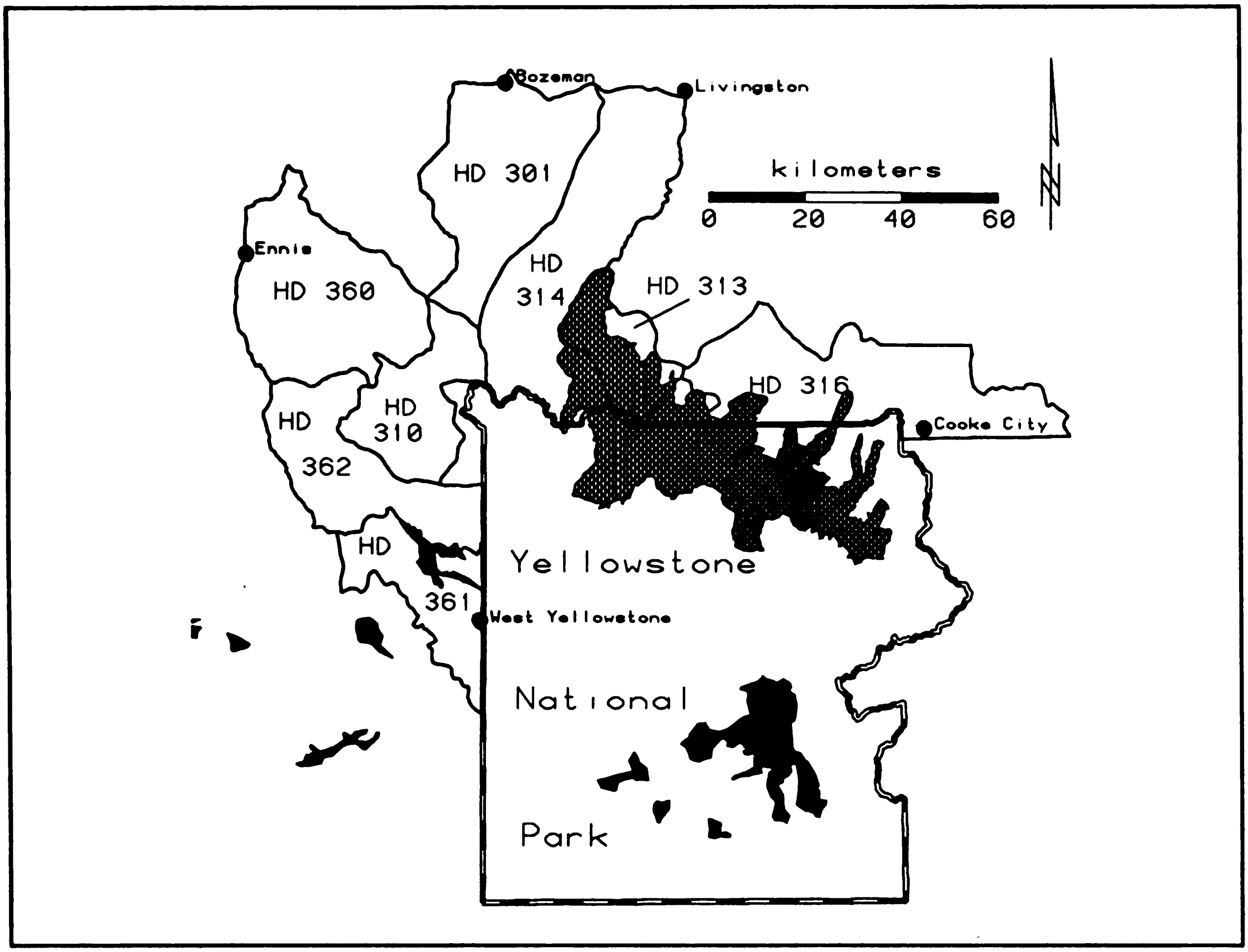

Figure 3-3. The northern Yellowstone elk winter range in portions of Montana and Yellowstone National Park.

For the portion of the Madison EMU in our analysis area (hunting districts 360, 361, and 362), trend counts are more complete (Table 3-3). Average elk numbers from 1980 to 1988 were 2,538. The trend since the early 1980s has been stable to slightly increasing in all but hunting district 361.

From 1980 to 1990, trend counts for the northern elk herd have been variable and averaged 15,299 (Mack and Singer 1992a, J.A. Mack unpubl. data). POP-II population estimates were developed for this herd and the post-hunting season estimate was about 17,300 animals in late winter 1990 (Mack and Singer 1992a). Recent trend count data indicates the population has grown, with the 1992-1993 trend count of 17,585 elk (MDFWP and National Park Service unpubl. data) being larger than the POP-II estimate for 1990.

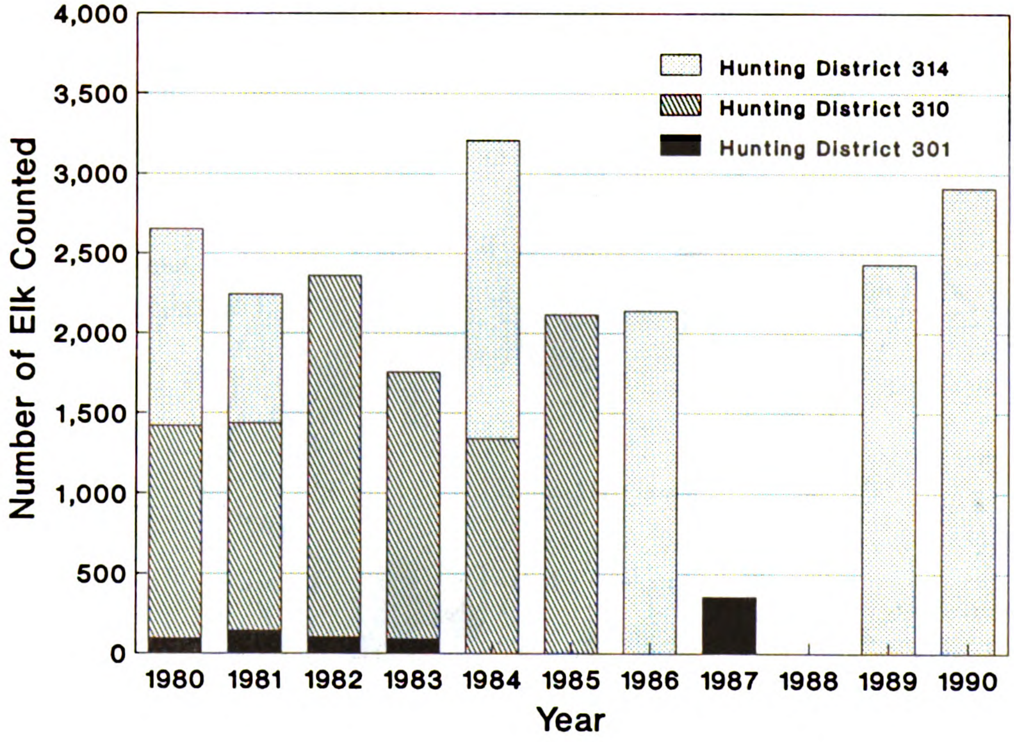

Figure 3-4. Elk trend counts during the 1980s for Montana hunting districts 301, 310, and 314.

Age/sex Composition.--Age/sex composition data is most complete for hunting district 310 in the Gallatin EMU. From 1980 to 1987, ratios averaged 46 calves/100 cows (range 32-59 calves/100 cows) and 28 bulls/100 cows (range 9-56 bulls/100 cows) prior to the hunting season (1980 data was post-hunting season). Only 4 years of winter compositions were obtained for hunting district 314 between 1980 and 1990. Winter ratios in hunting district 314 have ranged from 8 bulls/100 cows in 1986 to 16 bulls/100 cows in 1990-1991 and averaged 10 bulls/100 cows (MDFWP unpubl. data). Calf/cow ratios have ranged from 28 to 39 calves/100 cows and averaged 36 calves/100 cows. Composition data were not obtained for hunting district 301.

Composition data were mostly absent in hunting districts 360, 361, and 362 for the Madison EMU. Age/sex compositions were only obtained for all 3 districts in 1980 and averaged 61 calves/100 cows and 26 bulls/100 cows (MDFWP unpubl. data). Additional composition

Table 3-3. Population trend counts for the Madison elk management unit (hunting districts 360, 361, and 362)[a].

Year	Hunting districts 360	361[b]	362	Total
1980	624	76	485	1,185
1981	836	129	666	1,631
1982	1,181	155	1,013	2,349
1983	1,559	273	1,481	3,313
1984	1,095	83	1,548	2,726
1985	1,434	425	1,330	3,189
1986	1,447		1,251	2,698
1987	1,287	87	1,157	2,531
1988	1,394	106	1,723	3,223
Mean	1,206	167	1,184	2,538

[a] From Montana Dept. Fish, Wildl. and Parks, unpubl. data.
[b] Trend counts for Hunting district 361 are partial counts except for 1983, 1985, and 1988 when trends counts were total counts; no trend count was conducted in 1986.

data for hunting district 361 were obtained in 1983 and 1984. Bull/cow and calf/cow ratios averaged 30% to 40% lower than the 1980 average (MDFWP unpubl. data). Early winter ratios for the northern elk herd (hunting districts 313 and 316) averaged 34 calves/100 cows between 1982-1983 and 1990-1991 and 23 bulls/100 cows between 1985-1986 and 1990-1991 (Mack and Singer 1992a, F.J. Singer, unpubl. data).

Harvests.--From 1980 to 1990, elk harvests for the Gallatin EMU (hunting districts 301, 310, and 314) averaged 573 bulls and 315 antlerless elk during the general season (Table 3-4). Late season hunts occurred in hunting district 310 and averaged 42 bulls and 176 antlerless elk between 1980 and 1990 (MDFWP unpubl. data).

For the Madison EMU, general and late season elk harvests were combined in the yearly statistics for hunting districts 360 and 362. No late season harvests occurred in hunting district 361. Hunters harvested an average of 291 bulls and 347 antlerless elk (excluding 1982 data, Table 3-4).

During the general season from 1980 to 1990, an average of 321 bulls and 144 antlerless elk were harvested from the northern elk herd in hunting districts 313 and 316 (Table 3-4). For the Gardiner late hunt, an average of 177 bulls and 815 antlerless elk were harvested (Table 3-4).

Table 3-4. Elk harvests during the general and late season for areas north and northwest of Yellowstone National Park, 1980-1990[a].

	Gallatin EMU[b]		Madison EMU[c]		Northern range herd[d]			
					General season		Late hunt	
Year	Antlered[e]	Antlerless	Antlered	Antlerless	Antlered	Antlerless	Antlered	Antlerless
1980	553	224	276	74	200	43	75	58
1981	455	218	328	95	281	63	491	522
1982	698	78			404	43	462	213
1983	638	132	291	202	338	66	396	1,211
1984	550	200	270	301	281	79	173	1,033
1985	524	400	215	345	352	104	126	933
1986	565	587	214	417	494	400	71	772
1987	390	280	274	364	224	135	11	204
1988	788	433	448	671	376	111	48	2,304
1989	603	339	326	366	341	474	39	384
1990	543	573	272	634	240	61	50	634
Mean[f]	573	315	291	347	321	144	177	815

[a] From Montana Dept. of Fish, Wildlife and Parks, unpubl. data; and Mack and Singer 1992a.
[b] Gallatin EMU includes hunting districts 301, 310, and 314.
[c] Madison EMU includes hunting districts 360, 361, and 362.
[d] Northern range herd includes hunting districts 313 and 316.
[e] Antlered are antlered males, antlerless are females and young (calves).
[f] Mean for the Madison EMU excludes 1982 harvest because harvest data were absent for hunting district 362 in 1982.

Deer

Distribution.--In Montana, mule deer are the primary deer species found in habitats adjacent to Yellowstone. Few whitetails summer in Yellowstone and they rarely winter in the park. White-tail numbers increase with increasing distance from the park boundary and become more numerous along major riparian and river drainages north and northwest of Yellowstone National Park. The primary analysis areas are found north and northwest of Yellowstone National Park (Figure 3-2) and include Montana hunting districts 301, 310, 313, 314, 316, 360, 361, and 362. The specific seasonal habitat ranges of deer are not well known for most of Montana's hunting districts. Foothills and lowland valleys are primarily winter range. Deer likely migrate into higher elevation mountainous terrain as spring and summer progress. It is likely, although not well documented (except for northern range mule deer), that some deer wintering in many of the hunting districts near Yellowstone probably migrate and summer in the high elevation mountains in Yellowstone National Park.

Deer winter ranges in hunting district 301 are generally along the Gallatin River and foothills in the northern portion of the hunting district (Figure 3-5). Very few deer winter in hunting district 310 with deer winter range primarily near U.S. Highway 191 (Figure 3-5). In hunting district 360, mule deer winter on the edge of mountain slopes in the Madison valley. Whitetails primarily winter along the Madison River and a mixture of both species can be found between the river and mountain foothills (Figure 3-5). Winter range distribution of deer in hunting district 362 is similar to that of hunting district 360 with mule deer wintering along the mountain foothills and whitetails wintering along the Madison River (Figure 3-5). Hunting district 361 provides very little winter range for mule deer (about 25, MDFWP unpubl. data) and few whitetails winter in the Hebgen Basin area. This area is described as good summer range (MDFWP unpubl. data).

Hunting districts 313 and 316 contain mostly mule deer and they winter on Yellowstone's northern winter range outside Yellowstone National Park in hunting district 313 (Figure 3-5). It is unknown if winter range exists in hunting district 316 (MDFWP unpubl. data). Summer and fall ranges include mountains in both hunting districts, and mule deer do migrate and summer throughout the northern Yellowstone National Park area.

It is likely that some of the deer summering in Yellowstone National Park winter in hunting district 314 (probably the southern portion of the district). Winter range is predominantly between the Yellowstone River to the east and mountain foothills to the west (Figure 3-5). Mule deer primarily inhabit this hunting district; some whitetails winter along the Yellowstone River and lower creek bottoms.

Population Numbers.--The northern range mule deer population has been increasing and has a 1991-1992 count of 2,544 animals (T. Lemke, MDFWP, unpubl. data, Livingston, Montana). This herd was modeled at about 2,600 deer in 1990 (Mack and Singer 1992a).

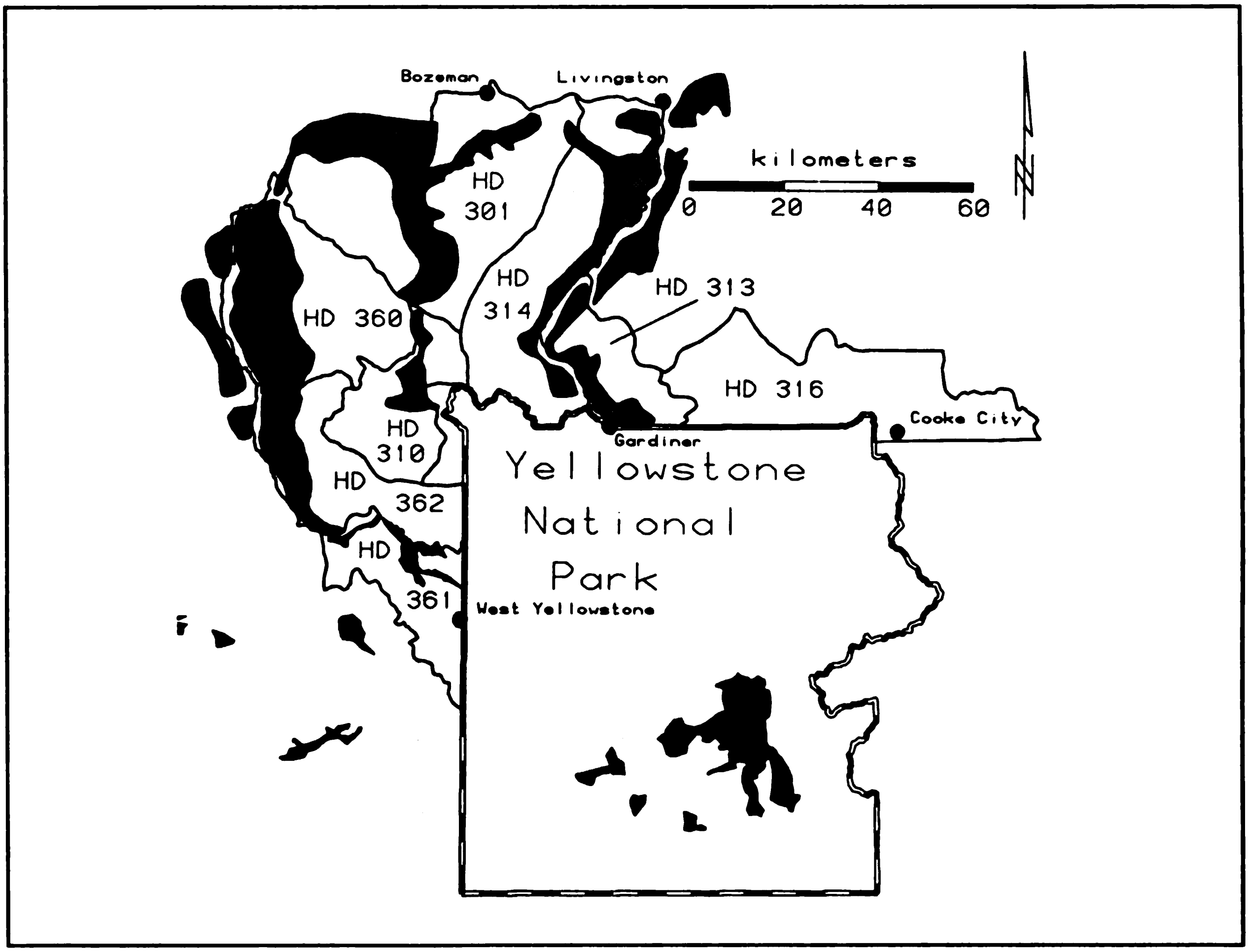

Figure 3-5. Winter ranges in Montana hunting districts 301, 310, 313, 314, 316, 360, 361, and 362. Shaded areas are winter range.

When using aircraft in mountainous terrain, only 54% to 66% of the mule deer in a population are counted (Mackie et al. 1980, Ackerman 1988), so as many as 4,700 mule deer may have been present in late winter 1991-1992. Complete trend counts have not been conducted for other districts in Montana, north or northwest of Yellowstone National Park (Mack et al. 1990, MDFWP unpubl. data).

Age/sex Composition.--Spring fawn/100 adult ratios for hunting district 314 averaged 46 fawns/100 adults from 1979-1980 to 1988-1989 (Mack et al. 1990). Buck/doe ratios have been low for this hunting district. In the mid-1980s, 3 surveys ranged from 14 bucks/100 does in 1983 to 4 bucks/100 does in 1985 (Mack et al. 1990).

Spring fawn/adult ratios for hunting district 313 averaged 41 fawns/100 adults from 1981-1982 to 1990-1991 (Mack and Singer 1992a, MDFWP unpubl. data). Bucks/100 does data were collected for only 7 years between 1979-1980 and 1990-1991 and averaged 11 bucks/100 does (Mack and Singer 1992a, MDFWP unpubl. data). These data also apply to hunting district 316 because deer from this area are considered a part of the population that winters in hunting district 313 (T. Lemke, MDFWP Biologist, pers. commun.).

From 1979-1980 to 1983-1984, the late winter fawn/adult ratio averaged 74 fawns/100 adults in hunting district 360 (MDFWP unpubl. data). Comparisons with other areas are not warranted because the sample size is small and the population status of this herd could have changed considerably since the early 1980s.

Harvests.--Hunters harvest between 46 and 906 deer per year for 7 hunting districts north and northwest of Yellowstone National Park (Table 3-5). Males comprise most (63%-97%) of the deer harvest in all hunting districts. Mule deer are the primary species harvested, averaging from 69% to 93% of the harvest (Table 3-5). For hunting districts found closest to Yellowstone National Park, mule deer comprise more than 86% of the harvest.

Table 3-5. Deer harvest statistics for Montana hunting districts north and northwest of Yellowstone National Park (1980-1988)[a].

Hunting district	Mean annual harvest[c]	Mean annual percent of harvest[b]		Mean annual percent of mule deer in harvest[d]
		Antlered	Antlerless	
301	397	83	17	69 (60-78)[e]
310	89	96	4	86 (80-94)
313, 316	554	76	24	91
314	906	74	26	88 (89-100)
360	468	69	31	77 (70-85)[e]
361	46	97	3	90 (81-100)
362[f]	104	63	37	93 (89-100)

[a] From Montana Dept. Fish, Wildl., and Parks, unpubl. data, Mack and Singer 1992a, and Mack et al. 1990.
[b] Animals of unknown sex were not included in these numbers.
[c] Harvest statistics are for mule deer and whitetail deer. Data from 1980-1988.
[d] Range is in parenthesis.
[e] Data from 1985 to 1991.
[f] New hunting district created in 1982 so data are from 1982 to 1988.

Moose

Distribution.--Several Montana moose hunting districts border northern Yellowstone National Park (Figure 3-6). As with elk and mule deer, we grouped hunting districts according to moose populations and major drainages or geographic areas. Montana's northern range moose herd occupies hunting districts 316, 317, 318, 322, and 328 (Mack and Singer 1992a). The Gallatin River area includes hunting districts 306, 307, and 310. The Madison River drainage minimally includes hunting districts 309 and 361 (Figure 3-6). Hunting district 314 borders Yellowstone National Park and is identified as the Gallatin/northern range area.

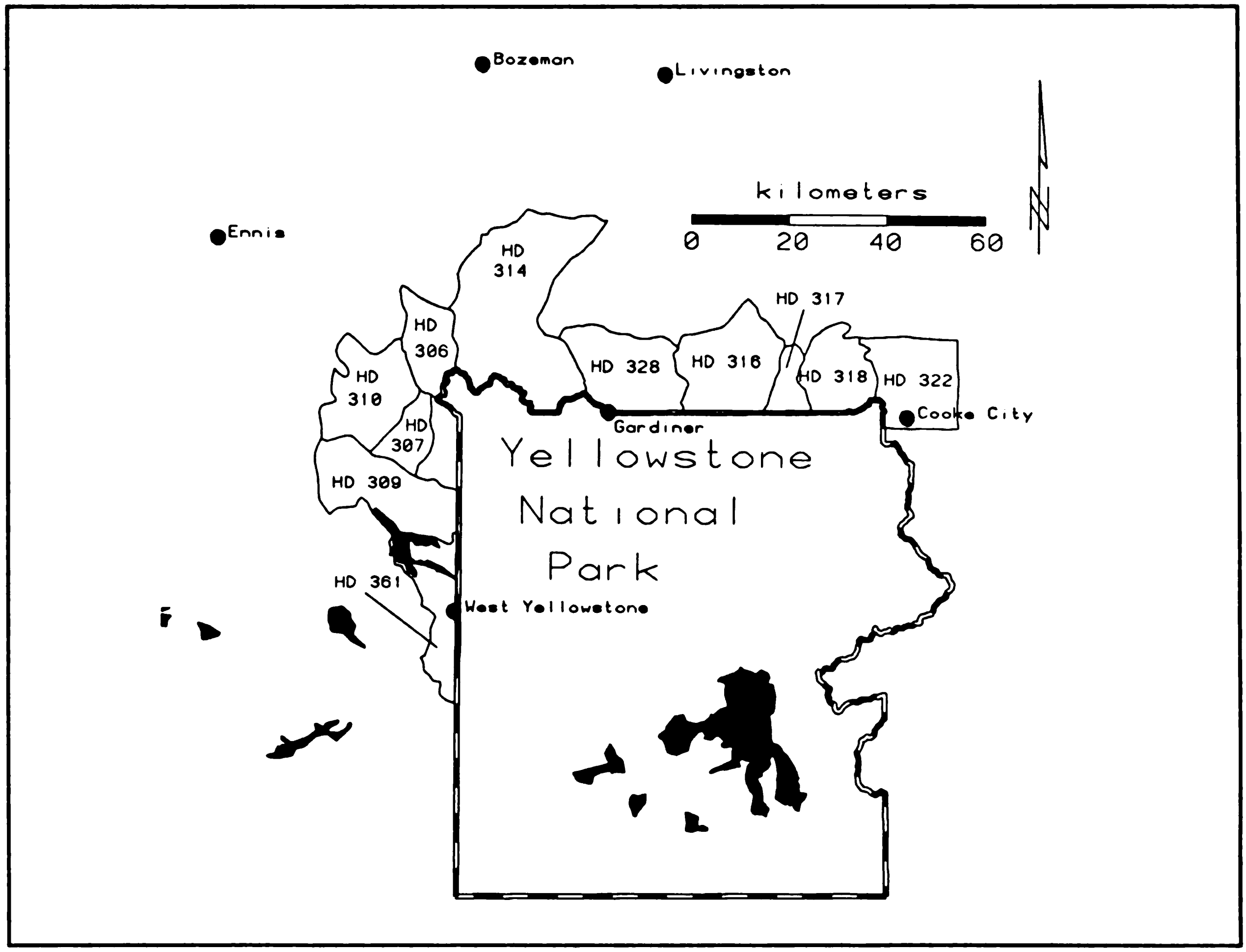

Figure 3-6. Montana hunting districts associated with moose populations living in or near Yellowstone National Park.

Moose associated with the northern range herd primarily winter in drainages associated with the hunting districts such as Pine-Bear Creek, Slough Creek, Soda Butte, Buffalo Creek, and Hellroaring Creek. Moose in the Gallatin River area winter along the Gallatin River and Taylor Fork, Sage, Porcupine, and Buffalo Horn Creeks (MDFWP unpubl. data). For the Madison area, moose winter throughout the Hebgen Lake valley and Madison River area.

Population Numbers.--From a POP-II population model, Mack and Singer (1992a) estimated the northern range moose population to be about 430 animals. Aerial trend count data are not collected for Montana moose herds bordering Yellowstone National Park (Mack et al. 1990). Surveying moose in timbered habitats can be difficult (Houston 1982) and can greatly underestimate population numbers (Mack and Singer 1992a), so surveys are probably not accurate for this part of Montana.

Age/sex Composition.--Age/sex composition data are not collected for moose in Montana moose but a index of moose population parameters can be obtained from Montana moose hunter survey reports. In these reports, unduplicated moose sightings are used to determine bull/cow and calf/cow ratios. For the northern range, hunter survey reports averaged 64 bulls/100 cows and 27 calves/100 cows (Mack and Singer 1992a). Swenson (1982) indicated hunter classifications may underestimate calf/cow ratios, so the data presented probably represent minimum productivity.

Harvests.--For the northern range moose population, hunter harvest averaged 21 bulls/year, 8 cows/year and 2 calves/year between 1980 and 1989. Total harvest averaged 31 moose/year. Bulls averaged 68% of the total harvest, cows 25% and calves 7% (Table 3-6). From 1980-1989, average harvest for the Gallatin population was 31 moose/year. Between 1980 and 1989, bulls averaged 76% of the harvest, cows averaged 17%, and calves averaged 6% (Table 3-6). From 1980-1989, moose harvests for the Madison area averaged 36 moose/year. Bulls averaged 80% of the harvest, cows 13% and calves 7% (Table 3-6). Moose harvests averaged 8 moose/year for the Gallatin/Northern Range area. Bulls averaged 89% of the harvest, cows 6%, and calves 5% (Table 3-6).

Wyoming Ungulate Populations

Elk

Distribution.--In Wyoming east of Yellowstone National Park, the analysis area includes hunting areas associated with the Clarks Fork, North Fork Shoshone, and Carter Mountain herds. This area includes hunting areas 50-61 and 121 (Figure 3-7).

All elk from these herds migrate to winter ranges outside the park and as many as 80% migrate into the park during summer (Rudd 1982, Rudd et al. 1983, Mack et al. 1990). The Clarks Fork herd winters along the Clarks Fork River drainage about 25 miles (40 km) northwest of Cody, Wyoming (Figure 3-8). The North Fork Shoshone herd winters along much of the North Fork Shoshone River drainage 12-37 miles (20-60 km) west of Cody, Wyoming. As the name implies, the Carter Mountain herd winters in the Carter Mountain area and along the South Fork Shoshone River 12-37 miles (20-60 km) southwest of Cody, Wyoming (Figure 3-8).

South of Yellowstone National Park, the analysis area includes hunt areas 70-83 (Figure 3-7) which are associated with the relatively small Targhee herd and the larger Jackson herd.

Table 3-6. Moose harvest from 1980 to 1989 for the Northern Range herd (hunting districts 316, 317, 318, 322, and 328), the Gallatin herd (hunting districts 306, 307, and 310), the Madison herd (hunting districts 309 and 361), and the Gallatin/Northern Range (hunting district 314)[a].

	Mean annual harvest				Mean annual percent of harvest		
Herd	Bulls	Cows	Calves	Total	Bulls	Cows	Calves
Northern Range[b]	21	8	2	31	68	25	7
Gallatin[c]	24	5	2	31	76	17	6
Madison	29	5	2	36	80	13	7
Gallatin/Northern Range	7	1	1	8	89	6	5

[a] Adapted from Mack et al. 1990 and Montana Dept. Fish, Wildl., and Parks, unpubl. data.
[b] Data for hunting district 328 was unavailable in 1980 and 1981.
[c] Data for hunting district 307 was unavailable from 1980 through 1983.

Elk from the Targhee herd primarily summer outside Yellowstone National Park and winter along the Idaho-Wyoming border south of Yellowstone National Park (Mack et al. 1990). About 40% of the Jackson herd summers in and near Yellowstone National Park. During fall these elk migrate south and winter on the National Elk Refuge near Jackson, Wyoming, and in the Gros Ventre River valley (Mack et al. 1990, Figure 3-8).

Population Numbers.--During the 1980s, elk populations have generally increased for all herds surrounding Yellowstone National Park. Populations east of Yellowstone totaled about 9,700 elk in 1988. South of the park the Jackson herd totaled about 16,000 animals in 1988, while the Targhee herd west of the park was nearly 500 animals (Table 3-7).

Age/sex Composition.--Age/sex composition data was collected from 1980-1988 for every elk herd except the Targhee herd (only 2 years). Calf/cow ratios averaged 40, 42, and 40 calves/100 cows for the Carter Mountain, Clarks Fork and North Fork Shoshone herds, respectively (Mack et al. 1990). The Jackson herd calf/cow ratios averaged 29 calves/100 cows on the National Elk Refuge and Gros Ventre winter ranges during the 1980s. Bull ratios for nearly all the Wyoming herds (except for a portion of the Jackson herd wintering on the National Elk Refuge) were in the low teens or single digits (Mack et al. 1990).

Harvests.--From 1980 to 1988, elk harvests east of Yellowstone National Park averaged 661, 509, and 586 for the Clarks Fork, North Fork Shoshone, and Carter Mountain herds, respectively (Table 3-8). The sex of the harvest averaged between 51% and 62% bulls and 38% and 49% antlerless for the 3 herds (Table 3-8).

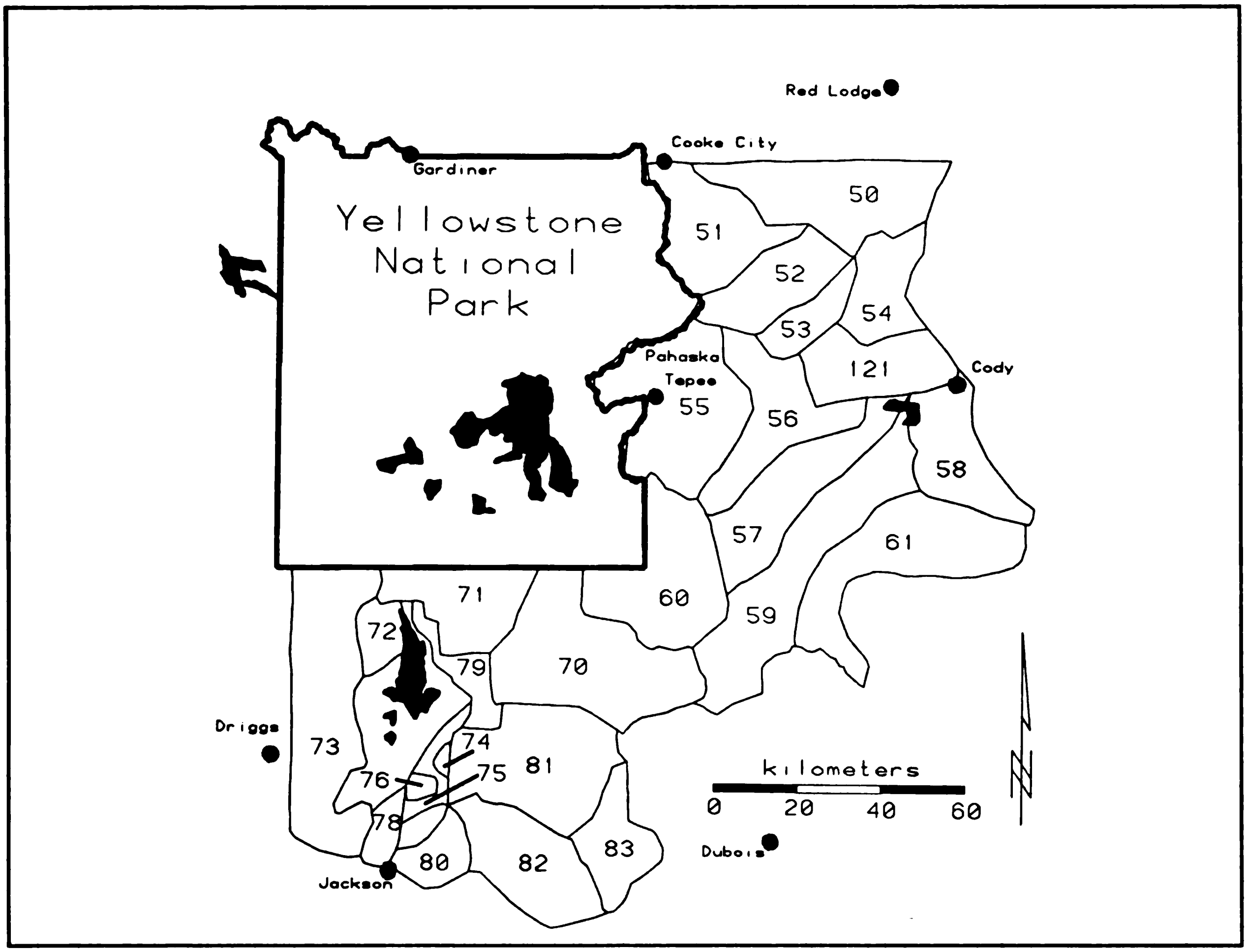

Figure 3-7. Wyoming elk hunting areas associated with elk populations living in or near Yellowstone National Park.

For the Jackson herd the annual harvest averaged 2,499 with an average of 58% being bulls and 42% antlerless. Harvests for the Targhee herd were nearly all bulls and averaged 55/year during the 1980s (Table 3-8).

Mule Deer

Distribution.--East of Yellowstone National Park, mule deer are managed in 3 herd units, The Clarks Fork, North Fork Shoshone, and South Fork Shoshone. The analysis area includes hunt areas 105-115 (Figure 3-9). Winter ranges for these herds are associated with the Clarks Fork, North Fork Shoshone, and South Fork Shoshone River drainages and overlap to a large extent with the elk winter ranges (Figure 3-10). Prior to 1989, radio-telemetry studies had not been conducted to determine if mule deer from any of these herds summered within Yellowstone National Park.

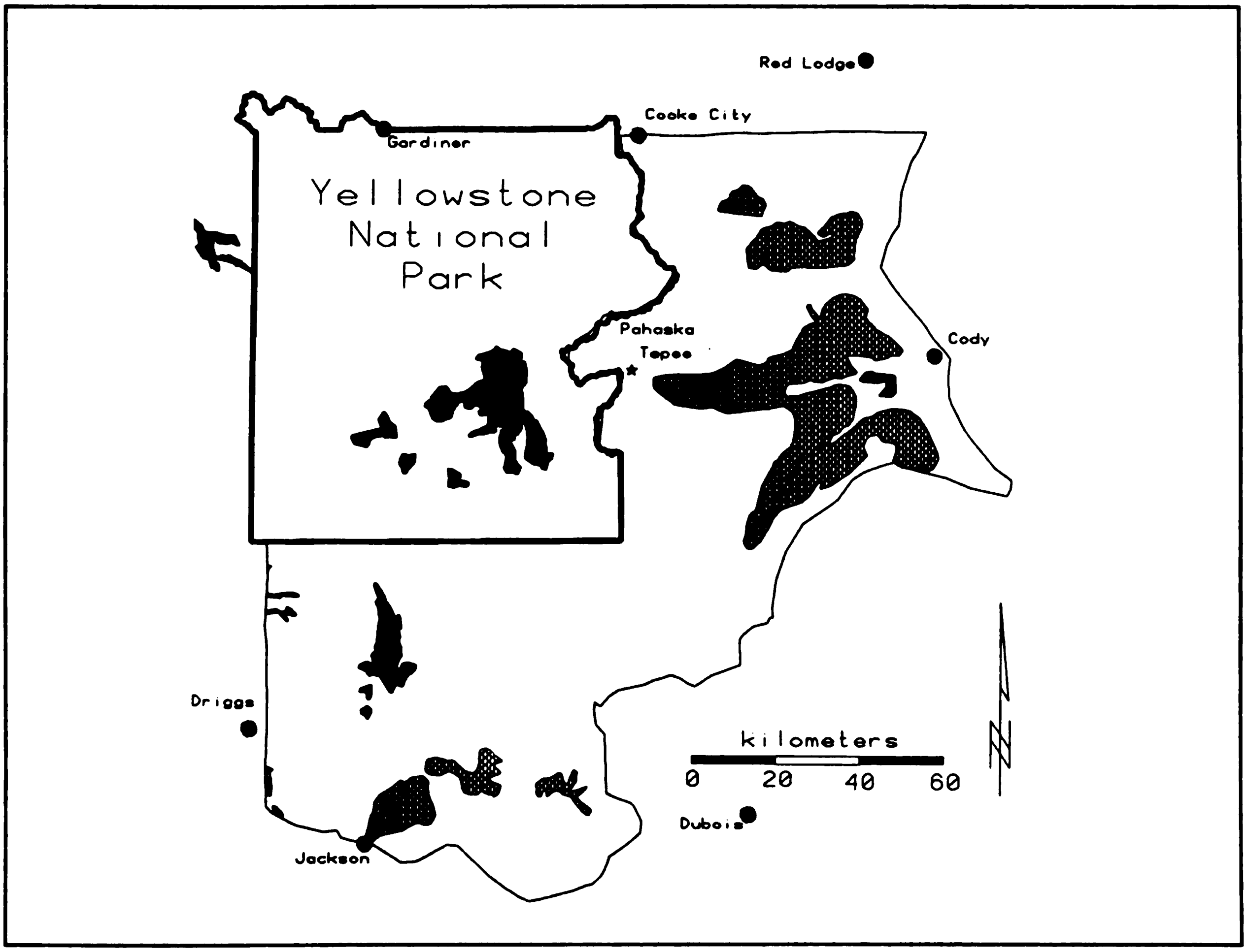

Figure 3-8. Winter ranges for several Wyoming elk populations living in or near Yellowstone National Park.

Two relatively small mule deer populations inhabit winter ranges south of Yellowstone National Park. The Jackson mule deer herd is associated with hunt unit 150 (Figure 3-9) and deer from this area likely migrate and summer in Yellowstone (Lockman et al. 1989) and winter just north of Jackson, Wyoming (Figure 3-10). Mule deer from the Targhee herd are found in hunt area 149 (Figure 3-9), but as many as 84% winter in Idaho or along the Wyoming-Idaho border (Figure 3-10). Some mule deer summer in the Teton Wilderness Area in hunt areas 148, 155, and 156 (Figure 3-9) but they winter with very large deer herds (Sublette and Dubois) south and southeast of Yellowstone National Park and outside the analysis area.

Population Numbers.--Through the 1980s, mule deer populations east of Yellowstone National park have been stable or increasing (Table 3-9). Total deer numbers east of Yellowstone were about 14,000 in 1988. Mule deer populations wintering south of

Table 3-7. POP-II winter population estimates for 5 Wyoming elk herds adjacent to Yellowstone National Park[a].

	Population estimate				
Year	Clarks Fork	North Fork Shoshone	Carter Mountain[b]	Jackson	Targhee
1980-1981	2,500				170
1981-1982	2,600	1,800	2,000	15,533	170
1982-1983	2,600	1,700	2,225	13,980	200
1983-1984	2,550	1,700	2,400	13,293	215
1984-1985	3,000	2,400	2,400	13,504	205
1985-1986	3,000	2,400	2,050	14,431	215
1986-1987[c]	2,900	2,000	2,100	15,478	205
1987-1988	3,334	3,131	3,047	16,509	440
1988-1989	3,666	2,945	3,101	16,093	490

[a] Adapted from Mack et al. 1990.
[b] In 1981, the Carter Mountain herd was newly created and included hunt areas 58, 59, and 60S (known in 1980 as the South Fork Shoshone elk herd) and 61.
[c] Winter population estimates were not tabulated in 1986 so the values listed were estimated from graphs.

Yellowstone near Jackson, Wyoming, also generally increased (Table 3-9). Total deer numbers south of Yellowstone National Park were estimated at about 1,700 in winter 1988 (Table 3-9).

Age/sex Compositions.--From 1980 to 1988, fawns/100 does ratios averaged 66, 70, and 59 for the Clarks Fork, North Fork Shoshone, and South Fork Shoshone deer herds, respectively (Mack et al. 1990). Buck/doe ratios after the hunting season averaged between 17 and 18 bucks/100 does for mule deer herds east of Yellowstone (Mack et al. 1990). Fawn/doe and buck/doe ratios for the Jackson herd south of the park were generally higher than east of the park and averaged 82 fawns/100 does and 39 bucks/100 does (Mack et al. 1990). Higher buck/doe ratios may be reflective of low harvest, limited hunter access, and more restrictive hunting seasons for the Jackson herd (Mack et al. 1990). Age/sex composition data were collected only 2 years for the Targhee mule deer herd. Averages were not warranted because of the small sample size.

Harvests.--Annual hunter harvest averaged 564, 242, and 792 mule deer for the Clarks Fork, North Fork Shoshone, and South Fork Shoshone herds, respectively (Table 3-10). For these 3 herds, bucks dominated the harvest and averaged between 78% and 82% of the total harvest (Table 3-10).

Table 3-8. Average annual harvest (between 1980 and 1988) and average annual composition of the elk harvest in Wyoming for elk herds east and south of Yellowstone National Park[a].

Herd	Hunt areas	Average harvest			Average percent of total[b]	
		Antlered[c]	Antlerless[d]	Total[e]	Antlered	Antlerless
Clarks Fork	50-54, 121	329	332	661	51	49
North Fork Shoshone[f]	55-57, 60N	317	192	509	62	38
Carter Mountain[g]	58-60S, 61	302	284	586	54	46
Jackson	70-72, 74-83	1,332	1,166	2,499	58	42
Targhee	73	46	8	55	84	15

[a] Adapted from Mack et al. 1990.
[b] Average percent of total data are calculated from yearly data and may not exactly equate with average harvest data because of rounding.
[c] Includes yearling and adult males.
[d] Includes adult females and young.
[e] Average total harvest may not equal sum of average antlered and antlerless harvest due to rounding.
[f] In 1981 hunt area 57 was added to the North Fork Shoshone herd, therefore, harvest data from 1980 are not comparable to later years and are not included in the averages.
[g] In 1981, the Carter Mountain herd was newly created and included hunt areas 58, 59, and 60S (known in 1980 as the South Fork Shoshone herd) and 61. Data are from 1981 to 1988.

Hunter harvests from the Jackson herd (hunt area 150) averaged 31 deer/year (Table 3-10). Since 1982, harvests have ranged from 7 to 15 deer/year (Mack et al. 1990). The low harvests in the late 1980s were likely a result of limited hunting access, restrictive hunting seasons, and reduced rifle hunting opportunities (Moody et al. 1988, Lockman et al. 1989). Bucks dominated the harvest (68%, Table 3-10), and in the late 1980s, they accounted for 100% of the total (Mack et al. 1990).

Harvests for the Targhee herd averaged 73 deer/year from 1980 to 1988 (Table 3-10). From 1980 to 1988, bucks averaged 84% of the harvest (Table 3-10).

Moose

Distribution.--Moose east of Yellowstone National Park are managed in 5 herds (Crandall, Sunlight Basin, North Fork Shoshone, South Fork Shoshone, and Thorofare), and are found in hunt areas 8, 11-13, and 31 (Figure 3-11). Winter ranges are better defined for the Crandall and Thorofare herds than for the other 3 herds (Figure 3-12). Moose migration to and from Yellowstone is speculative for the Sunlight, North Fork Shoshone, and South

Table 3-9. Winter population estimates for Wyoming mule deer herds east and south of Yellowstone National Park, 1980-1988[a].

	Herd unit population estimate				
Year	Clarks Fork	North Fork Shoshone	South Fork Shoshone	Jackson[b]	Targhee
1980	3,000	950	4,125		550
1981	1,900	1,200	3,600	200	500
1982	5,000	2,675	6,150	230	550
1983	3,000	1,200	3,600	270	485
1984	4,000	1,400	4,800	275	510
1985	3,200	1,500	3,800	300	675
1986[c]	3,900	1,600	4,300	325	770
1987	4,000	2,500	4,312	340	880
1988[d]	6,699	2,500	4,800	700	1,000

[a] Based on POP-II computer models generating post-hunting season population estimates. Adapted from Mack et al. 1990.
[b] From 1981 to 1984, the Jackson herd unit trend counts included hunting areas 148, 150, 155, and 156. The boundaries for this herd unit were changed in 1985 and only mule deer herd statistics from hunting area 150 were considered and recalculated back to 1981.
[c] Values for Clarks Fork, North Fork Shoshone, and South Fork Shoshone were estimated from a graph.
[d] Values for Jackson and Targhee herds were from hand calculations using the classification data to estimate the population.

Fork Shoshone herds because radiotelemetry studies have not been conducted on these moose herds.

South of Yellowstone, moose are managed in the Jackson and Targhee herds and are found in hunt areas 7, 14, 15, 17-20N, 28, and 32 for the Jackson herd and 16 and 37 for the Targhee herd (Figure 3-11). Winter ranges for the Jackson herd are found north and east of Jackson, Wyoming, (Figure 3-12) with critical winter ranges being restricted to drainages and the associated riparian habitat (i.e., willow flats along the Buffalo River area).

Few moose from the Targhee herd winter in Wyoming. Most winter in drainages in Idaho within 10 miles (16 km) west of the Wyoming-Idaho border. In summer, these moose move northeast and 39% summer in Yellowstone (Mack et al. 1990).

Population Numbers.--Of the 5 moose herds east of Yellowstone National Park, the Thorofare herd is probably located in the best moose habitat and likely has more moose

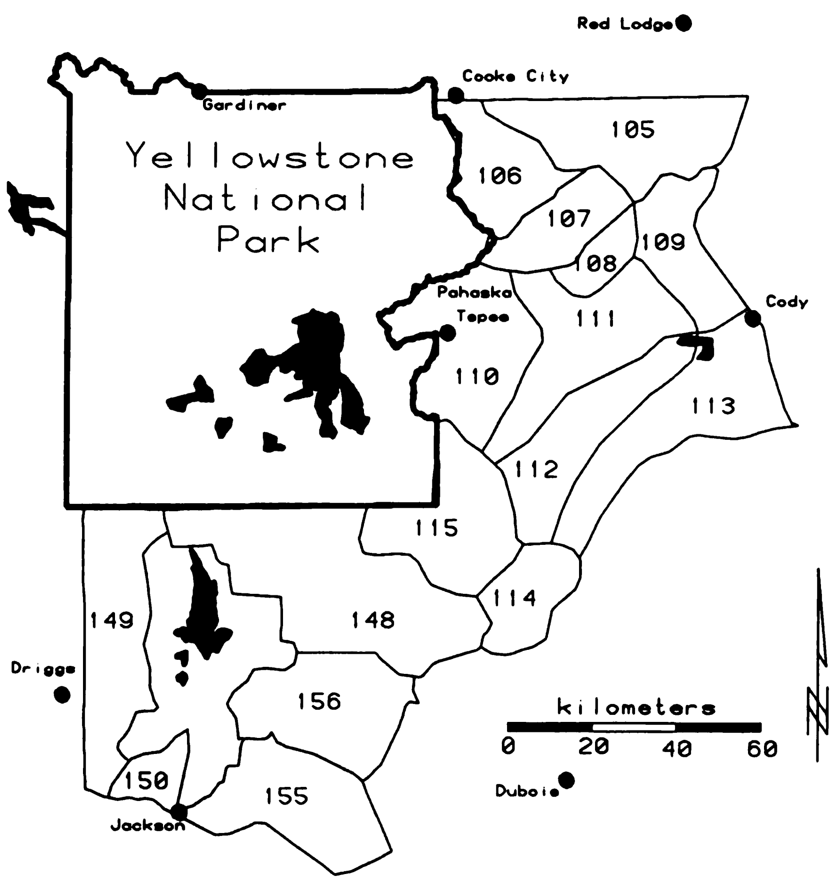

Figure 3-9. Wyoming mule deer hunting areas associated with mule deer populations living on or near Yellowstone National Park.

than the Crandall, Sunlight, North Fork Shoshone, and South Fork Shoshone herds combined (Mack et al. 1990). Some rough approximations have been offered for moose populations east of the park (Table 3-11), but population models have not been developed for any of the moose herds.

Population estimates were computed for the Jackson herd and it has generally increased from 1,800 in 1982 to about 2,300 in 1988 (Mack et al. 1990). Population estimates for the Targhee herd have increased from 130 in 1981 to about 300 in 1989 (Mack et al. 1990).

Age/sex Composition.--Age/sex composition data was not collected for moose herds east of Yellowstone National Park between 1980 and 1988. Age/sex composition data for the Jackson herd averaged 47 bulls/100 cows and 48 calves/100 cows between 1980 and 1988 (Mack et al. 1990). For the Targhee moose herd, age/sex composition data from hunter

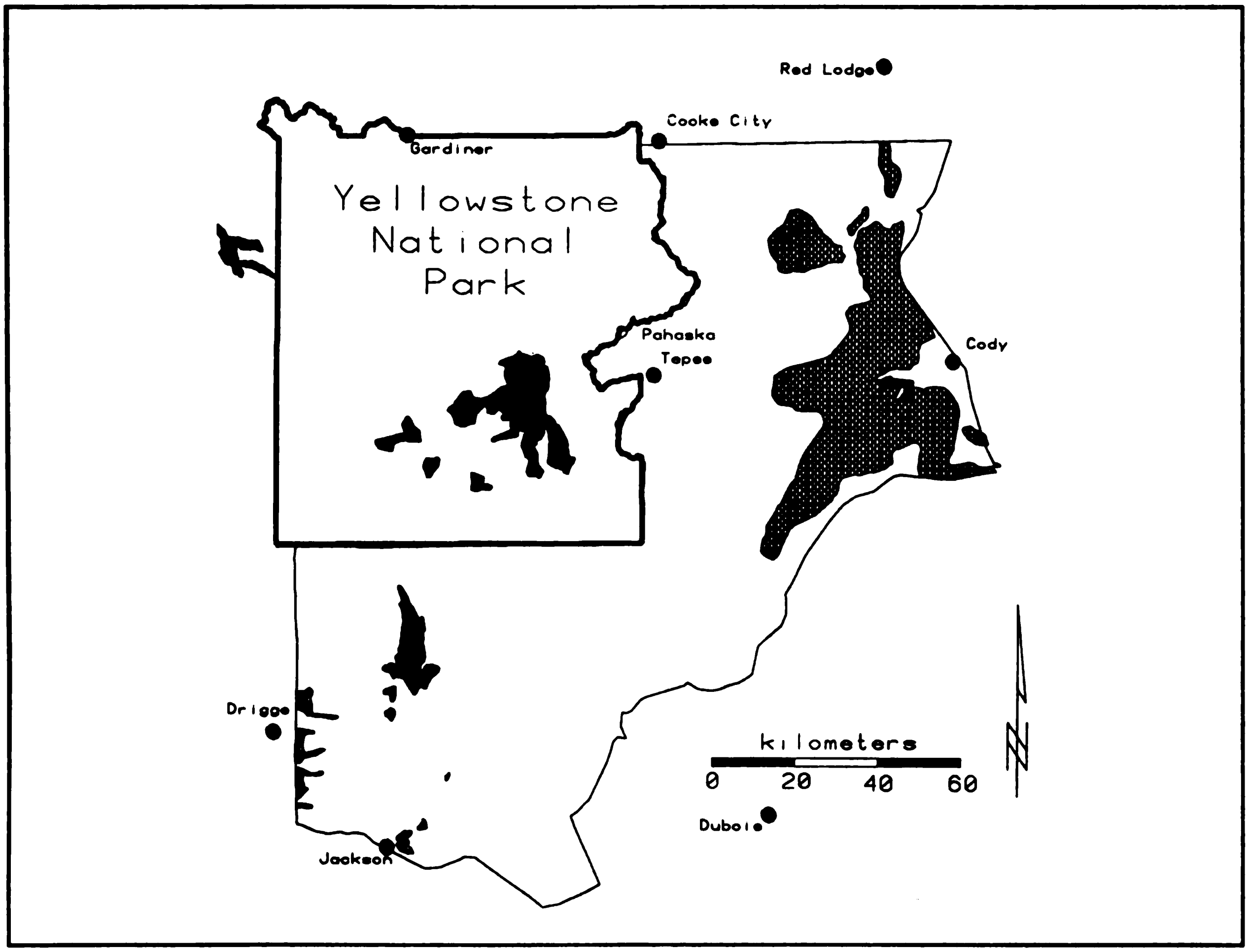

Figure 3-10. Winter ranges for Wyoming mule deer populations living in or near Yellowstone National Park.

surveys ranged from 39 bulls/100 cows to 69 bulls/100 cows between 1980 and 1985. During the same period, cow/calf ratios ranged from 34 to 59 calves/100 cows (Mack et al. 1990). Only 3 years of aircraft composition data were collected for this herd and ratios averaged 60 bulls/100 cows and 51 calves/100 cows (Mack et al. 1990).

Harvests.--Only bulls were harvested east of the park, with the exception of 1 calf that was harvested in 1980 in the Thorofare area. Moose harvests in the Thorofare area averaged 23 bulls/year which was 2-7 times higher than the average yearly harvest in other areas east of Yellowstone National Park (Table 3-12). Moose harvests south of the park averaged 323/year for the Jackson herd and 34/year for the Targhee herd (Table 3-12).

Table 3-10. Average annual harvest and average annual sex composition of the harvest between 1980 and 1988 for mule deer herds east and south of Yellowstone National Park[a].

	Average harvest			Average percent of total[b]	
Herd	Antlered[c]	Antlerless[d]	Total[e]	Antlered	Antlerless
Clarks Fork	450	114	564	78	22
North Fork Shoshone	205	37	242	82	18
South Fork Shoshone	621	172	792	78	22
Jackson	21	10	31	68	32
Targhee	58	15	73	84	16

[a] Adapted from Mack et al. 1990.
[b] Average percent of total data are calculated from yearly data and may not exactly equate with average harvest data because of rounding.
[c] Includes yearling and adult males.
[d] Includes young and females.
[e] Average total harvest may not equal sum of average antlered and antlerless harvest due to rounding.

Table 3-11. Moose population estimates in 1988 for the Crandall, Sunlight, North Fork Shoshone, South Fork Shoshone, and Thorofare herds in Wyoming east of Yellowstone National Park[a].

	Moose herd unit				
	Crandall	Sunlight	North Fork Shoshone	South Fork Shoshone	Thorofare
Population estimate	183	100	75	74	553

[a] Population models have not been developed for any of these herds and moose numbers are only rough approximations. Adapted from Hurley et al. 1989.

Bighorn Sheep

Distribution.--Four bighorn sheep herds live east of Yellowstone National Park and are associated with hunt areas 1-4 (Figure 3-13). The Clarks Fork (hunt area 1), Trout Peak (hunt area 2), and Younts Peak (hunt area 4) herds primarily live outside Yellowstone National Park (Hurley 1985, K. Hurley pers. commun., Wyoming Game and Fish, Dept., Thermopolis) but within potential wolf activity (Mack et al. 1990). The Wapiti Ridge herd (hunt area 3) has summer and winter ranges both inside and outside the southeastern corner of Yellowstone National Park (Hurley 1985, T. Fagan, pers. commun., Wyoming Game and Fish, Cody).

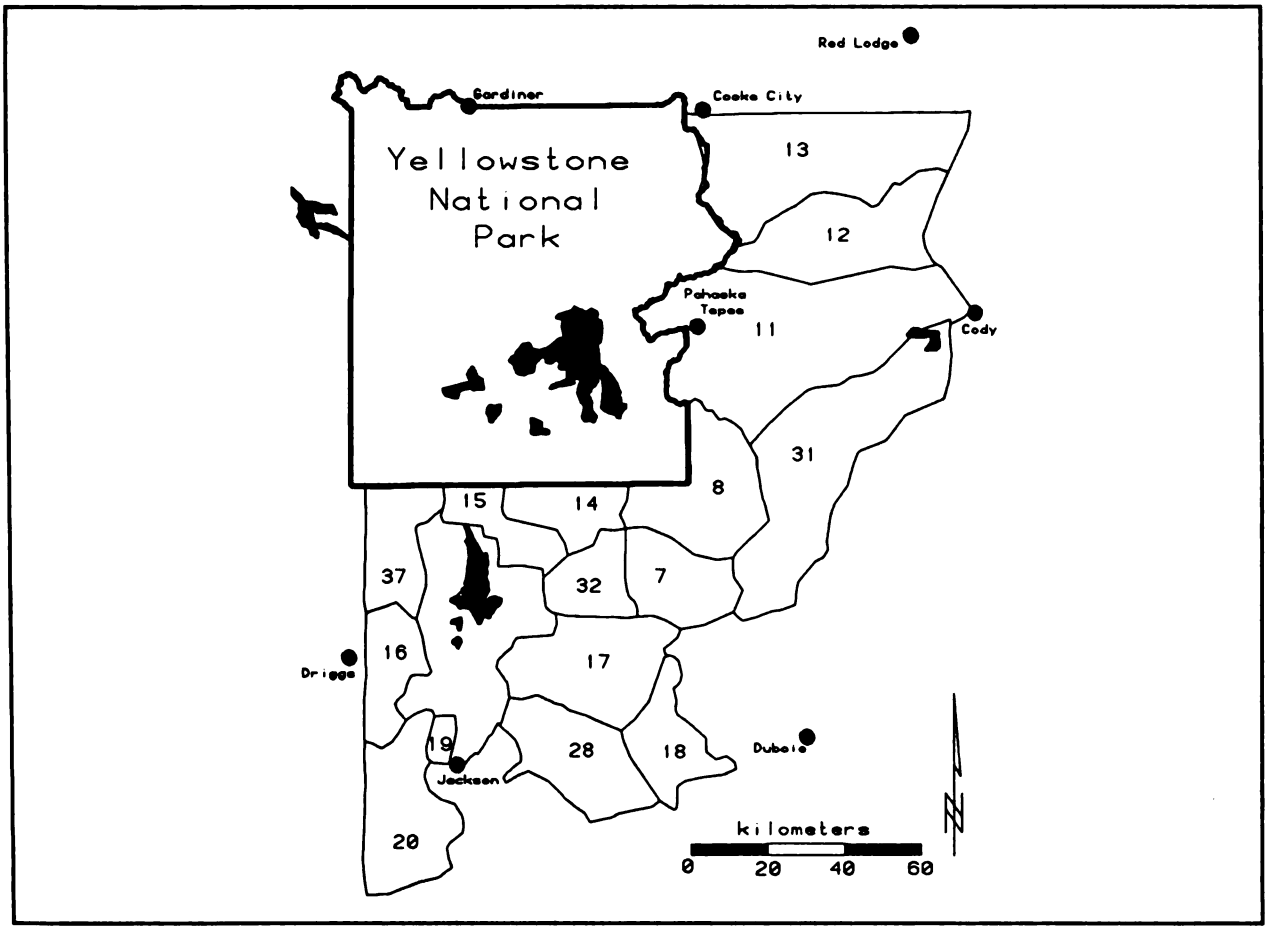

Figure 3-11. Wyoming moose hunt areas associated with moose populations living in or near Yellowstone National Park.

Population Numbers.--Bighorn sheep populations east of the park have increased slightly through the 1980s (Mack et al. 1990). Population estimates in 1988 were 500 for the Clarks Fork herd, 497 for the Trout Peak herd, 967 for the Wapiti Ridge herd, and 770 for the Younts Peak herd (Mack et al. 1990).

Age/sex Compositions.--Between 1981 and 1988, age/sex composition ratios annually averaged 41 lambs/100 ewes and 47 rams/100 ewes for the Wapiti Ridge herd and 39 lambs/100 ewes and 31 rams/100 ewes for the Younts Peak herd (Mack et al. 1990).

Only 6 years of data between 1981 and 1988 are available for the Clarks Fork and Trout Peak herds. Lamb/ewe ratios annually averaged 42 lambs/100 ewes for the Clarks Fork herd and 38 lambs/100 ewes for the Trout Peak herd. Ram/ewe ratios annually averaged 74 rams/100 ewes for the Clarks Fork herd and 51 rams/100 ewes for the Trout Peak herd (Mack et al. 1990).

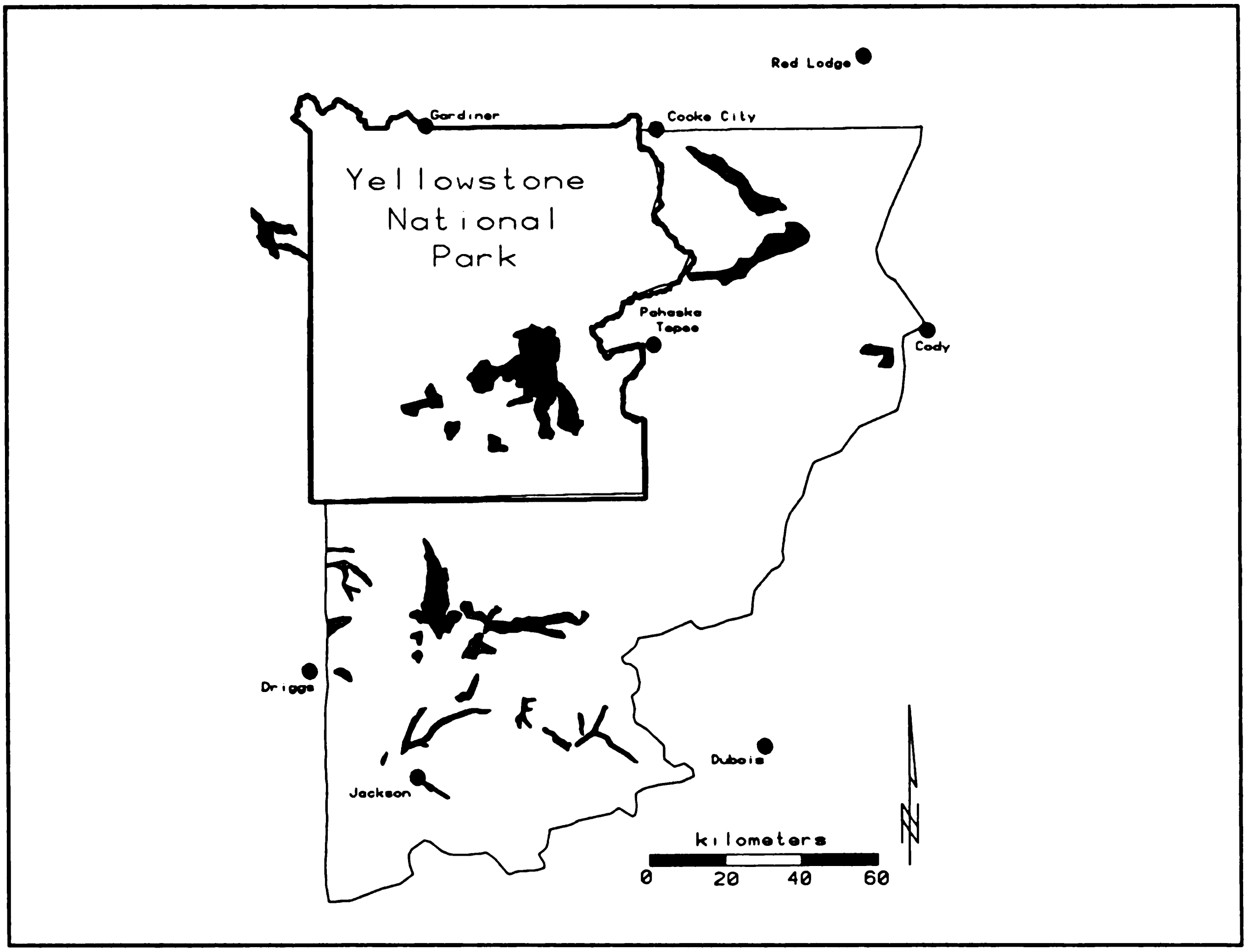

Figure 3-12. Winter ranges for Wyoming moose herds living in or near Yellowstone National Park.

Harvests.--All sheep harvested east of Yellowstone National Park were adult rams (males) having a 3/4 curl horn or larger. Except for the exceptionally low harvest of 3 rams from the Clarks Fork herd in 1988 (due to forest fires in that area), hunter harvests of bighorn sheep have been relatively stable to slightly increasing for all 4 herds east of Yellowstone during the 1980s (Mack et al. 1990). Average harvests from 1980 to 1988 were 13 rams/year (Clarks Fork herd), 19 rams/year (Trout Peak), 28 rams/year (Wapiti Ridge), and 31 rams/year (Younts Peak, Mack et al. 1990).

Eastern Idaho Ungulate Populations

Elk

Distribution.--In eastern Idaho, the Sand Creek elk herd is associated with 5 hunt units (60, 60A, 61, 62, and 62A) located west and southwest of Yellowstone National Park (Figure 3-14). About 76% of the herd summers east of Highway 20 near or in Yellowstone (Brown

Table 3-12. Average annual moose harvest from 1980 to 1988 for Wyoming moose herds east and south of Yellowstone National Park[a].

	Average harvest[b]			
Herd	Bulls	Cows	Calves	Total
Crandall	9	0	0	9
Sunlight	5	0	0	5
North Fork Shoshone	3	0	0	3
South Fork Shoshone	3	0	0	3
Thorofare	23[c]	0	0	23
Jackson	243	68	10	323[d]
Targhee	28	5	1	34

[a] Adapted from Mack et al. 1990.
[b] Bulls are yearling and adult males, cows are yearling and adult females and calves are young.
[c] Includes 1 calf harvested in 1980.
[d] Includes average harvest of 1 unclassified moose/year.

1985, Vales 1989). During fall, most elk migrate southwest to the Sand Creek winter range located northwest of Rexburg and southeast of Dubois, Idaho, between Highway 20 and Interstate 90 (Brown 1985, see also Figure 3-20).

Population Numbers.--Population trend counts for the Sand Creek elk herd have ranged from 1,803 to 2,959 between 1980 and 1988 (Mack et al. 1990). Brown (1985) estimated the elk population was 4,900 in 1982-1983 while Vales (1989) calculated that the actual herd size must be 4,200 in spring (postharvest) to support observed hunter harvests. The difference between the trend counts and population estimates might be due to some elk living near southwestern Yellowstone during summer but not wintering on the Sand Creek winter range and not being counted in the trend counts (J. Naderman, Idaho Dept. of Fish and Game, pers. commun. in Mack et al. 1990).

Age/sex composition.--Age/sex composition data for the Sand Creek herd was collected between 1980-1981 and 1987-1988. Age/sex compositions averaged 53 calves/100 cows and 22 bulls/100 cows (Mack et al. 1990).

Harvests.--From 1980 to 1988, the general season elk harvests were all bulls and averaged 546/year (Mack et al. 1990). From 1980 to 1988, elk harvests during controlled hunts averaged 108 bulls/year and 355 cows/year (Mack et al. 1990). Bulls comprised an average of 65% and cows an average of 35% of the total harvest (J. A. Mack unpubl. data, Natl. Park Serv., Yellowstone National Park, Wyoming).

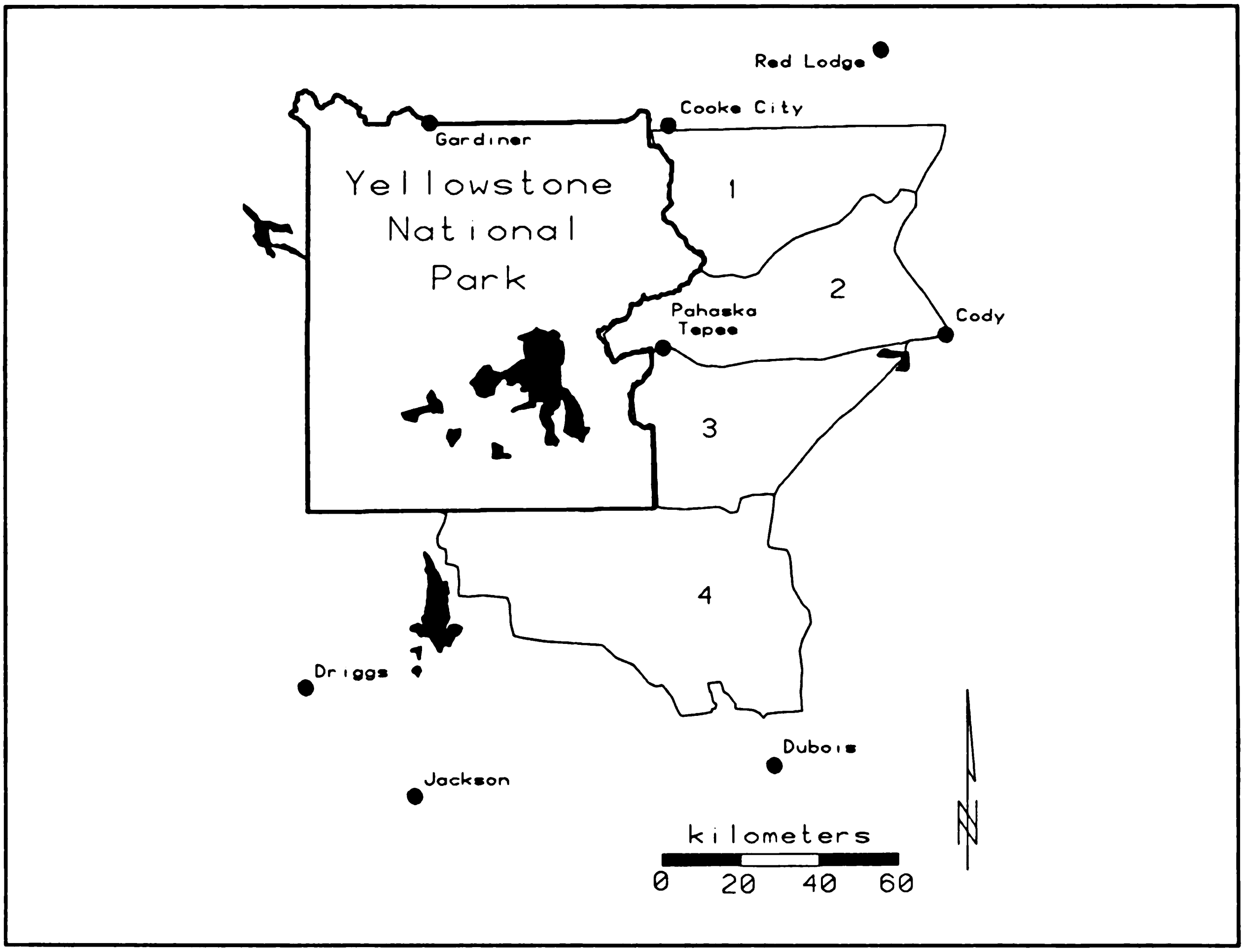

Figure 3-13. Wyoming bighorn sheep hunt areas associated with bighorn sheep populations east of Yellowstone National Park.

Mule Deer

Distribution.--Mule deer living in areas adjacent to the southwestern portion of Yellowstone National Park are found in hunt areas 60, 60A, 61, 62, and 62A, the same hunt units as for Idaho elk (Figure 3-14). Mule deer from this area summer in the Island Park area, portions of Wyoming near the Idaho border, and in southwestern Yellowstone National Park (Mack et al. 1990). These mule deer winter in the Junipers-Sand Creek winter range in hunt area 60A (Figure 3-14).

Population Numbers.--Mule deer trend counts were conducted 5 out of 9 years between 1980-1981 and 1988-1989 and averaged 1,599 (Mack et al. 1990). The population objective for this area is 1,200 (Mack et al. 1990). The trend for this herd, either increasing or decreasing, cannot be described because few counts were conducted during the 1980s.

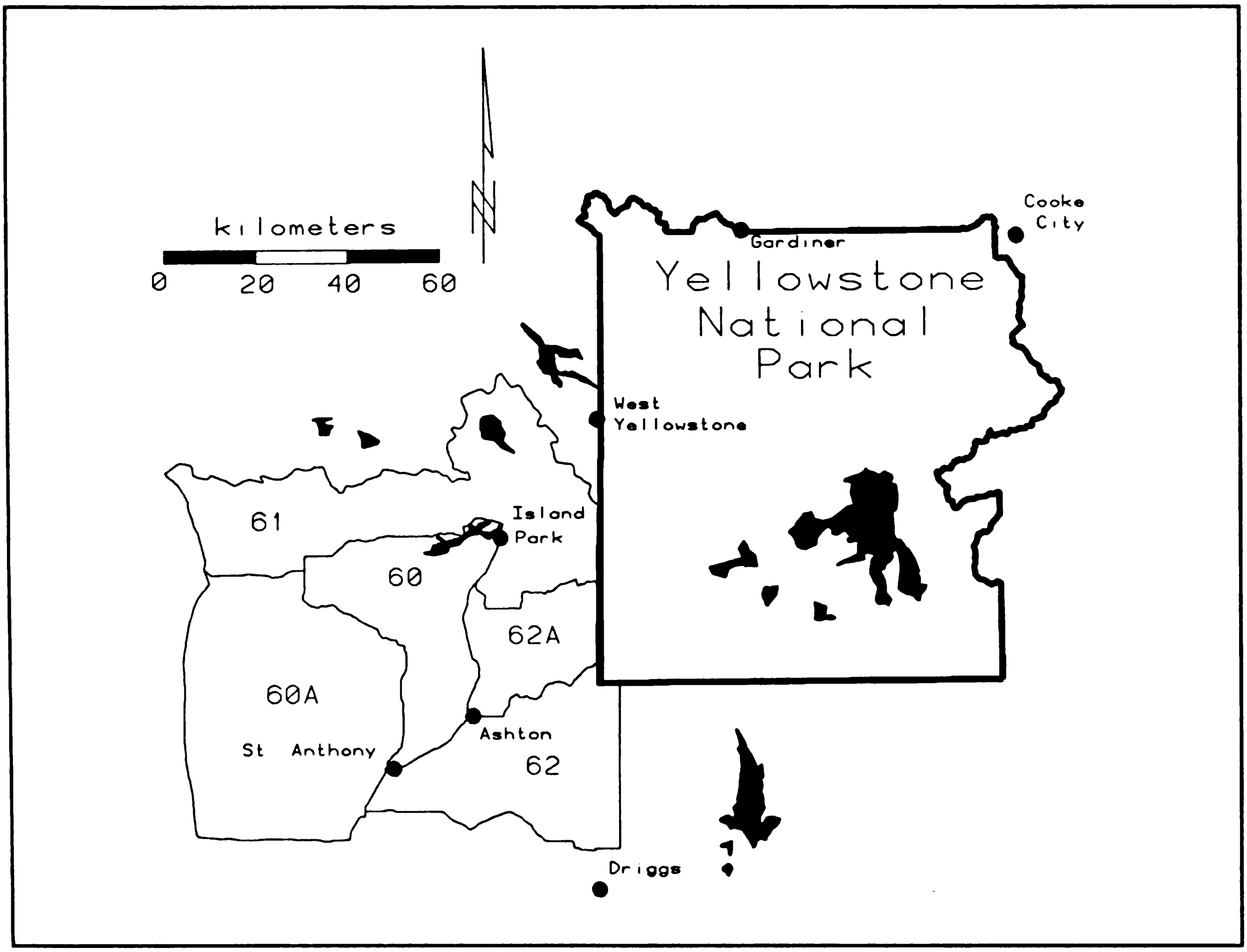

Figure 3-14. Idaho hunt units associated with elk, deer, and moose populations living in or near Yellowstone National Park.

Age/sex composition.--Fawn/doe ratios were relatively high for this herd and averaged 98 fawns/100 does during the 1980s (Mack et al. 1990). Buck/doe ratios generally decreased during the 1980s from a high of 65 bucks/100 does in 1980-1981 to 23 bucks/100 does in 1986-1987 and averaged 41 bucks/100 does (Mack et al. 1990).

Harvests.--Deer harvests averaged 1,021 deer/year. Bucks averaged 73% of the annual harvest and does averaged 27% (Mack et al. 1990). White-tailed deer are rarely harvested and averaged 4% of the total deer harvest from 1983 to 1988.

Moose
Distribution.--Near southwestern Yellowstone National Park, eastern Idaho moose use the same 5 hunt units as elk and mule deer (Figure 3-14), and winter on the Junipers, Big Bend, Fall River, Island Park, and Shotgun Valley ranges near and southwest of Ashton, Island

Park and the Henrys Lake areas (Ritchie 1978). A small number of moose also winter in the Bechler area in Yellowstone (Mack et al. 1990). In summer, moose from the Big Bend, Junipers, and Fall River winter ranges summer in Idaho near Yellowstone, in Yellowstone, and south of Yellowstone in Wyoming. Moose from the Island Park winter range remain in the Island Park area during summer an average of 8 miles (13 km) from the winter range (Ritchie 1978). Shotgun Valley moose primarily summer in the Centennial Mountains (Ritchie 1978).

Population Numbers.--Moose trend counts declined between the 1950s and 1970s. Trend counts increased in the 1980s to a high of 813 in 1988-1989 (Table 3-13).

Table 3-13. Moose trend counts in 3 wintering areas in eastern Idaho, southwest of Yellowstone National Park, 1951-1952 to 1988-1989[a].

	Wintering area			
Year	Junipers and Big Bend	Fall River Ridge	Island Park	Total
1951-1952	400	153	124	677
1952-1953	241	135	133	509
1955-1956	270	152	177	599
1957-1958	173	92	65	330
1962-1963	148	66	68	282
1968-1969	126	40	66	232
1972-1973	86	69	22	177
1975-1976	90	109	74	273
1980-1981	172	151	65	388
1981-1982	136	159	66	361
1982-1983	353	138	61	552
1988-1989	372	217	224	813

[a] Adapted from Mack et al. 1990.

Age/sex Composition.--Calf/cow ratios were collected for 6 years during the 1980s and averaged 69 calves/100 cows; bull/cow ratios averaged 103 bulls/100 cows (Mack et al. 1990). Twinning rates were not collected during the 1980s but during the 1970s, twinning rates averaged 12% (Ritchie 1978).

Harvests.--From 1980-1982, moose harvests were allowed only in hunt unit 61. During these years the moose harvest averaged 6 bulls/year (Mack et al. 1990). After 1983, all hunt units

(60, 60A, 61, 62, and 62A) had moose hunting. Harvests increased from 42 bulls in 1983 to 68 bulls in 1988 and averaged 58 bulls/year between that period (Mack et al. 1990).

Bison in the Yellowstone Area

Within the Yellowstone area, 2 separate, wild, free ranging bison populations exist. The largest population lives in Yellowstone National Park. Except for extreme winter weather conditions, these bison remain within Yellowstone National Park's boundaries year round. The Northern Range (Lamar), Pelican, and Mary Mountain subunits generally describe bison wintering areas in Yellowstone (Meagher 1973, M. M. Meagher pers. commun.). The Northern Range wintering area approximates most of the northern elk winter range (Houston 1982, M. M. Meagher pers. commun.). The Pelican wintering area is located in Pelican Valley in east-central Yellowstone and the Mary Mountain wintering area extends from Hayden Valley to the Madison-Firehole river area in the west-central portion of the park.

The Yellowstone bison population steadily increased during the 1980s and numbered about 3,400 in winter 1992-1993 (M. M. Meagher, Yellowstone National Park, Wyo., pers. commun.). Numbers of bison residing in the 3 wintering areas are highly variable both between years and within a winter because bison groups can move from one wintering area to another. Minimum bison numbers in the 3 wintering areas likely are 400-500 in the Northern Range, 300-400 in Pelican, and 1,200 to 2,000 in Mary Mountain (M. M. Meagher pers. commun.).

The extent of human caused mortality of bison in the Yellowstone National Park population is highly variable according to bison movements and resulting conflicts outside the park. Between the winters of 1984-1985 and 1991-1992 bison removals outside the park in Montana averaged 131 bison/year and ranged from 6 in 1986-1987 to 569 in 1988-1989 (M. M. Meagher unpubl. data). Currently, sporthunting of bison leaving Yellowstone is not allowed in Montana. If a landowner requests it, state game wardens and National Park Service rangers can kill bison that leave the park and move onto private land. A few bison (3) have also been killed for research purposes inside Yellowstone National Park (M. M. Meagher pers. commun.). Road-killed bison in Yellowstone averaged 7 bison/year between 1990 and 1992 (K. Gunther, unpubl. data, Natl. Park Serv., Yellowstone Natl. Park, Wyoming).

The second small bison population summers in Grand Teton National Park and winters on the National Elk Refuge feeding grounds near Jackson, Wyoming (Peterson et al. 1991). This population has increased from 9 in 1970 (Peterson et al. 1991) to about 170 in winter 1992-1993 (B. Smith, pers. commun., National Elk Refuge, Jackson, Wyoming). These bison are supplementally fed during winter on the National Elk Refuge. Government agency reductions and controlled public hunts occurred during 4 years between 1983-1984 and 1990-1991 and removals averaged 11 bison/year (R. Wallen, pers. commun., Grand Teton Natl.

Park, Wyoming). Future management plans for this herd are being developed under the NEPA process.

YELLOWSTONE: DOMESTIC LIVESTOCK

Land Ownership

The general area involves portions of 17 counties in east-central Idaho, southwestern Montana, and northwestern Wyoming. (Figure 3-15). Land ownership in these counties is mixed with about 60% federal, 4% state and other local government, 5% Native American, and 31% private ownership (Table 3-14). These counties include a total of approximately 36 million acres, (145,800 km^2) with national forests, Bureau of Land Management, and private land totalling almost 30 million acres (121,500 km^2).

Not all of the area in these 17 counties will be affected by the presence of wolves in the Yellowstone area, and the effects of wolf reintroduction will likely decrease the farther an area is from Yellowstone National Park. Consequently, a primary analysis area was identified (Figure 3-15, Table 3-15).

Table 3-14. Percent of lands in major categories in the 17 county area around Yellowstone National Park.

	Idaho	Montana	Wyoming	17 county average[a]
National forests	38	34	31	33
National parks	1	2	12	7
Wildlife refuges	1	0	T[b]	T[b]
BLM lands	8	9	27	19
Federal total	50	45	71	60
State total	7	5	4	4
Tribal	0	0	9	5
Private	43	50	16	31

[a] Weighted average.
[b] Indicates a value less than 1%.

The primary analysis area includes about 16 million acres (64,800 km^2) in these 17 counties, 2.3 million acres (9,300 km^2) in Idaho, 4.9 million acres (19,800 km^2) in Montana, and 8.9 million acres (36,000 km^2) in Wyoming (Table 3-15). The proportion of land ownership includes about 76% federal ownership, 2% other governmental ownership, 1% Native American ownership, and 21% private ownership (Table 3-15, Figure 3-16).

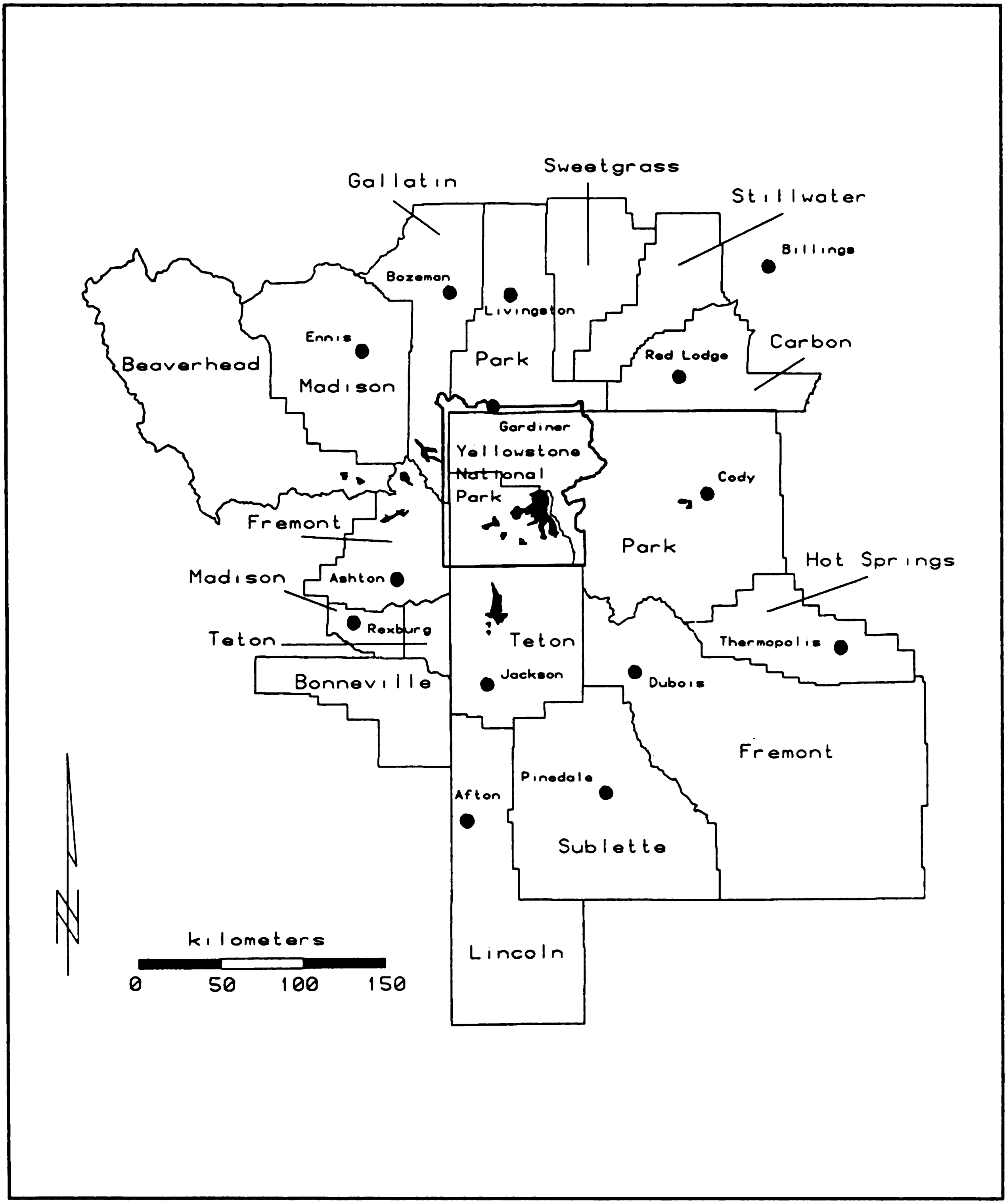

Figure 3-15. Idaho, Montana, and Wyoming counties adjacent to Yellowstone National Park and primary analysis area.

Table 3-15. Lands in major categories in the primary analysis area.

	Idaho	Montana	Wyoming	Total analysis area
National forests	1,025,900	2,476,400	5,118,400	8,620,700
National parks	31,500	167,700	2,350,900	2,550,100
Wildlife refuges	0	44,200	24,800	68,900
BLM lands	173,800	216,500	596,400	986,700
Other federal	33,500	600	27,500	61,600
Federal total	1,264,700	2,905,400	8,118,000	12,288,100
State total	142,400	120,700	72,700	335,800
Tribal	0	0	117,700	117,700
Private	891,800	1,880,800	552,500	3,325,100
Grand total	2,298,900	4,906,900	8,860,900	16,066,700

In the center is Yellowstone National Park, 2,219,773 acres (8,990 km^2). Other lands under National Park Service management include Grand Teton National Park and John D. Rockefeller Memorial Parkway south of Yellowstone, totalling 330,282 acres (1,338 km^2).

Southeast of Grand Teton National Park is the 24,760 acre (100 km^2) National Elk Refuge, managed by the FWS as winter range and an artificial winter feed ground for elk. Red Rock Lakes National Wildlife Refuge (44,159 acres; 179 km^2) in Beaverhead County, Montana, west of Yellowstone National Park is the only other area managed by the FWS in the primary analysis area.

Surrounding Yellowstone National Park is a complex of national forests including large areas of federally designated wilderness (about 4 million acres; 16,200 km^2) as well as land managed for a broader spectrum of multiple use objectives. Within the 17 county area there are all or portions of 10 national forests comprising over 11 million acres (44,600 km^2). Within the primary analysis area are portions of 6 national forests including Beaverhead, Bridger-Teton, Custer, Gallatin, Shoshone, and Targhee National Forests. Total area of national forest within the primary analysis area is about 8.6 million acres (34,800 km^2) or about 1/2 of the primary analysis area (Table 3-15).

The Bureau of Land Management (BLM) is the third largest federal land management ownership in the primary analysis area with about 987,000 acres (4,000 km^2) (Table 3-15, Figure 3-16). Most BLM land lies west of Yellowstone National Park in Montana and

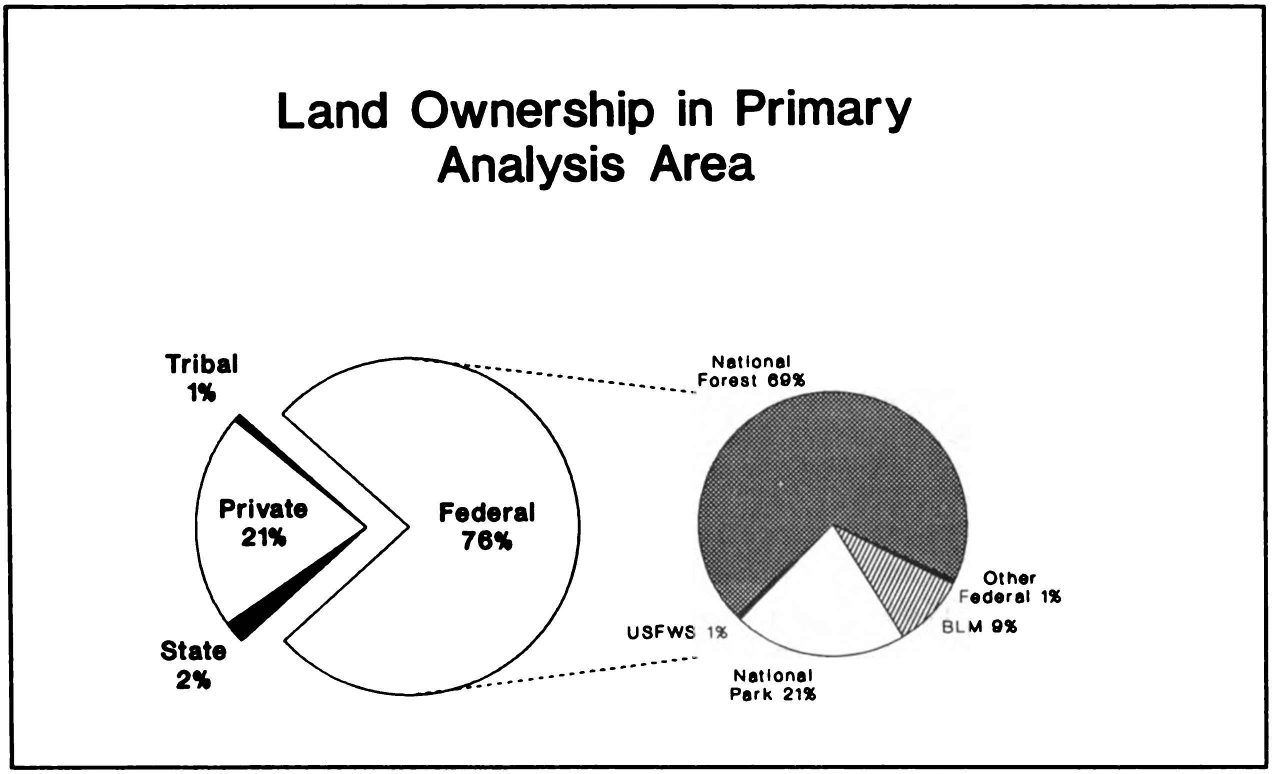

Figure 3-16. Land ownership in primary analysis area.

Idaho and south and east of Yellowstone National Park in Wyoming generally outside of the perimeter formed by national forests adjacent to Yellowstone National Park.

The Wind River Indian Reservation is located southeast of Yellowstone National Park and the Bridger-Teton National Forest in Fremont and Hot Springs counties, Wyoming, and includes a total of approximately 1.9 million acres (7,700 km^2), of which 95% is in tribal ownership, less than 1% in federal ownership, and 5% in private ownership. About 117,700 acres (480 km^2) are included in the primary analysis area.

Private land comprises about 3.3 million acres (13,400 km^2) or about 21% of the analysis area (Table 3-15 and Figure 3-16). The amount of private land in the analysis area varies among states from an estimate of about 0.9 million acres (3,600 km^2) in Idaho, and 1.9 million (7,700 km^2) in Montana, to about 0.5 million (2,000 km^2) in Wyoming. The vast majority of private land is located at lower elevations, primarily beyond the perimeter of federal lands or in the major river valleys that head at higher elevations on public land.

Livestock Abundance and Distribution

Domestic livestock in the primary analysis area are mainly cattle and sheep. During winter (October to June) cattle and sheep are moved to lower elevations, often to farm and ranch

Table 3-16. Numbers of livestock by class in primary analysis area[a].

State	County	Cattle[b]	Calves[b]	Sheep[b]	Lambs[b]	Swine[c]	Chickens[c]	Horses[c]	Turkeys[c]
Idaho	Bonneville	18,100	10,100	1,200	900	2,179	572	860	22
	Fremont	13,000	7,300	13,400	10,900	514	666	785	35
	Madison	17,600	9,900	2,600	2,100	829	0	605	24
	Teton	12,500	7,000	300	200	33	306	1,055	0
	Sub total	61,200	34,300	17,500	14,200	3,555	1,544	3,304	82
Montana	Beaverhead	7,600	4,200	1,200	1,000	31	34	92	0
	Carbon	22,300	12,300	7,100	6,000	1,773	619	860	26
	Gallatin	15,800	8,700	2,600	2,200	1,447	0	804	12
	Madison	26,100	14,300	5,300	4,500	989	530	626	6
	Park	20,200	11,100	2,000	1,700	274	889	865	28
	Stillwater	15,400	8,500	5,400	4,600	2,832	0	410	166
	Sweetgrass	11,000	6,000	6,800	5,700	1,307	241	285	15
	Sub Total	118,400	65,100	30,300	25,800	8,652	2,313	3,942	253
Wyoming	Fremont	3,800	1,900	1,700	1,300	95	93	250	9
	Hot Springs	700	300	200	100	3	9	30	0
	Lincoln	700	400	500	400	29	41	46	0
	Park	24,200	11,800	7,000	5,300	429	1,017	1,553	36
	Sublette	11,700	5,700	1,600	1,200	0	107	454	0
	Teton	9,600	4,700	1,100	8,600	11	0	1,170	0
	Sub total	50,600	24,800	12,000	16,900	566	1,268	3,502	45
Total		230,200	124,200	59,900	56,900	12,773	5,125	10,748	380

[a] Classes prorated based on livestock density in entire county; totals may not add because of rounding.
[b] Rounded to the nearest 100.
[c] Rounded to the whole numbers due to the smaller values compared to cattle, calves, sheep and lambs.

headquarters on private lands. Based on county livestock densities from the Census of Agriculture (U.S. Department of Commerce 1989a,b,c) mid-winter livestock numbers in the analysis area are estimated to be about 230,000 cattle and 60,000 sheep with fewer numbers of other livestock classes (Table 3-16). Annual production of calves and lambs, based on state wide averages, are estimated to be about 124,000 and 57,000 respectively (Table 3-16).

Seasonal livestock grazing occurs on portions of all 6 national forests. Livestock grazing is permitted on approximately 4 million acres (16,200 km^2) (Figure 3-17). Percentages of each forest that are grazed range from 14% on the Custer National Forest to 71% on the Beaverhead National Forest (Table 3-17). The number of livestock in each class varies between forests with the most livestock permitted on the Bridger-Teton and Targhee National Forests (Table 3-18). About 143,000 cattle and calves, about 265,000 sheep and lambs, and about 1,300 horses are grazed seasonally on national forests in the primary analysis area.

Table 3-17. Total allotments, number of active allotments, total permits, permits per allotment, total and mean allotment area, and percent of total forest and national park in active allotments for each of 6 national forests and Grand Teton National Park (GTNP) surrounding Yellowstone National Park during 1991[a].

National park or forest	Allotments			Total permits	Permits per allotment	Active allotment area (km^2)		Percent of park or forest area with active allotments
	Total	Active	Percent			Total	Mean	
Gallatin	88	77	87.5	107	1.4	1,971	25.6	28
Custer	19	17	89.5	26	1.5	286	16.8	14
Shoshone	63	56	88.9	69	1.2	3,473	62.0	39
Bridger-Teton	104	104	100.0	173	1.7	6,079	58.5	55
GTNP	5	5	100.0	10	2.0	111	22.2	8
Targhee	116	99	85.3	144	1.5	3,507	35.4	59
Beaverhead	45	34	75.6	48	1.4	1,215	35.7	71
Totals	440	392		577		16,642		

[a] Mack et al. 1992a.

Livestock (primarily cattle, sheep, and horses) are grazed, both within and outside wilderness areas, under permit to livestock operators for a specified period and number and class of livestock. In general, on national forest grazing allotments, livestock are permitted on allotments during late spring or early summer and taken off in the fall with no over-winter grazing. The mean date livestock are permitted on the national forests varies but livestock generally are allowed on during middle to late June and taken off in middle to late October (Table 3-19).

Livestock grazing is also managed on BLM lands under a permit system. Various situations include summer grazing at higher elevations similar to that on national forests, grazing during specified seasons usually associated with lower elevation areas, and year round grazing on isolated parcels in conjunction with private lands.

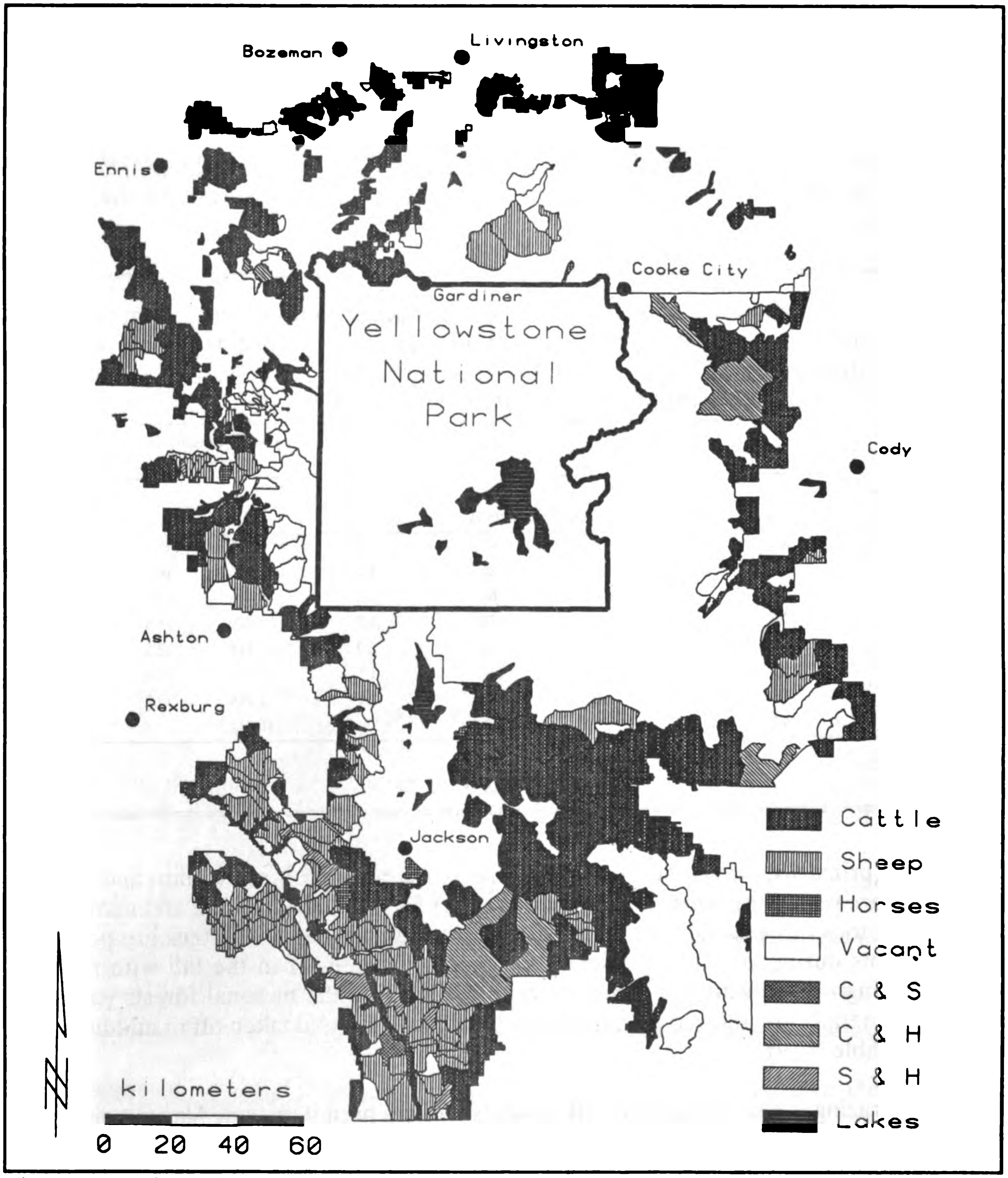

Figure 3-17. Location and type of livestock on grazing allotments on national forests and national parks within the primary analysis area during June through October. C & S = cattle and sheep, C & H = cattle and horses, S & H = sheep and horses.

Table 3-18. Number of cattle, sheep, and horses grazed on active allotments in 6 national forests and Grand Teton National Park (GTNP) within the primary analysis area, 1991[a].

National park or forest	Cattle	Calves	Sheep	Lambs	Horses	Total
Gallatin	7,002	6,302	4,351	5,221	243	23,119
Custer	2,064	1,858	0	0	25	3,947
Shoshone	15,047	13,542	5,900	9,440	204	44,133
Bridger-Teton	32,111	28,900	42,747	68,395	524	172,677
GTNP	1,368	1,231	0	0	75	2,674
Targhee	11,497	10,347	49,486	79,178	164	150,672
Beaverhead	7,573	6,816	167	267	35	148,858
Total	76,662	68,996	102,651	162,501	1,270	412,080

[a] Mack et al. 1992a.

Table 3-19. Average total days all livestock graze on 6 national forests and Grand Teton National Park (GTNP) in the primary study area and the median dates livestock are allowed on and taken off active grazing allotments[a].

		Median date[b]	
National park or forest	Average total days on allotments	On allotment	Off allotment
Gallatin	95	07/01	10/15
Custer	129	06/26	10/18
Shoshone	98	06/26	10/10
Bridger-Teton	90	06/18	09/30
GTNP	93	05/28	10/25
Targhee	84	06/26	09/15
Beaverhead	94	06/26	10/05

[a] Mack et al. 1992a.
[b] Median date is expressed as month and day (mm/dd).

With the exception of pack and riding stock, livestock grazing is not permitted in Yellowstone National Park or John D. Rockefeller Memorial Parkway. Within Grand Teton National Park, 27,400 acres (110 km^2), or 8% of the total park area, is open to livestock grazing (Table 3-17). Permitted grazing includes 1,368 cattle and 75 horses (Table 3-18) from late June through late October, for an average of 93 days (Table 3-19).

Livestock are not grazed on National Elk Refuge, but grazing of domestic livestock is allowed under permit on Red Rock Lakes National Wildlife Refuge.

Within the analysis area, at least 7.5 million acres (30,400 km^2) of public land (national forest and national park lands) have no livestock grazing anytime of the year. Areas without livestock grazing lie between Yellowstone National Park and livestock allotments on national forests. Grazing allotments border Yellowstone National Park only on the southwestern and northwestern corners of the park. The largest areas with no commercial livestock grazing are found north, east, and south of Yellowstone National Park and include large areas of designated wilderness. The average distance between Yellowstone National Park and active grazing allotments on national forests range from about 11 miles (18 km) on the west side to 22 miles (35 km) on the east side (Table 3-20). Livestock grazing is not permitted on these allotments during the remainder of the year. consequently, there is approximately 11.5 million acres (46,600 km^2) of public land with no livestock grazing for approximately 8 months.

Table 3-20. Average minimum distance (km) between Yellowstone National Park (YNP) and active grazing allotments and minimum and maximum distance of grazing allotments closest to YNP according to 4 compass directions[a].

Direction from YNP boundary	Distance (km)				
	Minimum	Maximum	Mean	SD[b]	*N*
North	0	59.7	23.4	19.96	373
East	9.1	58.5	36.2	12.65	134
South	0.6	33.8	21.1	9.26	38
West	1.6	32.5	16.6	9.14	100

[a] Mack et al. 1992a.
[b] SD = Standard deviation.

Private land used for livestock production is generally located at lower elevations and often along the major river valleys. Most of the livestock in the analysis area are wintered on private land, usually at lower elevations and along major river valleys. Few livestock remain on the public land grazing allotments during winter. In the spring, many of the cattle are moved to public land grazing allotments during middle to late June. Sheep are usually moved to higher elevation allotments slightly later, usually after lamb docking.

YELLOWSTONE: LAND USE RESTRICTIONS

National Parks

National parks are managed under authority of the acts that established park and the National Park Service Organic Act, which established the National Park Service to "promote and regulate the use of... parks..." and defined the purpose of national parks "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

In addition to these basic pieces of legislation, subsequent legislation, either specific to a particular park or addressing some aspect of park management, directs such diverse park issues as concessions, water rights, school facilities, park protection, lease of lands, and wild life management (Yellowstone National Park 1991).

These laws and regulations are the basis for management of the parks and protection of not only the natural and cultural resources located there but the protection of the over 3 million people while they are visiting Yellowstone and Grand Teton National Parks. Some restrict types of activities just as ordinances in cities limit people's activities for the common good. Others limit the season an activity can occur (such as fishing regulations). Still others limit or preclude certain activities in particular areas or in these areas during particular times of the year, such as no off-road vehicle use or no off-trail travel in areas with high risk of grizzly bear encounters.

A number of concessioners operate within the parks providing a variety of services ranging from hotel accommodations and stores to small guide services. These businesses operate under a variety of different concession contracts and agreements. Portions of these agreements may limit activities and seasons of operations to protect natural and cultural resources. Backcountry outfitters generally do not operate prior to July 1 (unless a specific exemption is authorized) to protect trails during spring thaw.

Both Yellowstone and Grand Teton National Parks are classified as natural area parks with primary emphasis on preservation and maintenance of natural values. Within this overall management objective, zones are established with varying management objectives (Table 3-21). These zones include a natural zone and a developed zone. Over 98% of Yellowstone and 89% of Grand Teton are classified as natural zones. The natural zone includes areas managed for retention of natural values and areas recommended for wilderness, essentially the backcountry.

The development zones contain most of the "built" infrastructure. Approximately 2% of Yellowstone and about 12% of Grand Teton are in developed areas. Developments include some roads and trails, visitor service facilities, developed campgrounds, visitor lodging

Table 3-21. Management zones in Yellowstone and Grand Teton National Parks (acres).

Unit	Natural zone		Special use, historic, and development zones	Total
	Wilderness recommendation	Natural environment subzone		
Grand Teton N.P.	122,600	167,700	40,000	330,300
Yellowstone N.P.	2,016,200	163,600	40,000	2,219,800
Total	2,138,800	331,300	80,000	2,550,100

Source: Yellowstone and Grand Teton National Park Statements for Management and Yellowstone National Park Planning Office.

facilities, employee housing, and administrative headquarters found in various areas throughout the parks (Figure 3-18).

Visitor facilities in the 2 parks are located within the developed zones. Typical seasonal opening and closing dates of facilities are in Table 3-22. Peak visitor use season occurs from early July through mid-August. For example, during 1990, July was the peak month and averaged about 24,000 visitors per day; the peak day was August 6, with 29,737 visitors. Most backcountry use is recorded July through September. Winter use has increased dramatically since the mid-1960s; 30 years ago there was virtually no winter use within the parks. During the winter of 1990-1991 over 98,000 visitors came to Yellowstone; 72% for snowmobiling and 24% for cross-country skiing (Yellowstone National Park 1991).

Yellowstone has about 523 miles (842 km) of public roads with no off-road use of vehicles authorized. During summer, primary roads are open to the public. The main road from the north entrance (Gardiner, Montana) to the northeast entrance (Silvergate/Cooke City, Montana) is maintained for wheeled vehicle use year-round. During the fall and spring other roads (about 371 miles; 597 km) are closed temporarily to wheeled vehicles when they become impassible because of weather and prior to being suitable for over-snow machine use. During winter all interior roads are open to over-snow machine use except a segment between Tower and Canyon over Mount Washburn because of heavy snow accumulation, avalanche, and other hazards. No off-road use of over-snow machines is permitted.

The 2 national parks contain about 1,200 miles (1,900 km) of trail available during the summer season and about 250 miles (400 km) of trail maintained during winter months (Table 3-23). Visitor use of these trails is outlined in the visitor use section. Some of these trails have travel restrictions regarding season of use, party size, or limits on stock to protect resources and visitors.

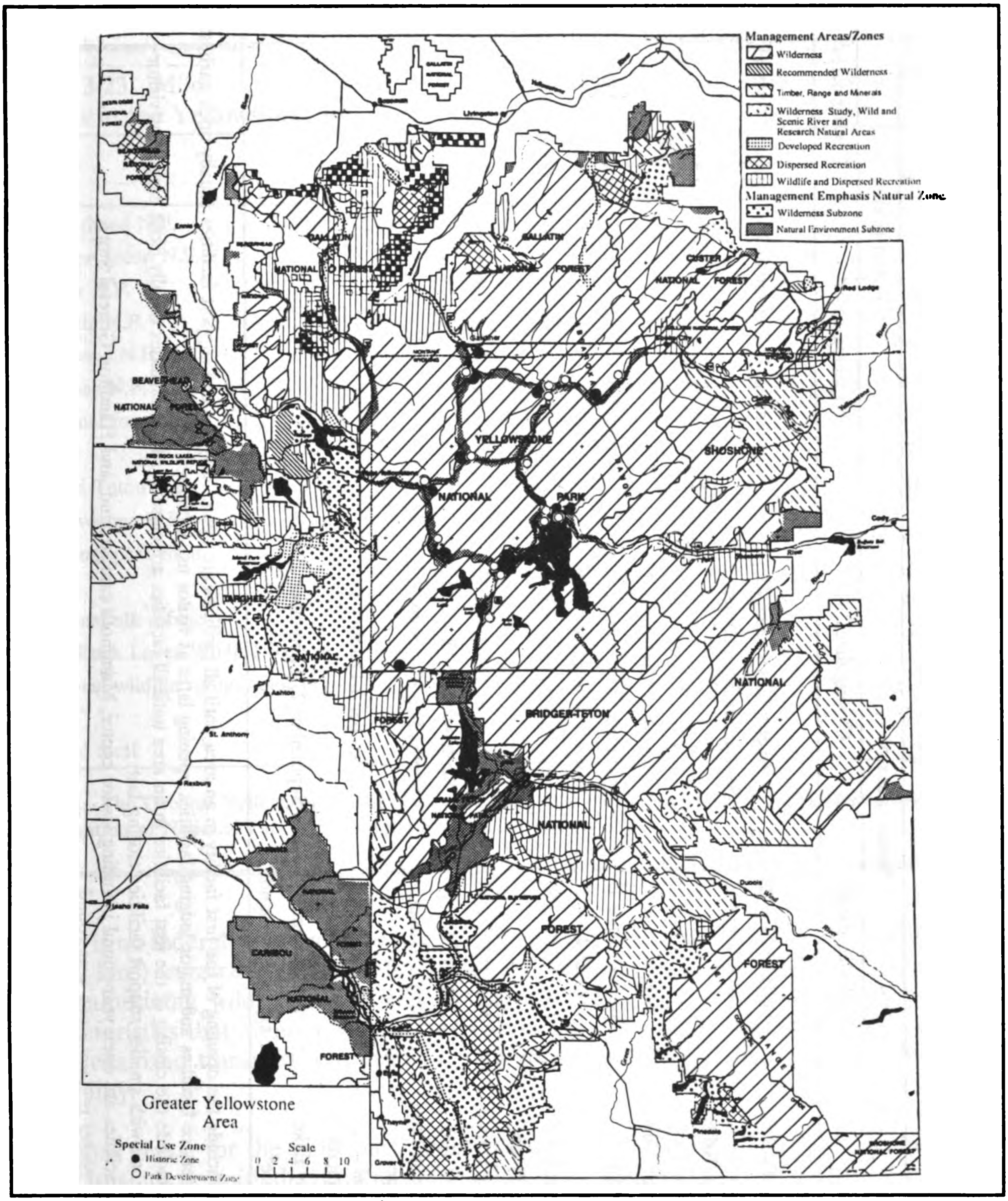

Figure 3-18. Management areas/zones on national parks and national forests in the Yellowstone area. Adapted from Greater Yellowstone Coordinating Committee (1987).

Table 3-22. Seasonal operating periods for visitor facilities in Yellowstone and Grand Teton National Parks, 1992-1993.

Area	Summer season		Winter season	
	Opening dates[a]	Closing dates[b]	Opening dates[a]	Closing dates[b]
Yellowstone				
Old Faithful	April 24-May 23	August 30-October 25	December 12-December 16	March 14-March 21
Lake Area/Bridge Bay	May 16-June 15	September 7-September 27		
Grant Village	May 8-June 7	September 12-October 12		
Canyon	April 23-June 13	August 30-November 1	December 12-December 16	March 10-March 15
Tower	May 23-June 7	August 30-September 20		
Mammoth[c]	May 9-May 28	September 7-October 11	December 12-December 19	March 7-March 14
Grand Teton				
Flagg Ranch	May 15-June 1	September 1-October 15	December 1-December 15	March 1-March 15
Colter Bay	May 2-June 5	September 7-October 11		
Jackson Lake Lodge	May 27-June 5	September 20-October 11		
Signal Mountain	May 9-May 29	October 1-October 13		
Jenny Lake	May 31-June 1	September 27-September 28		
Moose[d]	Open year-round			

[a] Dates include the opening of the first facility in an area until all facilities are open. Day use and support facilities usually open earliest with full service facilities and major lodging facilities opening later as visitor use increases.
[b] Dates include the closing of the first facilities in an area until all facilities are closed. Major facilities usually close earliest as visitor levels decline with smaller support facilities closing last.
[c] Some facilities are open year-round including visitor center, Mammoth campground, and Hamilton General Store.
[d] Visitor center remains open year-round.

Table 3-23. Miles of trail in national parks, national forests, and national wildlife refuges in the Yellowstone area.

	Miles		
Unit	Motorized	Horse and foot	Winter
Beaverhead N.F.	86	110	120
Bridger-Teton N.F.	800	1,304	128
Custer N.F.	126	178	27
Gallatin N.F.	434	850	159
Shoshone N.F.	205	687	125
Targhee N.F.	662	351	518
National forest total	2,313	3,480	1,077
Grand Teton N.P.	0	163	0
Yellowstone N.P.	0	1,000	247
National park total	0	1,163	247
National elk refuge	0	0.5	0
Red Rock Lakes Wildlife Refuge	0	0	0
National wildlife refuge total	0	0.5	0
Grand total	2,313	4,643.5	1,324

Source: The Greater Yellowstone Coordinating Committee. 1987. The Greater Yellowstone Area, An Aggregation of National Park and National Forest Management Plans.

There is no federally designated wilderness in either park. However, about 2.1 million acres (8,500 km^2) were recommended for wilderness designation (Table 3-21) and are managed for maintaining wilderness values. Management is directed at maintaining wilderness characteristics that allows dispersed recreation but limits the use of motorized equipment or mechanized transport and prohibits new development that would diminish wilderness suitability.

National parks, for the most part, are withdrawn from mineral development, and timber harvest is not permitted. Hunting is not allowed in Yellowstone, and there is a limited elk hunt allowed in portions of Grand Teton National Park and John D. Rockefeller Memorial

Parkway. Livestock grazing is not permitted in Yellowstone. Limited grazing is allowed on about 8% of Grand Teton (see Livestock Section).

Superintendents are authorized to place limits on visitor use of certain areas for protection of resources or for public safety. Restrictions for public safety often involve limits on use in thermal areas, climbing in hazardous areas such as Grand Canyon of the Yellowstone, swimming in hazardous river sections, and limits on boats and motors on lakes and rivers. A complete listing of these are available in 36 CFR 1-7 (Office of the Federal Register 1992) and Yellowstone Compendium 36 CFR 1.7(B).

Limits on human activity to protect resources may involve limits on numbers, care and handling of stock, limits on activities in areas which are key habitats for sensitive species, and limits on the duration of certain activities. A major component of bear management is limiting human entry into very important seasonal habitats for bears or where there is a history of high potential of bear/human confrontation. Bear management areas have seasonal closures or human use restrictions such as no off-trail travel or party size limitations (Table 3-24). Other areas may have temporary restrictions for specific emergency situations (Yellowstone National Park 1992f). Unless activities are specifically restricted to protect natural or cultural resources or for human safety, off-trail travel is authorized throughout the park. Consequently, during July through September, the principal summer use season (47,876 acres, 194 km^2; about 2% of the backcountry) is closed to human entry for grizzly bear conservation and human safety.

National Forests

National forests are established under the Creation Act and managed under the Organic Act. In addition to these basic pieces of legislation, subsequent legislation, either specific to a particular forest or addressing some aspect of forest management direct such diverse issues as timber management, range management, recreation, wilderness management, air and water quality, natural and cultural resources, water and water rights, soil conservation, and minerals management.

The National Forest Management Act directs the management of national forests. Plans are prepared for each forest as required by the Forest and Rangeland Renewable Resources Planning Act. These forest plans guide natural resource management activities on the national forests and, along with the associated laws and regulations, are the basis for management of the national forests, production of outputs, use by the public, and protection of not only the natural and cultural resources located there but the protection of the millions of people visiting the national forests.

These regulations are the basis for regulating activities on national forests to achieve the overall objectives. Within each plan, management direction and associated goals and objectives are established and standards and guidelines are described for the conduct of

Table 3-24. Human use restrictions in bear management areas in Yellowstone National Park, 1992.

Area name	Use limit	Duration	Reason for restriction	Acres
Firehole	Closed	Mar. 10-MDW[a]	Concentrated grizzly feeding area	20,670
Richard's Pond	Closed	Mar. 10-MDW	Frequent grizzly encounters	6,107
Gneiss Creek	Closed	Mar. 10-June 30	Frequent grizzly encounters	9,333
Gallatin	No off trail travel	May 1-Nov. 10	Frequent grizzly encounters	78,460
Blacktail	Closed	Mar. 10-June 30	Concentrated grizzly spring feeding area	10,300
Washburn	Closed	Aug. 1-Nov. 10	Concentrated grizzly use area	32,613
Antelope	Closed (roads and turnouts open)	Mar. 10-Nov. 10	Concentrated grizzly use area	15,260
Mirror Plateau	Day use only	May 15-Nov. 10	Grizzly security area, no trails or designated campsites	63,867
Pelican Valley	Closed	Apr. 1-July 3	Cutthroat trout spawning	33,460
	Day use only	July 4-Nov. 10	Concentrated grizzly use area	
Clear Creek	Trail limits--No off trail travel	Apr. 1-Aug. 10	Concentrated grizzly feeding area	28,560
Lake Spawn	No off-trail travel	May 15-July 14	Concentrated grizzly feeding area	34,040
Two Ocean	No off-trail travel	Mar. 10-July 14, Aug. 22-Nov. 10	Grizzly bear security area	65,004
Riddle/ Solution	Closed	Apr. 30-July 14	Concentrated grizzly feeding area	12,060
Grant Village	Campgrounds closed	to June 20	Concentrated grizzly feeding area	168
Heart Lake	Closed	Apr. 1-June 30	Concentrated grizzly use area	54,600

[a] MDW = Through Friday of Memorial Day weekend.
Source: National Park Service unpubl. data.

Table 3-25. Management direction by acres on each national forest in the Yellowstone area.

Management areas/zones	National forest						
	Beaverhead	Bridger-Teton	Custer	Gallatin	Shoshone	Targhee	Total
Wilderness	101,400	1,190,300	339,800	713,700	1,277,100	131,800	3,754,100
Recommended wilderness	4,500		5,700	21,900		16,400	48,500
Wilderness study, W&S River		127,900		3,300	14,700	91,400	237,300
Developed recreation	3,400	47,700	2,600	38,700	6,000	76,300	174,700
Dispersed recreation	23,900	408,400	19,600	100,800	24,700		577,400
Range, minerals, wildlife, dispersed recreation	197,300		25,000	77,300	49,400	296,600	645,600
Timber, range, minerals			34,200	83,900			118,100
Timber, range, minerals, wildlife, dispersed recreation	47,800	166,200		53,000	682,200	354,100	1,303,300
Timber wildlife dispersed recreation	26,400	433,600	53,600	182,700	13,700	199,600	909,600
Wildlife dispersed recreation	18,400	366,700	20,000	460,100	156,100	320,700	1,342,000
Others			17,000				17,000

Source: The Greater Yellowstone Coordinating Committee. 1987. The Greater Yellowstone Area, An Aggregation of National Park and National Forest Management Plans.

activities to achieve multiple objectives. These plans are available for all national forests in the Yellowstone area. A detailed display of their content is beyond the scope of this document. Within each management area a priority is given to certain management objectives (Table 3-25). Management area specific objectives are identified, and standards and guidelines direct how each activity is to be coordinated with other multiple objectives.

Three general types of activities involve large areas of national forest land; livestock grazing, timber harvest, and recreation. The areas on national forests utilized for livestock grazing are described in the livestock section (see Table 3-18, Figure 3-17). Each livestock allotment has specifications and stipulations regarding conduct of that activity. In general, grazing is permitted from late June through late October (see Table 3-19).

Timber harvest occurs within areas determined to be suitable for timber production, which includes about 1.5 million acres (6,100 km^2) (Table 3-26). The level of timber harvest activity varies by year and by national forest. From 1986 to 1996 an annual average of about 28,000 acres (113 km^2) are planned or have been in active timber harvest (Table 3-27 and Figure 3-19). The majority of future timber harvest (about 55%) will occur on the Targhee National Forest (Greater Yellowstone Coordinating Committee 1987).

Table 3-26. Forested land (acres) determined suitable for timber production on national forests in the Yellowstone area.

National forest	Suited	Not suited
Beaverhead	54,600	204,100
Bridger-Teton	97,900	1,817,200
Custer	33,900	50,100
Gallatin	263,700	857,500
Shoshone	144,700	1,156,400
Targhee	910,600	377,500
Total	1,505,400	4,462,800

Source: The Greater Yellowstone Coordinating Committee. 1987. The Greater Yellowstone Area, An Aggregation of National Park and National Forest Management Plans.

A substantial portion of the national forests are within designated wilderness, areas recommended for wilderness, or other roadless or undeveloped situations (Table 3-28). Wilderness is managed to maintain the primitive characteristics of an area, and activities such as road construction, timber harvest, and motorized use or mechanical transportation are generally prohibited. Activities such as camping, hiking, hunting, horseback riding,

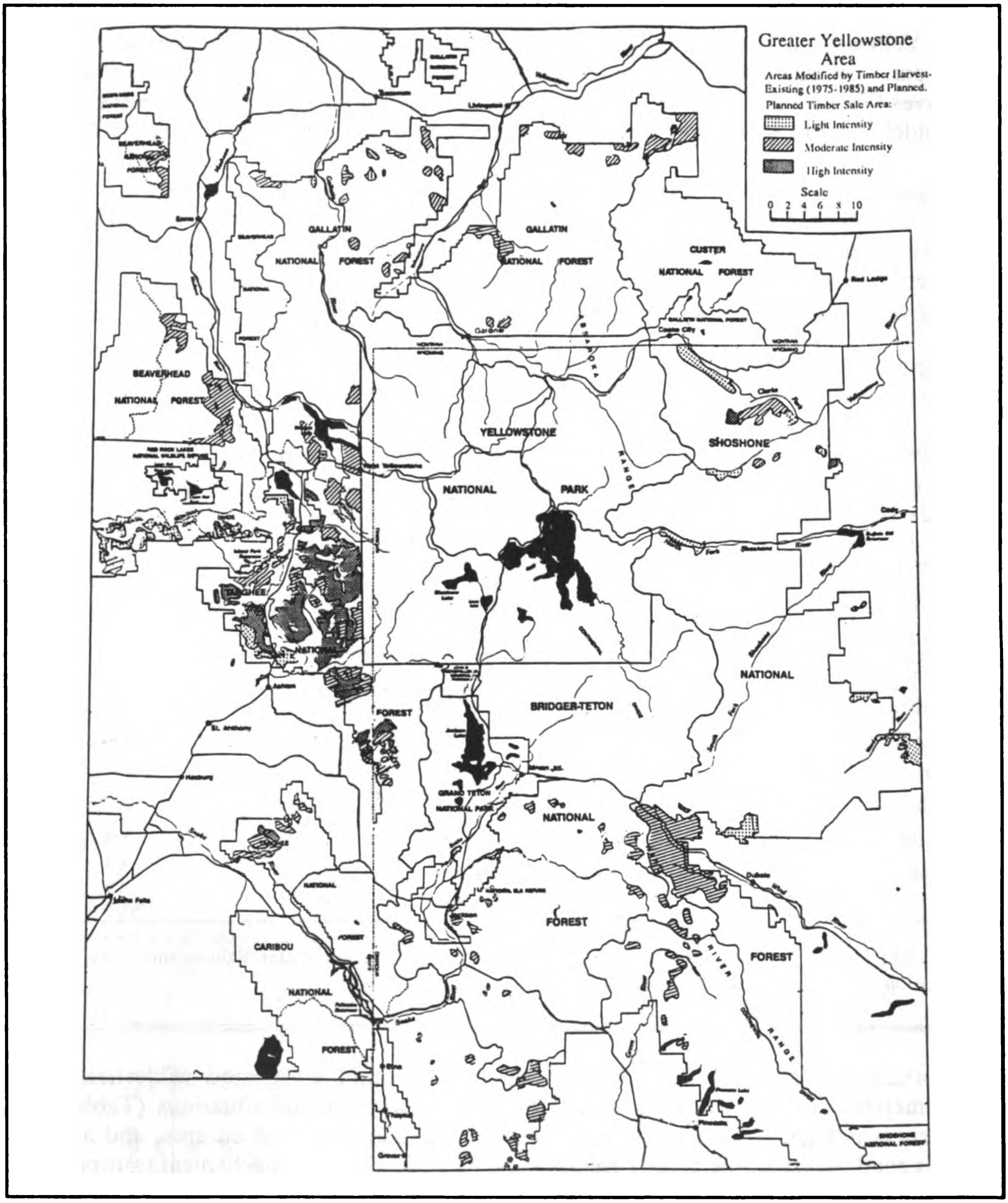

Figure 3-19. Areas modified by timber harvest from 1975-1985, and planned areas of timber harvest. Adapted from Greater Yellowstone Coordinating Committee (1987).

Table 3-27. Acres of timber harvest planned annually on national forests in the Yellowstone area.

Year	Beaverhead[a]	Bridger-Teton[b]	Custer[c]	Gallatin[d]	Shoshone[e]	Targhee[f]
1996		3,620	425	2,130		18,000
1995	1,972	2,830	400	2,130	2,313	18,000
1994	1,491	2,830	675	2,130	2,076	18,000
1993	1,781	2,830	375	2,130	2,304	18,000
1992	2,796	2,830	300	2,130	2,077	18,000
1991	2,326	2,830	450	2,130	1,947	18,000
1990	2,467	2,830	600	1,910	2,459	18,000
1989	2,265	2,830	650	1,718	2,065	18,000
1988	2,514	2,830	450	1,891	1,641	18,000
1987	3,250	2,830	400	1,509	3,205	18,000
1986	386	2,830	690		1,812	18,800
Annual average	2,125	2,902	492	1,981	2,190	18,073

[a] Doesn't include thinning; data from Beaverhead National Forest, Management Plan, 1985.
[b] Average for 1985-1994 for all harvest types (poles, posts and other products, commercial fuel wood, dead sawtimber, firewood and green sawtimber); data from Bridger-Teton National Forest, Management Plan, 1985.
[c] Includes small sales; data from Custer National Forest, Management Plan, 1986.
[d] Includes posts and poles; data from Gallatin National Forest, Management Plan, 1986.
[e] Includes thinning but not small sales (posts, poles, etc); data from Shoshone National Forest, Management Plan, 1986.
[f] Includes firewood, posts and poles; data from Targhee National Forest, Management Plan, 1986.

fishing, and livestock grazing are allowed. When an area is designated as wilderness, it is normally withdrawn from mineral entry.

Areas recommended for wilderness are managed with the objective of maintaining wilderness values, and no new development that would diminish wilderness suitability is permitted. Areas managed as wilderness or recommended as wilderness in the Yellowstone area are mostly adjacent to Yellowstone National park and at higher elevations. Consequently the majority of public use is limited by terrain and weather. Primary use occurs from middle to late June through October or early November.

Table 3-28. Acres of wilderness and other undeveloped areas on national forests in the Yellowstone area.

National forest	Wilderness	Recommended wilderness, wilderness study	Undeveloped areas	Other
Beaverhead	101,400	4,500	211,600	3,700
Bridger-Teton	1,190,300	127,900	1,004,500	
Custer	339,800			
Gallatin	713,700	25,200	379,000	43,300
Shoshone	1,277,100	14,700	432,500	28,800
Targhee	131,800	101,800	474,100	
Total	3,754,100	274,100	2,501,700	75,800

Source: The Greater Yellowstone Coordinating Committee. 1987. The Greater Yellowstone Area, An Aggregation of National Park and National Forest Management Plans.

Table 3-29. Miles of roads in national forests in the Yellowstone area.

National forest	Open	%	Closed	%	Seasonal restrictions	%	Total
Beaverhead	223	57	56	14	115	29	394
Bridger-Teton	720	40	552	30	540	30	1,812
Custer	131						
Gallatin	162	20	21	3	624	77	807
Shoshone	1,250	77	326	20	50	3	1,626
Targhee	1,350	74	420	23	56	3	1,826
Total	3,836	58	1,375	21	1,385	21	6,596

Source: The Greater Yellowstone Coordinating Committee. 1987. The Greater Yellowstone Area, An Aggregation of National Park and National Forest Management Plans.

In national forests in the Yellowstone area there are about 6,600 miles (10,600 km) of road (Table 3-29). About 58% are open to unrestricted use, about 21% are closed to general public use, and about 21% have some form of seasonal restriction. There are also about 2,300 miles (3,700 km) of motorized trails and about 3,480 miles (5,600 km) of horse and foot trails primarily used during summer and about 1,077 miles (1,700 km) of winter trails that are used primarily for over-snow machines or cross-country skiing (Table 3-23).

Roads provide access to national forest lands for a variety of purposes including recreation, timber harvest, grazing, mining, oil and gas development, and access to camp grounds and trail heads. Management of roads on national forests are described in the transportation plans for each forest. Access to national forest land by various classes of road management is displayed in Table 3-30. About 28% is open to all motorized use, about 44% is closed to all motorized use (primarily wilderness and recommended wilderness), and about 8% is closed to all except snowmobiles. About 6% has some seasonal or other restriction and about 14% includes areas where travel is restricted to designated routes. On average, a mile of open road provides access to about 1 square mile (0.62 km/km^2) of national forest.

Table 3-30. Acres accessed under various classes of road management restrictions on national forests in the Yellowstone area.

National forest	Open to all motorized use	Closed to all motorized use	Closed to all except snowmobiles	Seasonal or other restrictions to motorized use	Travel restricted to designated routes
Beaverhead		138,800		288,000	
Bridger-Teton	966,300	1,066,000	699,300	6,300	2,900
Custer	159,500	346,200	1,000		10,800
Gallatin	555,100	834,700		187,100	158,500
Shoshone		1,350,300		39,300	834,300
Targhee	844,300	254,500	39,200	44,800	294,400
Total	2,525,200	3,990,500	739,500	565,500	1,300,900

Source: The Greater Yellowstone Coordinating Committee. 1987. The Greater Yellowstone Area, An Aggregation of National Park and National Forest Management Plans.

Seasonal restrictions on public access generally result from several main causes. Snow closes most roads in national forests, except for those plowed by private or public groups who require business access. Reasons for seasonal restrictions include human safety, protection of the road bed itself during spring thaw and break-up, protection of seasonally important wildlife habitats such as elk winter range or calving areas, or for conservation of threatened or endangered species such as grizzly bears and bald eagles.

Elk winter range (Figure 3-20) and elk calving areas in the Yellowstone area are distributed at middle to lower elevation. These areas comprise about 1.3 million acres (5,300 km^2) of winter range and about 500,000 acres (2,000 km^2) of calving area (Table 3-31). Seasonal

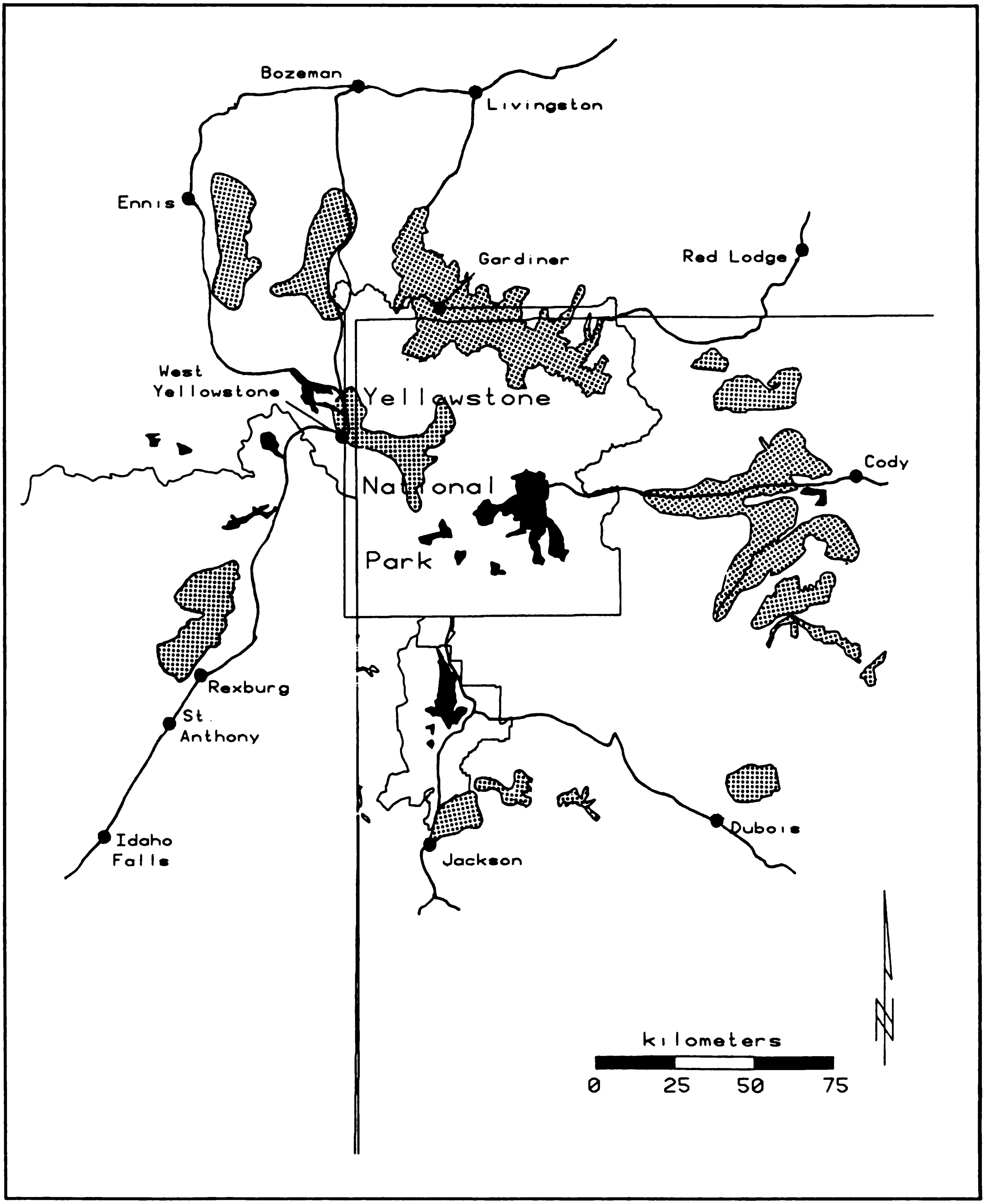

Figure 3-20. Elk winter range in the Yellowstone area.

restrictions on access in these areas are usually a combination of road closures, open road density standards, or restricting vehicle access to certain designated routes to achieve cover/security objectives. Restrictions for big game winter range generally include the period from middle to late November through April or May (Table 3-32). Seasonal restrictions for big game birthing (elk calving, bighorn sheep lambing) areas generally include the period from middle to late May through June.

Important habitats for threatened and endangered as well as sensitive species also receive consideration. Grizzly bear habitat has been stratified into management situations based on importance of habitat in an area to seasonal needs of grizzly bears and grizzly/human conflict potential (Figure 3-21). These include about 1.8 million acres (7,300 km^2) in situation I, about 1.6 million acres (6,500 km^2) in situation II, and about 79,600 acres (330 km^2) of situation III (Table 3-33). In general, situation I is important bear habitat year-round, situation II is important seasonally, and situation III areas are areas of high conflict potential, such as developments and campgrounds, where grizzly presence is not desirable.

Table 3-31. Acres of elk seasonal ranges in national forests in the Yellowstone area.

National forest	Summer	Winter	Calving
Beaverhead	425,000	45,000	31,800
Bridger-Teton	345,900	212,100	229,900
Custer	31,900	33,500	4,100
Gallatin	1,057,300	513,200	[a]
Shoshone	1,180,200	421,300	41,100
Targhee	757,500	103,800	236,500
Total	3,797,800	1,328,900	543,400

[a] Information is not available.
Source: The Greater Yellowstone Coordinating Committee. 1987. The Greater Yellowstone Area, An Aggregation of National Park and National Forest Management Plans.

In some situations, human activity is limited to allow use by bears of important seasonal ranges. Limits on human activity such as use of roads or other access usually involve the spring from March through June to allow use of key spring ranges while bears are stressed after den emergence. Many of these areas include ungulate winter ranges or ungulate calving and fawning areas where winter killed carrion is available. Many of the seasonal restrictions for the various reasons including road bed protection, big game seasonal ranges,

Table 3-32. Examples of seasonal restrictions to protect wildlife seasonal ranges on national forests in the Yellowstone area[a].

Restrictions	Shoshone	Gallatin	Beaverhead	Targhee	Custer	Bridger-Teton
Big game–winter	Nov. 15-Apr.15 (Crucial range)	Oct. 15-June 30; Yearlong	Dec. 15-May 15; Oct. 15-May 15; Yearlong	Dec.-March; Nov.-April;	Nov. 1-June 1; Nov. 30-June 15	Nov. 15-April 30; Dec. 1-April 30
Big game–calving	May 1-June 15	May 1-June 15	Yearlong; April 1-July 1	May-June	June 1-June 15; May 1-July 10; June 1-July 1	May 15-June 30
Wildlife security		Oct. 15-June 30; Sept. 1-Nov. 30; Jan. 1-May 15; Yearlong (limited)	May 15-Dec. 1; Oct. 15-May 15; Oct. 1-July 1; April 1-Dec. 1; Sept. 1-Dec. 1; May 15-Dec.1; Yearlong	March-July;		May 1-Nov. 30 (open to motorized use on designated routes, open to foot and horse travel).
Erosion control		Oct. 15-June 30; Jan. 1-May 31; Jan. 1-June 30; Yearlong	April 1-July 1; April 1-Dec 1; Oct. 1-July 1; Dec. 1-May 15; Oct. 15-July 15; May 15-Dec. 1; Yearlong			Yearlong in designated areas.
Migration route	Oct. 15-Nov. 15					
Nest sites	Feb. 1-July 31 (Peregrine Falcon and Bald Eagle)		Yearlong (swan); Dec. 1-May 15 (waterfowl); Feb. 15-Aug. 1 (Bald Eagle)	Feb. 15-July 15 (Eagles, Falcons, Merlins and Prairie Grouse)	March-July; May-July; April-July; March-July Feb. 15-July 15	

[a] Targhee National Forest–Management Plan; Custer National Forest–Management Plan; Dave Henry, pers. commun. and maps of the Shoshone, Gallatin, Beaverhead, Targhee, Custer and Bridger-Teton National Forests.

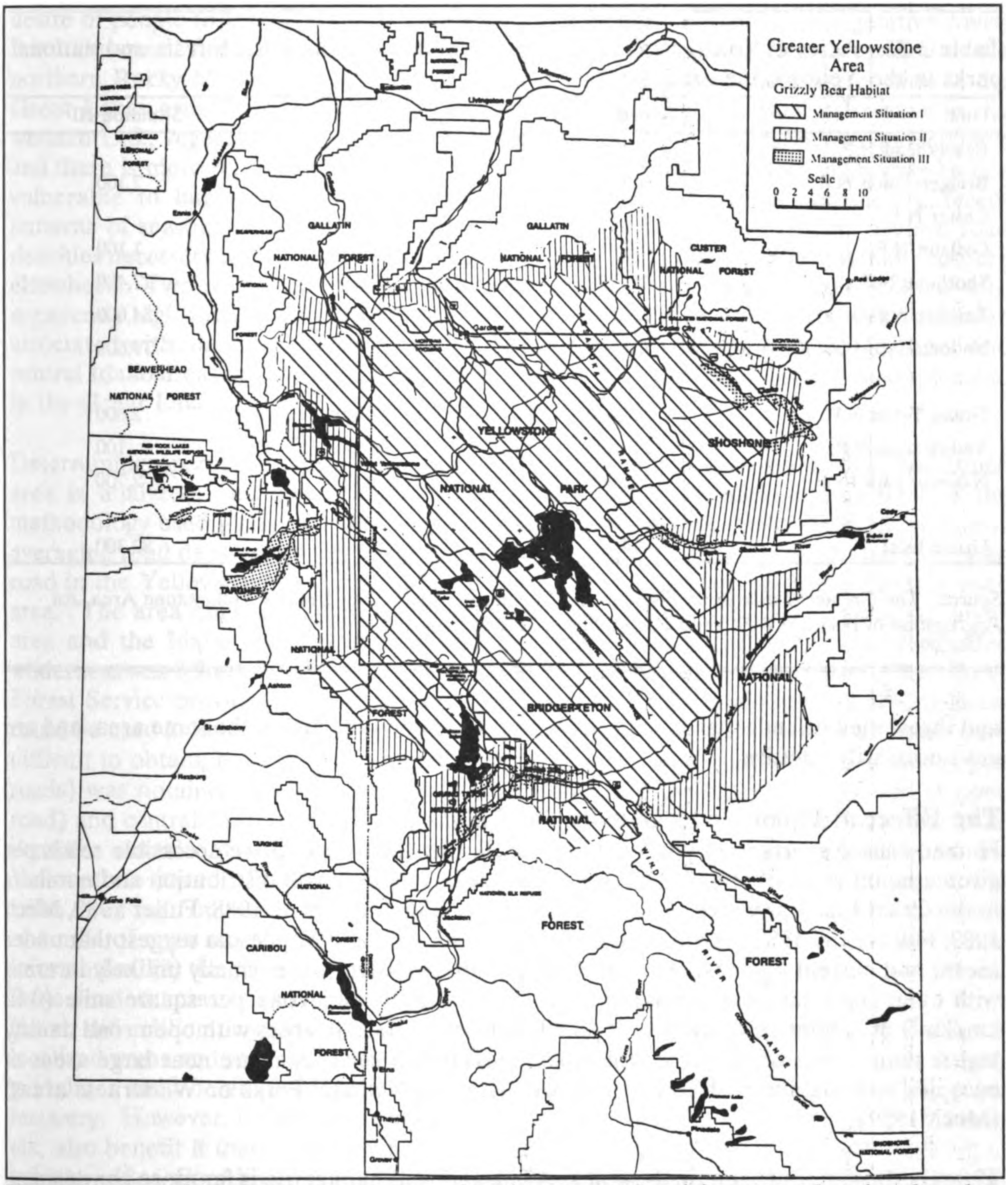

Figure 3-21. Grizzly bear management situations on national forests and national parks in the Yellowstone area. Adapted from Greater Yellowstone Coordinating Committee (1987).

Table 3-33. Acres of grizzly bear management situations in national forests and national parks in the Yellowstone area.

Unit	Situation I	Situation II	Situation III
Beaverhead N.F.		68,500	
Bridger-Teton N.F.	665,500	61,500	7,100
Custer N.F.	5,500	105,000	
Gallatin N.F.	493,400	324,000	1,100
Shoshone N.F.	412,000	819,600	17,400
Targhee N.F.	180,500	266,500	54,000
National forest total	1,756,900	1,645,100	79,600
Grand Teton N.P.	118,400	212,700	2,600
Yellowstone N.P.	2,219,400	2,300	100
National park total	2,337,800	215,000	2,700
Grand total	4,094,700	1,860,100	82,300

Source: The Greater Yellowstone Coordinating Committee. 1987. The Greater Yellowstone Area, An Aggregation of National Park and National Forest Management Plans.

and threatened or endangered species occur at the same time and in the same area, and are not necessarily additive.

The Effect of Open Road Density on Wolves

Human-caused mortality, as indexed by road density (two-wheel drive accessible roads per given amount of area) and thus human access, seems to limit wolf distribution and numbers in the Great Lakes area (Thiel 1985, Jensen et al. 1986, Mech et al. 1988, Fuller 1989, Mech 1989, Fuller et al. 1992). Data from Wisconsin, Michigan, and Minnesota suggest that under recent and current circumstances, wolf population persistence is normally unlikely in areas with open road densities greater than about 1 mile of open road per square mile (0.62 km/km^2) of habitat. However, wolf populations can persist in areas with open road density higher than 1 mile of open road/mi^2 (0.62 km/km^2), if such areas are near large areas of occupied wolf habitat with few or no roads (such as National Parks or Wilderness areas) (Mech 1989).

The relationships between roads, wolf survival, and wolf habitat use is far more complicated than simply road density alone. Wolf vulnerability is influenced by terrain, topography, cover, traffic, and road distribution in the landscape as well as the ability, opportunity, and desire of people to kill wolves. Because of differences in topography and vegetative cover, it is unknown if the information from the Great Lakes area can be directly applied to the northern Rocky Mountains. Wolves may be less susceptible to human persecution in the Great Lakes area than they would be in the northern Rocky Mountains because in the western U.S., vegetation is less dense, mountainous terrain concentrates wolf movements, and there is more topographical relief. In contrast, wolves in the western U.S. may be less vulnerable to human persecution because of lower overall human densities, different patterns of seasonal road use, and different patterns of human settlement. Hence, road densities necessary to provide security for wolves in the West may be different than reported elsewhere. Two wolf packs in Montana have survived for at least 3 years in areas with apparently high road density, but in contrast, most documented wolf mortalities have been associated with road access. We examined the issue of road density in the Yellowstone and central Idaho areas to determine if open road density exceeded the threshold recommended in the Great Lakes area.

Determining open road density depends upon the definition of an open road, how much area is analyzed, and how seasonal or temporary roads are measured as well as the methodology used ("precise" road densities using a GIS "roving window" technique versus averaging road densities over a broad geographical area). For simplicity, the miles of open road in the Yellowstone and central Idaho areas were divided by the square miles in each area. The area managed by the federal government in the Yellowstone primary analysis area and the Idaho primary analysis area that was not in national parks or designated wilderness was 8,966 mi^2 (23,200 km^2) and 14,723 mi^2 (38,100 km^2), respectively. The USDA Forest Service provided estimates of the miles of roads or trails where motorized vehicles could be used in both areas. Inventories of open, seasonally opened, and closed roads were difficult to obtain, however, an estimate of miles of open roads (including seasonally open roads) was obtained for both the Yellowstone (up to 8,057 miles, or 13,000 km of open road) and central Idaho (up to 14,470 miles, or 23,300 km of open road) areas. Open road densities outside of national parks and USDA Forest Service wilderness areas in the Yellowstone (up to 0.90 miles open road/mi^2; 0.56 km/km^2) and central Idaho (up to 0.98 miles open road/mi^2; 0.61 km/km^2) areas were close to but below the theoretical threshold of 1 mile of open road/1 mi^2 (0.62 km/km^2) of habitat. Based upon (1) current open road information, (2) the success of wolf packs in highly roaded habitats in Montana, and (3) that these roaded areas of public land being proposed for wolf recovery are adjacent to large (about 4-5 million acres; 16,200-20,300 km^2) roadless areas, it appears that, other than in localized areas and at certain times (den sites), it is unlikely, at this time, that road density guidelines must be employed as a wide spread land management strategy to support wolf recovery. However, it should be emphasized that besides to wolves, wolf prey, particularly elk, also benefit if there is less than 1 mile of open road per square mile (0.62 km/km^2) of habitat. (See Coordinating Elk and Timber Management, Lyon et al. 1985 for further references.)

Animal Damage Control Techniques

Activities to control damage by wildlife to livestock or property are conducted primarily by private individuals or USDA, Animal and Plant Health Inspection Service (APHIS), Animal Damage Control (ADC). Capture or control of game animals that are predators, such as bears or mountain lions, may be conducted by state wildlife agencies or tribal wildlife authorities. Bears are normally captured by leg-hold snares or culvert traps. Lions are normally treed with dogs and shot or tranquilized.

USDA, Animal and Plant Health Inspection Service, Animal Damage Control (ADC) initiated a programmatic consultation in 1990 on the effects of the ADC program on threatened and endangered species. The FWS concluded that the use of snares, steel traps, and aerial shooting in the ADC program would not likely jeopardize the continued existence of the gray wolf. Under Section 7 of the ESA, the FWS authorized the incidental take of 1 wolf annually in each occupied state during legitimate ADC control actions. Terms and conditions in the Biological Opinion included the following: (1) an incidental take in excess of 1 wolf in any state (in a given calendar year) will result in cessation of the activity causing take and reinitiation of consultation, (2) all leghold traps shall be checked at least daily in areas known to be occupied by gray wolves, (3) neck snares shall not be used in areas known to be occupied by gray wolves except for areas where wolves may be a target species, (4) number 3 or smaller traps may pose a threat to juvenile wolves and therefore should not be used in proximity to occupied dens and rendezvous sites, (5) the FWS's Ecological Services Office, in the Regions of the species' occurrence, shall be notified within 5 days of the finding of any dead or injured gray wolf, (6) ADC personnel shall participate fully in interagency wolf monitoring programs, and (7) ADC personnel shall informally consult on an annual basis with the FWS on the current status of the wolf in areas where recolonization is occurring. The Draft Environmental Impact Statement on the ADC program concluded that the above-ground use of strychnine to control rodents and rabbits, the use of compound 1080 toxic collars to control coyotes, and the use of M-44s to control coyotes, could adversely affect the gray wolf.

In accordance with the existing label, strychnine baits should not be used in the geographic range of the gray wolf except under programs and procedures approved by the Environmental Protection Agency (EPA). EPA label restrictions also do not allow the 1080 toxic livestock collar to be used in areas where gray wolves may occur. M-44s are also prohibited in occupied gray wolf range.

The vast majority of these efforts are directed at reducing or controlling coyote depredation on cattle and sheep. These are conducted using a variety of techniques. Aerial shooting is used, but has limitations because of weather, terrain, and cost. Aerial shooting by private parties on federal land is not permitted. Other techniques include leg-hold traps and neck snares. These are primarily used at lower elevations on private land.

Only 2 toxicants are registered by the Environmental Protection Agency (EPA) for control of coyotes. These include toxic collars and M-44s. Toxic collars are placed on the necks of sheep and when bitten by a coyote expel compound 1080 (Sodium fluoroacetate). These devices are registered for experimental use, and receive extremely limited application.

M-44s contain capsules of sodium cyanide and are lethal to most mammals that activate them. Their use around Yellowstone is generally on areas of private land at lower elevations away from any area occupied by grizzly bears.

M-44s are primarily used by ADC personnel to control coyotes on private land in response to landowner requests. Use of M-44s by ADC on private lands in the Montana part of the primary analysis area may involve up to 160 ranches. The devices are not used on every ranch every year or on any ranch all year, but may be used based on the particular situation (ADC personnel, pers. commun.). There are an estimated 3,470 farms in the 7 Montana counties around Yellowstone, with an estimated 2,266 farms larger than 160 acres (0.65 km^2) (U.S. Department of Commerce 1989b). Within the Montana portion of the primary analysis area there are an estimated 717 farms larger than 160 acres (0.65 km^2) and an estimated total of 1,100.

Use of M-44s by ADC on private lands in the Idaho part of the primary analysis area may involve 10 to 15 ranches. As in Montana, the devices are not used on every ranch every year or on any ranch all year, but may be used some time during the year based on the particular situation (ADC personnel, pers. commun.). There are an estimated 2,229 farms in the 4 Idaho counties around Yellowstone, with an estimated 1,061 larger than 160 acres (0.65 km^2) (U.S. Department of Commerce 1989b). Within the Idaho portion of the primary analysis area there are an estimated 858 farms larger than 160 acres (0.65 km^2) and an estimated total of 1,802.

M-44 use in the Wyoming portion of the primary analysis area is very limited and may involve 10 to 15 ranches in the area southwest of Pinedale, Wyoming, generally south of the primary analysis area. There are an estimated 2,575 farms in the 6 Wyoming counties around Yellowstone, with an estimated 1,346 larger than 160 acres (0.65 km^2) (U.S. Department of Commerce 1989b). Within the Wyoming portion of the primary analysis area there are an estimated 252 farms larger than 160 acres (0.65 km^2) and an estimated total of 482.

M-44s may also be used by private owners on private land after the operator receives certification. However, there are no certified operators in the primary analysis area now (ADC pers. commun.). There is now no authorized use of M-44s on any public land around Yellowstone.

YELLOWSTONE: VISITOR USE

An Overview of Visitor Use

U.S. citizens and people from all over the world spend 9 million visitor days of recreation in developed sites of the Yellowstone area each year. In the national parks, more than 95% of all recreation takes place at developed sites. In national forests, developed sites account for only about 25% of recreational use, and the rest is dispersed. Federal, state, and county public recreational sites number about 460, including campgrounds, picnic areas, trailheads, interpretive sites, and boat launching facilities (GYCC 1987).

In national parks, recreational activities are constrained by the responsibility to conserve the scenery and the natural and historic objects and the wildlife for the enjoyment of future generations (P.L. 64-235, 16 U.S.C. ss 1, 2-4). Therefore, motor vehicles are confined to roads, camping is confined to specified sites, hunting is prohibited except as an elk reduction measure in Grand Teton National Park, and fishing regulations are designed to protect native species.

National forests place fewer restrictions on recreation. Therefore, forests have fewer motor vehicle restrictions, camping is allowed in most areas, hunting is allowed, and state fish and game agencies administer harvest of fish and game.

Yellowstone National Park

Recreational visitation to Yellowstone National Park has grown by more than 23% in the last 10 years, from 2,404,862 in 1982 to 3,144,405 in 1992 (Yellowstone National Park 1992a and 1993).

Yellowstone National Park visitors in 1990 (Littlejohn et al. 1990) who stayed in the park more than 1 day reported their activities included viewing wildlife (93%), seeing thermal features (85%), photography (83%), walking for pleasure (75%), and visiting visitor centers (73%).

Of overnight visitors, 84% stayed in the park's developed campgrounds, usually for 1 night. Of those who stayed outside the park, 59% stayed in hotels or cabins, commonly for 3 nights (Littlejohn et al. 1990).

The University of Wyoming (Atkinson et al. 1986) questioned Yellowstone campers about how they spent portions of their time in the park. Sightseeing (vehicle touring) was the most frequent response (77%) (Table 3-34).

Of the 2.9 million April-September visitors to Yellowstone National Park in 1991, 17,618 registered to use park backcountry campsites, for a total of 38,447 visitor use nights (Yellowstone National Park 1992b).

Table 3-34. Activity of visitors to Yellowstone National Park.

Activity	% of time
Sightseeing (vehicle touring)	77.32
Hiking, backpacking	7.79
Other (cycling, photos, etc.)	5.06
Stream fishing	4.26
Lake fishing	4.17
Swimming, boating, etc.	1.40

Table 3-35. Monthly visitation to Yellowstone National Park as percentages of annual visitation, 1981-1991[a].

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
%	1.0	1.3	0.7	1.0	6.8	18	28	25	13	4.4	0.5	0.8
				Subtotal Apr., May, and June		26[b]						

[a] Source: Yellowstone National Park 1992a.
[b] Subtotal of April, May, and June percentages as a percent of April-October totals.

Several of the alternatives identify a period from April through June as a time when human activity near active wolf dens may be restricted. Consequently recreation visitation and backcountry use in Yellowstone National Park during that period is specifically summarized. Table 3-35 lists monthly visitation to Yellowstone as percentages of annual visitation.

Both private groups and commercially outfitted parties, the latter mainly on horseback, use backcountry trails and campsites overnight during wolf denning months (Table 3-36). Because fully half of a recovered wolf population is projected to live on the northern Yellowstone elk winter range (Garton et al. 1990 and Koth et al. 1990), backcountry use in Yellowstone is broken out by north and south, and by month, to better allow evaluation of possible effects of wolf presence (Table 3-37).

Table 3-38 shows that 215 (3.5%) of visitor use nights and 90 (1.5%) of stock use nights of commercial outfitter use were counted in April-June 1992.

Table 3-36. Backcountry use in Yellowstone National Park, April-October 1992[a].

1992	Visitor use nights	% Apr.-Oct.	No. of people	No. of permits	No. of stock	Stock use nights	% Apr.-Oct.
April	199		92	36	0	0	
May	1,602	19.2[b]	968	380	0	0	1.4[b]
June	5,876		3,391	1,131	58	96	
July	14,729		9,671	2,036	788	2,800	
August	12,035		5,613	1,821	859	3,100	
Sept.	4,368		2,018	814	310	840	
Oct.	1,153		562	211	45	101	
Totals	39,962		22,315	6,429	2,060	6,937	

[a] Source: Yellowstone National Park 1992b.
[b] Sum of April-June visitor use nights (2 visitors staying 3 nights = 6 visitor use nights) and stock use nights as a percentage of April-October totals.

Day users of trails do not usually get as far from trailheads as overnight users, although there are exceptions. Commercial outfitters registered 582 day trips with 2,089 guests and using 12,043 stock days in Yellowstone National Park in 1991 (Yellowstone National Park 1992c).

Trailhead data provide an index of day use of park trails. Assuming reintroduced or recolonizing wolves might use dens in the vicinity of those recorded in the park 1916-1923 (Weaver 1978, Figure 10), some trails of importance in relation to potential wolf dens by trail users could be those listed in Table 3-39.

Backcountry use is regulated during seasons, times of day, and under other conditions to allow threatened grizzly bears to feed, rest, and rear their young free of human disturbance. Bear Management Areas will offer refugia for denning wolves in, for example, the Blacktail Area and the Antelope Area, and will offer them, along with grizzly bears, undisturbed access to elk as prey in the Washburn Area, Pelican Valley, on the Mirror Plateau, Two Ocean, and Heart Lake Area (Table 3-24). Spring, when wolves are rearing pups, coincides with maximum numbers of elk and bison available as carrion or vulnerable prey, because the height of winter die-offs is March through May (Cole 1972, Houston 1978, Mattson and Henry, 1987). Historical data (Weaver 1978), the opinions of 15 North American wolf experts (Koth et al 1990), and several projections based on computer simulation models such as those of Boyce (1990), Garton et al (1990), Boyce and Gaillard (1992) suggest where recovered wolves might live in Yellowstone. More than half of the projected 50-150 wolves may live on the winter range of the northern Yellowstone elk herd in the park.

Table 3-37. Backcountry use by month, April-October, by area in Yellowstone National Park, 1992. North is defined as areas north of the park road from West Yellowstone, Montana, to Madison, Norris, Canyon, Fishing Bridge, and East Entrance. Areas south of the road are labeled south[a].

Area of Yellowstone	Visitor use nights	No. people	Permits	Stock	Stock use nights
North					
April	164	83	32	0[b]	0
May	895	576	248	0[b]	0
June	2,437	1,676	603	52[b]	90
July	14,729	9,671	2039	780	2,784
August	12,035	5,613	1821	859	3,100
September	1,539	818	336	143	564
October	358	186	71	8	16
South					
April	35	9	4	0[b]	0
May	707	392	132	0[b]	0
June	3,439	1,715	528	6[b]	6
July	9,758	6,774	1021	308	1,119
August	7,524	3,154	965	328	1,074
September	2,829	1,200	478	167	568
October	795	376	140	37	85

[a] Source: Yellowstone National Park 1992b.
[b] Muddy trails normally preclude horseback use of park trails until July. Backcountry permits are issued before July to stock users in exceptional cases, such as periods of dry spring weather that allow drying of low elevation trails (Yellowstone National Park 1992b).

Grand Teton National Park

Grand Teton National Park records more visits than Yellowstone National Park in some years (Table 3-40), but, because visitors spend much more time seeing Yellowstone, the larger park records roughly 6 times the number of recreation visitor days (RVDs - 1 visitor spending 12 hours) than does Grand Teton National Park. Of 9 million RVDs recorded annually in the Yellowstone area, Yellowstone National Park provided about 6.5 million, and Grand Teton National Park about 1.1 million. Six national forests provided the remaining 1.4 million RVDs (GYCC 1987).

Of the approximately 2.5 million visitors to Grand Teton National Park annually, about 26,800 (1%) use the backcountry overnight. Table 3-41 shows that 13.6% of April-October

Table 3-38. Backcountry use in Yellowstone National Park by commercial outfitters, April-October 1992[a].

1992	Visitor use nights	% April-October	No. of people	No. of permits	No. of stock	Stock use nights	% April-October
April	0		0	0	0	0	
May	0		0	0	0	0	
June	215	3.5[b]	62	9	52	90	1.5[b]
July	2,733		703	100	695	2,527	
August	2,408		586	82	766	2,845	
September	663		149	21	219	662	
October	132		37	4	26	70	
Totals	6,151		1,537	216	1,758	6,194	

[a] Source: Yellowstone National Park, 1992e.
[b] Sum of April-June visitor use nights and stock use nights as a percentage of April-October totals.

Table 3-39. Trail use in YNP recorded at trailhead registers, summer 1992.

	Total	April-June use	Percent of total
Lamar River	861	256	29.7
Slough Creek	1,604	340	21.2
Specimen Ridge	508	124	24.4
Hellroaring	1,038	234	22.5
Pelican Valley[a]	1,018	closed	0.0

[a] No dens were recorded here, but several sightings, including 3 of 3 or more animals together, suggest pack activity during 1914-1926 (Weaver 1978, Figure 6). (Yellowstone National Park 1992d).

overnight visitors use Grand Teton National Park during April-June. In John D. Rockefeller Memorial Parkway, April-June backcountry use is 7.8% of the April-October total.

Grand Teton National Park permits 31 concessioners to offer cabins, camping, mountaineering, lake tours, fishing, river floating, boat rentals, local or day use horse rides, and backcountry backpacking or horsepacking trips. These services reached 607,995 visitors in 1992. Six of the 31 concessioners offered backcountry horsepacking or backpack trips that served 2,458 visitors, or 0.4% of the 1992 total served by concessioners (Grand Teton National Park 1992c). Table 3-42 lists numbers of parties and visitors taken into the Grand

Table 3-40. Recreation travel to Yellowstone National Park and Grand Teton National Park, 1982-1991 compared[a].

	Grand Teton	Yellowstone
1982	3,446,260	2,404,862
1983	2,571,204	2,405,653
1984	2,239,513	2,262,969
1985	2,130,210	2,262,455
1986	2,180,361	2,405,063
1987	2,428,640	2,618,249
1988	2,076,698	2,219,128
1989	2,438,131	2,680,376
1990	2,680,777	2,857,096
1991	2,862,158	2,957,856
Ten-year average	2,505,400	2,510,700

[a] Source: YNP 1992a, GTNP 1992a.

Table 3-41. Grand Teton National Park (GTNP) and John D. Rockefeller Memorial Parkway (JDRMP) backcountry use, April-June, and April-October 1991[a].

1991	April	May	June	April-October
GTNP visitor use nights[b]	57	452	3,143	26,842
% of April-October total	0.2+	1.7+	11.7 =	(13.6%)
JDRMP visitor use nights	48	6	11	322
% of April-October total	2.5+	1.9+	3.4 =	(7.8%)

[a] Source: Grand Teton National Park 1992b.
[b] V.U. nights: 2 visitors staying 3 nights = 6 visitor use nights.

Teton National Park backcountry April to October, 1992; 17 parties totaling 93 visitors by horse, and 94 parties totalling 2,365 visitors by backpack.

National Forests

The 6 national forests surrounding Yellowstone National Park and Grand Teton National Park provided a total of 9,176,800 Recreation Visitor Days in 1992 (Table 3-43).

Table 3-42. Grand Teton National Park concessioner backcountry trips April to October 1992[a].

1992	June[b]	July	August	September	Totals
Horsepacking					
Parties	0	3	11	3	17
Visitors	0	16	57	20	93
Backpacking					
Parties	12	58	22	2	94
Visitors	141	1,653	499	72	2,365

[a] Source: Grand Teton National Park 1992c.
[b] No backcountry trips by concessioners were recorded in April, May, or October, and they do not operate in the winter months.

Use of Yellowstone area national forests by commercial outfitters is recorded and reported differently between forests, and forestwide figures for the Gallatin National Forest, for example, would represent use of areas both within and outside the analysis area.

In 1991, Beaverhead National Forest recorded 19 outfitters providing 2,806 use days (2 visitor x 2 days = 4 use days). Custer National Forest, Beartooth District recorded 17 outfitters providing 3,710 use days. Gallatin National Forest recorded 83 outfitters providing 15,532 service days, including the part of the forest north of I-90. Shoshone National Forest recorded 99 outfitters providing 20,385 service days. Targhee National Forest recorded 68 outfitters providing 13,677 service days. In 1992, 5 ranger districts on the Bridger-Teton National Forest (Big Piney, Buffalo, Greys River, Jackson, and Pinedale) reported a total of 240 outfitters providing 75,247 service days. Those 5 districts reported 111 outfitters provided 41,902 service days in summer using pack stock, 32 outfitters provided 16,776 service days in summer on foot (backpacking), and 97 outfitters provided 16,565 service days in fall, hunting (BNF 1992b, B-TNF 1992b, CNF 1992b, GNF 1992b, SNF 1992b, TNF 1992b).

National Wildlife Refuges

Red Rock Lakes National Wildlife Refuge, occupying 69 mi^2 of the Centennial Valley 45 miles west of Yellowstone National Park, receives an estimated 10,000-13,000 recreation visits annually. About 85% of the refuge visits are for wildlife observation (Red Rock Lakes National Wildlife Refuge 1990).

Table 3-43. Beaverhead, Bridger-Teton, Custer, Gallatin, Shoshone, and Targhee National Forests recreation use, by Recreation Inventory Management (RIM) Activity Group, FY 1992, in thousands of Recreation Visitor Days (RVDs)[a]. Percentages of grand total of recreation activities are in parentheses.

RIM activity grouping	Beaverhead	Bridger-Teton	Custer[b]	Gallatin	Shoshone	Targhee
Camping, picnicking, swimming	109.1 (30)	663.2 (25)	157.1 (31)	425.9 (15)	332.3 (27)	462.6 (28)
Mechanized travel and viewing scenery	73.5 (20)	753.1 (28)	91.6 (18)	858.5 (31)	393.0 (32)	329.1 (20)
Hiking, horseback, and water travel	41.0 (11)	728.9 (27)	75.6 (15)	453.7 (16)	97.8 (8)	99.6 (6)
Winter sports	11.5 (3)	129.7 (5)	60.6 (12)	192.7 (7)	16.3 (1)	116.2 (7)
Resorts, cabins, organization camps	12.8 (3)	67.1 (2)	27.1 (6)	113.6 (4)	157.8 (13)	210.6 (13)
Hunting	82.7 (22)	160.8 (6)	21.3 (4)	210.6 (7)	84.7 (7)	119.0 (7)
Fishing	26.6 (7)	95.8 (4)	46.6 (9)	243.3 (9)	78.6 (7)	90.0 (6)
Non-consumptive wildlife use	2.0 (1)	0.5 (0)	10.5 (2)	16.0 (1)	18.9 (2)	10.8 (1)
Other recreational activities	10.5 (3)	67.6 (3)	14.7 (3)	283.6 (10)	31.0 (3)	189.1 (12)
Grand Total	369.7 (100)	2,666.7 (100)	505.1 (100)	2,797.9 (100)	1,210.4 (100)	1627.0 (100)
Wilderness total use (included above)	39.0 (11)	543.5 (20)	141.5 (28)	291.8 (10)	173.6 (14)	45.1 (3)
Total number of recreational visits (thousands)[c]	485	87,800	680	3,968	2,714	1,781
Percentage of forest area within the primary analysis area	19	79	100[b]	90	97	83

[a] Recreation Visitor Day (RVD): One visitor spending 12 hours recreating on a national forest. Sources: Beaverhead National Forest 1992a; Bridger-Teton National Forest 1992a, Custer National Forest 1992a, Gallatin National Forest 1992a, Shoshone National Forest 1992a, Targhee National Forest 1992a.
[b] Beartooth Ranger District only.
[c] A recreation visit is an entry of one person upon a national forest to participate in one or more recreation activities for an unspecified period of time.

Yellowstone Area

The National Elk Refuge, northeast of Jackson, Wyoming, received 704,929 visits in calendar year 1991. Most (355,746) were engaged in non-consumptive wildlife recreation, 1,445 were hunters, and 1,838 were fishers (National Elk Refuge 1992).

YELLOWSTONE: ECONOMICS

The 17 counties that constitute the Yellowstone area have a combined population of 288,000. Population growth has followed the same trend as the population in the region. The population of these 17 counties accounts for about 13% of the population of the 3 state region. About 17% of the people in the counties are aged 55 or older, slightly younger than the national average.

Per capita income was $14,676 in 1990 (Table 3-44). Real per capita income fell in the mid-1970s relative to the regional total to about 95%. Otherwise it followed the same trend as the regional real per capita income (remained relatively constant through the 1980s and showed some growth in 1989 and 1990).

Table 3-44. Per capita personal income trends in 3 state region and primary analysis areas: 1970-1990.

Area	1970 per cap. income[a]	1980 per cap. income[a]	1990 per cap. income.
3 state region (Idaho, Montana, Wyoming)	11,554	14,218	15,475
17 county Yellowstone area	11,520	13,514	14,676
10 county central Idaho area	11,712	13,839	15,552

[a] Dollar figures are adjusted to 1990 price levels.

Total personal income in the 17 county Yellowstone area was $4.2 billion in 1990, about 12% of the 3 state regional total--reflecting the slightly lower per capita income. The allocation of total personal income across sources is similar to the regional economy (Table 3-45). Farming and agricultural services account for about 6% and has fallen from about 11% in the early 1970s. Livestock accounted for about 56% of the value of farm products sold in 1987--a slightly higher percentage than in the region. Local services have consistently generated slightly less than 40% of total personal income. Other industry, however, is relatively less important--falling from about 27% in the early 1970s to 20% in 1990. In contrast, income other than earnings is relatively more important and has grown more rapidly than in the regional economy during the past 2 decades from 23% to 34% (Table 3-45). This reflects the relatively high amenity value of living in the area associated

Table 3-45. Major economic sectors as a percentage of total personal income: 3 state region and primary analysis areas.

Area	1970 percent of total personal income	1980 percent of total personal income	1990 percent of total personal income
	3 state region		
Farm income	10.9	4.8	5.6
Livestock income (1987)			2.9
Local services	40.0	38.1	39.9
Other industry	29.0	33.2	24.2
Non-earnings income	20.1	23.9	30.3
	Yellowstone area (17 counties)		
Farm income	11.3	5.7	6.4
Livestock income (1987)			3.6
Local services	38.9	38.2	39.5
Other industry	26.6	28.7	19.8
Non-earnings income	23.2	27.4	34.3
	Central Idaho (10 counties)		
Farm income	8.0	6.5	8.0
Livestock income (1987)			5.2
Local services	31.1	30.9	34.6
Other industry	41.4	36.9	24.8
Non-earnings income	19.4	25.7	32.6

with the proximity of Yellowstone and Teton National Parks and their various programs for protecting wildlife populations, ecosystem health, and access to outdoor recreation.

CENTRAL IDAHO: THE REGION

The state of Idaho covers nearly 53 million acres (214,700 km^2) in the northwestern U.S. Almost 64% of Idaho is federal land. The USDA Forest Service and U.S. Bureau of Land Management manage over 20 million (81,000 km^2) and 11 million acres (44,600 km^2), respectively. Table 3-59 (page 3-113) summarizes the central Idaho area information.

The state population grew from 713,015 people in 1970 (8.7 people/mi^2; 3.4/km^2) to 1,006,749 people (12.2 people/mi^2; 4.7/km^2) in 1990. About 43% of the population is rural. Most of the population occurs in the southern, more developed part of the state. Boise, the state capital, is the largest city with a 1990 population of 125,738 people, followed by Pocatello (46,062 people) and Idaho Falls (43,929 people).

Ten counties, encompassing 22,687,424 acres (91,900 km^2), are included in central Idaho (Figure 3-22). Within the 10 county area, 15,103,951 acres (61,200 km^2; 67%) are managed by the USDA Forest Service and 3,405,107 acres (13,800 km^2; 15%) are privately owned (Table 3-46). The army land is managed by a variety of federal and state agencies and tribes.

Table 3-46. Land ownership in acres by county in the general central Idaho area.

County	USDA Forest Service	U.S. Bureau of Land Management	Tribal	Private	State	Other[a]	Total
Shoshone	1,191,727	70,100	0	346,421	74,357	3,155	1,685,760
Clearwater	789,158	12,677	7,325	492,728	234,146	39,390	1,575,424
Idaho	4,428,680	93,319	5,101	822,978	78,798	1,652	5,430,528
Boise	872,055	31,744	0	197,234	85,132	31,435	1,217,600
Elmore	783,145	530,313	0	415,536	124,253	116,545	1,969,792
Valley	2,029,738	5,093	0	204,015	74,314	40,888	2,354,048
Blaine	489,636	796,272	0	320,494	60,321	26,013	1,692,736
Camas	323,546	120,490	0	216,426	25,075	2,463	688,000
Custer	2,123,047	813,041	0	160,775	53,194	2,327	3,152,384
Lemhi	2,073,219	579,405	0	228,500	38,152	1,876	2,921,152
Totals	15,103,951	3,052,454	12,426	3,405,107	847,742	265,744	22,687,424

[a] Includes: Bureau of Reclamation, United States Air Force, National Park Service, U.S. Army Corp of Engineers, USFWS, and municipal lands.

The 10 counties support a population of 92,353 people at a density of 2.6 people/mi^2 (1.0/km^2; Table 3-47). With the exception of Elmore County, populations in all counties

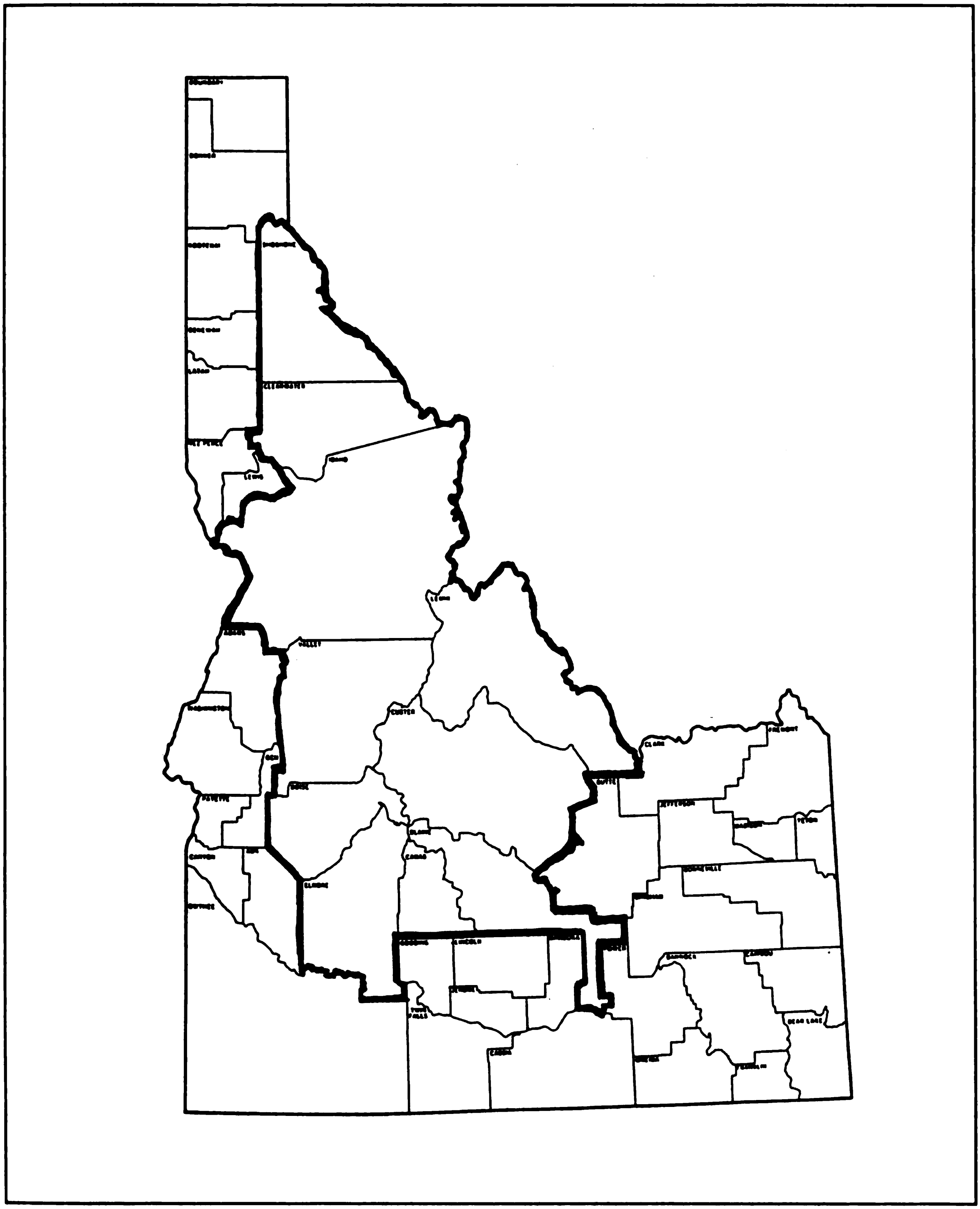

Figure 3-22. Affected 10 county central Idaho area.

are >50% rural. Boise, Valley, Camas, and Custer County populations are all considered 100% rural. The 10 county area supports 2,527 farms covering 2,252,929 acres (9,100 km^2; Table 3-47).

Table 3-47. Number and density of people and farms in 10 counties covering central Idaho[a].

Counties	Area (mi^2)	Population	Density/mi^2	Percent rural	Total farms	Total acres in farms
Shoshone	2,634	13,931	5.3	81.4	46	5,148
Clearwater	2,461	8,505	3.5	66.3	216	134,891
Idaho	8,485	13,783	1.6	76.6	774	802,746
Boise	1,903	3,509	1.8	100.0	73	66,811
Elmore	3,078	21,205	6.9	34.7	341	401,677
Valley	3,678	6,109	1.7	100.0	113	81,819
Blaine	2,645	13,552	5.1	54.2	221	246,774
Camas	1,075	727	0.7	100.0	117	174,842
Custer	4,926	4,133	0.8	100.0	261	137,022
Lemhi	4,564	6,899	1.5	57.4	365	201,199
Totals	35,449	92,353	2.6		2,527	2,252,929

[a] Idaho Dept. of Commerce (1992).

The primary analysis area in central Idaho for the gray wolf EIS includes about 13,300,000 acres (53,900 km^2) of contiguous national forests in central Idaho (Figure 3-23). These include the Bitterroot, Boise, Challis, Clearwater, Nez Perce, Payette, Sawtooth, Salmon, and Panhandle National Forests. A few scattered parcels of private and state land are interspersed throughout this area, but the total acreage is minor.

The center of the central Idaho primary analysis area is characterized by 3 wilderness areas covering a contiguous area of almost 4 million acres (16,200 km^2). These include the Frank Church River-of-No-Return (2,361,767 acres; 9,565 km^2), the Selway-Bitterroot (1,340,681 acres; 5,430 km^2) and the Gospel-Hump (206,053 acres; 835 km^2) wilderness areas.

The River-of-No-Return Wilderness Area covers parts of Custer, Idaho, Lemhi, and Valley counties and is administered by 6 national forests, including the Bitterroot, Nez Perce, Boise, Challis, Payette, and Salmon. The Selway-Bitterroot Wilderness Area covers parts of Idaho and Clearwater counties and is administered by the Nez Perce, Clearwater, and Bitterroot National Forests. The Gospel-Hump Wilderness Area is contained entirely within Idaho County and the Nez Perce National Forest.

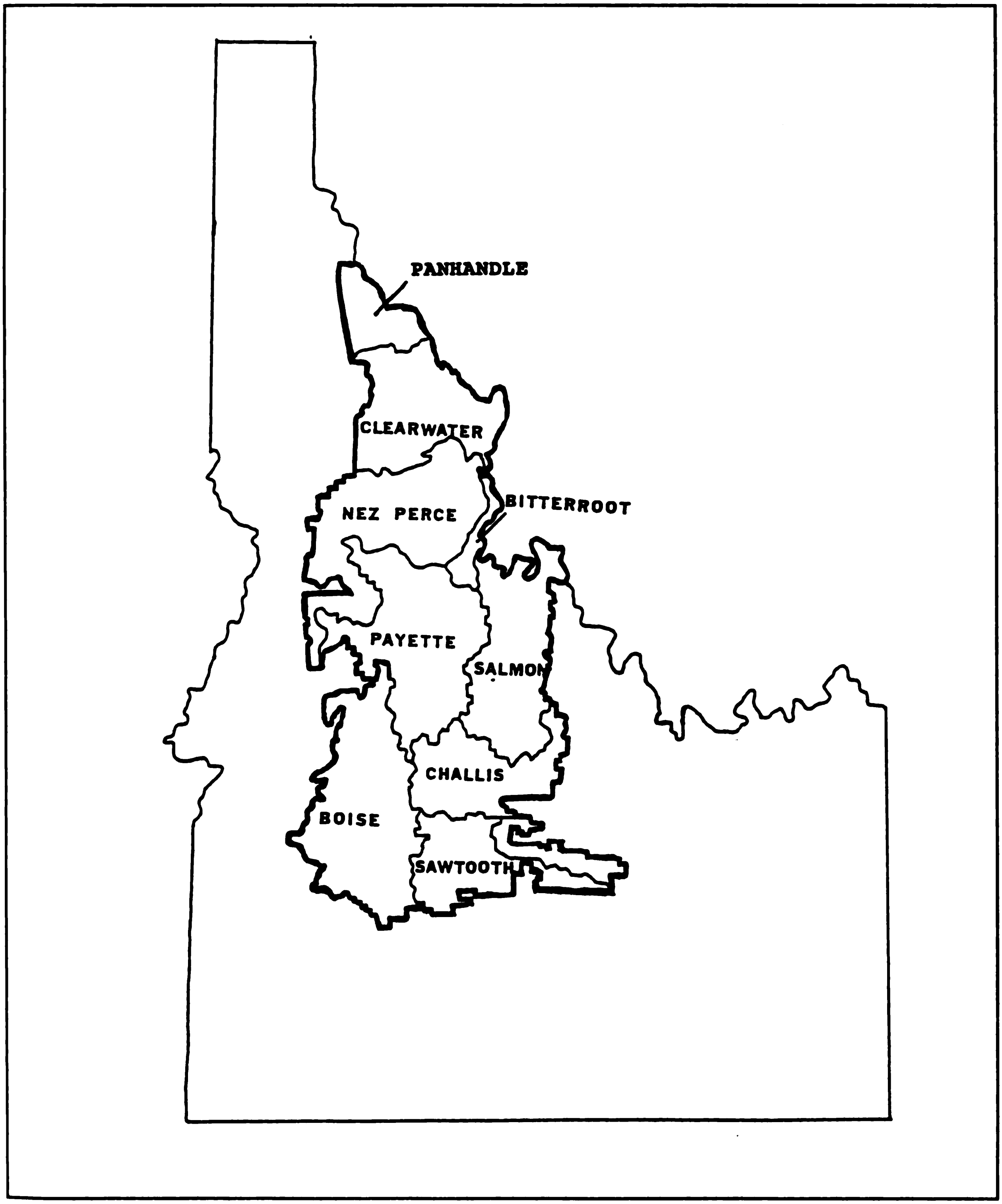

Figure 3-23. Nine contiguous national forests comprising the central Idaho primary analysis area.

Landscape

The Northern Rocky Mountain physiographic province includes the mountain ranges of central Idaho. The central Idaho primary analysis area contains 3 major mountain ranges--the Salmon River Mountains (south of the Salmon River), the Clearwater Mountains which extend from the Salmon River north to the upper Clearwater River drainage, and the Bitterroot Mountains which form the eastern border of the central Idaho recovery area along the Idaho-Montana border.

Most of central Idaho is characterized by rugged terrain and steep slopes. Elevations range from about 1,500 feet (460 m) along the Clearwater River in the northern portion of the central Idaho area to over 12,000 feet (3,700 m) on Hyndman Peak in the Sawtooth National Forest, near the southern portion of the central Idaho area.

The area varies from deeply incised canyons formed by rivers cutting through sheer rock to rolling basin lands at higher elevations. Soils throughout the area are characterized predominantly by the Idaho batholith, a highly erosive and course-grained granite.

Water Resources

The southern half of the central Idaho area provides water to the Salmon and Snake Rivers. The northern half of the central Idaho area drains primarily into the Clearwater River. Both the Salmon and Clearwater Rivers empty into the Snake River along the western border of Idaho, before the Snake empties into the Columbia River near Pasco, Washington. In total, the central Idaho area annually provides over 19 million acre feet of water to the Columbia River system.

Climate

The major modifying influence on climate throughout the central Idaho area is topography. Climate varies from the warm, dry Salmon River breaks to cool, moist subalpine areas. Annual precipitation varies from less than 14 inches at lower elevations to nearly 100 inches at high elevations. Most precipitation occurs during late fall through early spring. Precipitation at higher elevations is mostly in the form of snow.

Summers are dry with temperatures often exceeding 100°F, and winters are long with sub-zero temperatures common. Extremes of -50°F are occasionally reached.

Mean annual precipitation increases from the southern to the northern portions of central Idaho. Highest annual precipitation (about 100 inches) is found on the Bitterroot Divide along the Idaho/Montana border in the Clearwater National Forest.

Vegetation

Mountains of the central Idaho primary analysis area are covered by 3 major vegetation community types. The wide elevational range and accompanying climatic variations result in diverse flora. The grand fir/Douglas-fir, Engelmann spruce, subalpine fir habitat type is the most common, and occurs throughout central Idaho (IDPR 1989). The western red cedar/western hemlock type is more frequent in the northern portions of the area, and the ponderosa pine type exists intermittently throughout the central Idaho primary analysis area.

Vegetation varies by terrain, soils, aspect, elevation, and other factors. Below 4,000 feet (1,200 m), open slopes with brome, bluebunch wheatgrass, and Idaho fescue are common. Near 4,000 feet (1,200 m), grass types begin to give way to open ponderosa pine types. Subalpine fir and several types of lodgepole pine begin to appear at 5,000 feet (1,500 m) to 6,000 feet (1,800 m). Near-alpine habitat is found in the highest elevational areas.

Wildlife

Central Idaho contains a wide variety of habitats and wildlife species. Approximately 400 species of mammals, birds, amphibians, and reptiles inhabit the primary analysis area. The Idaho Department of Fish and Game (IDFG) is responsible for managing wildlife populations within the state. Major big game species in the primary analysis area include post harvest populations of approximately 76,300 elk, 129,700 mule deer, 29,900 white-tailed deer, 1,700 moose, 2,000 mountain goats, and 1,800 bighorn sheep (241,400 total ungulates). Black bears and mountain lions are also abundant throughout central Idaho. Coyotes, bobcats, lynx, fishers, martens, wolverines, and river otters are other predators present. Small numbers of grizzly bears and mountain caribou occur in the Idaho panhandle just north of the primary analysis area. Several reports of wolves have been received throughout the state in recent years, but few have been confirmed, and there is no evidence that successful reproduction has occurred.

Hunting is a major influence on dynamics of ungulate populations. In 1991, hunters harvested about 33,000 total ungulates in 36 big game management units in the central Idaho primary analysis area (Figure 3-24). The 1991 total harvest represents about 12% of the central Idaho pre-harvest ungulate population.

Gray Wolf

By the late 1930s, wolves had been virtually eliminated from Idaho and the rest of the continental western U.S. USDA Forest Service records estimated 48 wolves remained on national forest lands in Idaho in 1939 (Young and Goldman 1944). The gray wolf is currently listed as endangered.

Kaminski and Hansen (1984) suggested that no more than 15 wolves occurred in Idaho. No reproduction or pack activity has been documented. The IDFG's Conservation Data Center

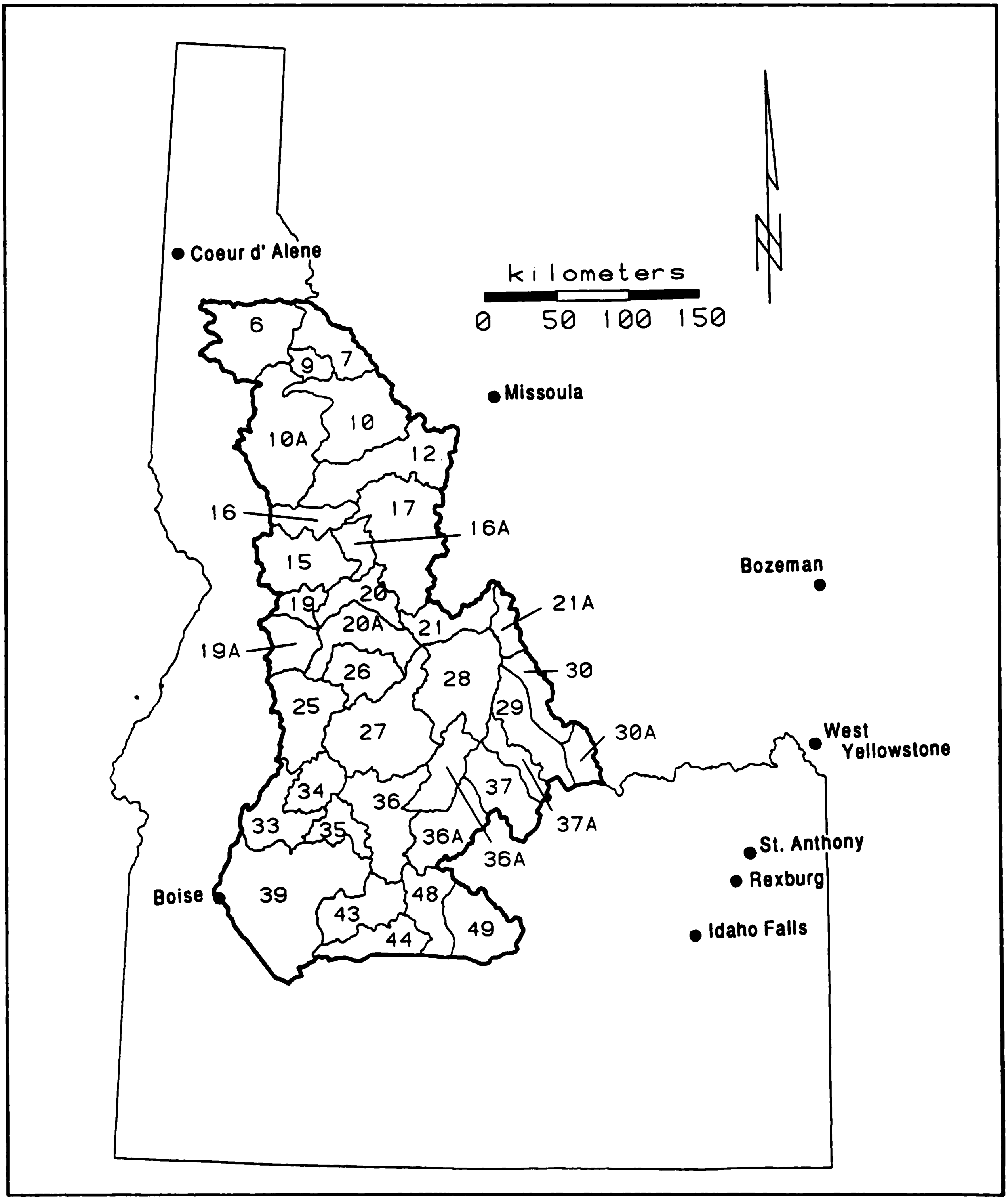

Figure 3-24. Idaho Department of Fish and Game big game management units considered in analysis of ungulates in the central Idaho primary analysis area.

maintains a database on Idaho wolf reports (tracks, sightings, howls, and scats). Almost 80% of the over 600 reports recorded since 1971 have been of single animals.

Reports of wolves in Idaho continue. A lone radio-collared male wolf is inhabiting the Clearwater National Forest. This wolf was radio-collared during field research in the North Fork of the Flathead River drainage in Montana and has dispersed into Idaho. A lone radio-collared female wolf travelled into the Idaho Panhandle National Forest for a short time in 1991, but soon returned to Canada. A large canid believed to be a wolf died from poisoning in the Bear Valley area in the Boise National Forest in August 1991. A large canid that appears to be a wolf was photographed near the Salmon National Forest in 1992. Throughout the last decade, the largest concentration of wolf reports have occurred in the Kelly Creek area in the Clearwater National Forest and the Bear Valley area in the Boise National Forest.

CENTRAL IDAHO: UNGULATE POPULATIONS AND HUNTER HARVEST

Ungulate Populations

Elk

Population distribution and statistics.--Elk winter along river bottoms of most major drainages in central Idaho, and are distributed throughout the primary analysis area in summer. IDFG wildlife managers estimate that elk populations in Idaho's core backcountry and wilderness areas are probably stable, while populations in the southern portion of the central Idaho primary analysis area appear to be increasing. Corrected sightability estimates from post-harvest survey flights indicated approximately 76,300 elk were present in the 36 Management Units included in the primary analysis area in early winter 1992. Current estimates of population size are considered to be the most reliable estimates ever available for elk in Idaho. Population structure was estimated at 25 bulls:100 cows:35 calves (Table 3-48).

Management objectives.--The IDFG manages elk under a 5-year plan (Unsworth 1991) structured to provide for a number of quality objectives and hunting opportunities in central Idaho. An integral part of Idaho's elk management program is to maintain the current post-season ratio of bulls:cows and the proportion of branch-antlered bulls:yearlings in the harvest. The IDFG believes these ratios are desired by the majority of sportsmen who hunt in Idaho.

The IDFG shifted to a bulls-only harvest strategy with a conservative cow harvest in the 1970s, and populations increased. This shift to bulls-only harvest has helped meet the goal of increasing elk populations, but in areas with high hunter density, heavy bull harvest has resulted in low bull:cow ratios.

Human access into elk habitat is the primary problem associated with roads and timber harvest. With increasing access and numbers of hunters, continued bulls-only hunting will

Table 3-48. Estimated population parameters and 1991 harvest numbers of elk, mule deer, white-tailed deer, bighorn sheep, mountain goats, and moose (by Idaho Department of Fish and Game hunting unit) in central Idaho gray wolf recovery area.

		Population numbers (Postharvest)				Classification ratio	Estimated harvest		
Species	Hunt units	Male	Female	Young	Total	Male:Female:Young	Male	Female	Total
Elk[a]	6-49[b]	11,877	47,673	16,750	76,300	25:100:35	8,137	3,957	12,094
Mule deer[c]	6-49[b]				129,667				15,774
White-tailed deer[d]	6-39[e]				29,908		3,517	1,709	5,226
Bighorn sheep[f]	17-37A[g]	442	1,187	141	1,780	37:100:12			66
Mountain goats[h]	9-49[i]		1,285	306	2,017	100:22[j]			35
Moose	6-29[k]				1,700		149	0	149

[a] Elk population estimates are for 1992 (Kuck and Nelson 1992a), except for hunting units 43, 44, 48, and 49 which are projected population estimates in Toweill (1985). Harvest estimates from Kuck and Nelson (1992a).
[b] Includes hunting units 6, 7, 9, 10, 10A, 12, 15, 16, 16A, 17, 19, 19A, 20, 20A, 21, 21A, 25, 26, 27, 28, 29, 30, 30A, 33, 34, 35, 36, 36A, 36B, 37, 37A, 39, 43, 44, 48, and 49.
[c] Estimated mule deer population is based on 1990 projected population size as reported in Trent (1985), but includes estimates from Kuck and Nelson (1992b). Harvest estimates from Kuck and Nelson (1992b), except that mule deer harvest estimates for units 6, 7, 9, 10, and 10A were based on calculations of average proportion of harvest from each unit Region 1, Group 1 and Region 2, Group 1 units (Scott 1991:43).
[d] Estimated white-tailed deer population is based on 1990 projected population size (Hanna 1985). Harvest estimates from Kuck and Nelson (1992c).
[e] Includes hunting units 6, 7, 9, 10, 10A, 12, 15, 16, 16A, 17, 19, 19A, 20, 20A, 21, 21A, 29, 30, 33, 35, and 39.
[f] Bighorn sheep population numbers from 1991 and 1992 (Oldenburg 1992b). Harvest data for 1991 (Oldenburg 1992b).
[g] Includes hunting units 17, 19, 20, 20A, 21, 26, 27, 28, 30, 36A, 36B, 37, and 37A.
[h] Mountain goat population estimates reflect actual number of goats counted during 1988, 1990, 1991, and 1992 surveys, including 56 unknowns, plus 370 from 1990 population estimates (Hayden 1990). Harvest estimates from Oldenburg (1992c).
[i] Includes hunting units 9, 9A, 10, 12, 17, 19, 20, 20A, 21A, 25, 26, 27, 29, 30, 35, 36, 36A, 36B, 37A, 39, 43, 48, and 49.
[j] Ratio of adults:kids.
[k] Includes hunting units 6, 7, 9, 10, 12, 15, 16, 16A, 17, 19, 20, 20A, 21, and 29.

inevitably result in low bull:cow ratios. Even with comprehensive access management, hunter numbers may eventually be so great that remaining security cover will be inadequate to ensure survival and maintain the age structure of the bull population. IDFG has been limiting total numbers of hunters, and is trying to achieve greater dispersal of elk hunters. A statewide limit on number of elk hunters would help prevent a further decline in the proportion of mature bulls in Idaho's elk herds. However, many changes in season dates, season lengths, weapon restrictions, etc., can also be implemented to allow the IDFG to achieve its biological goals.

Current annual sales of more than 106,000 elk tags has resulted in significant increases in the elk harvest throughout the state. IDFG has developed a strategy to increase or maintain the proportion of mature bulls in the elk population by limiting numbers of hunters in some portions of the state and by limiting the type of elk harvested in other areas. General elk seasons are also being shifted out of the breeding period in areas with moderate to high access. Controlled hunts are offered to regulate elk herd size within management units when desired levels cannot be achieved with general hunts.

Although management objectives vary by hunting unit, wildlife managers would like to increase bull:cow ratios in most units, and stabilize or increase elk populations. The current estimate of 25 bulls:100 cows in the primary analysis area exceeds the overall goal for central Idaho management units.

Hunting seasons and harvest.--General hunting seasons for elk vary by management unit, but generally run from about mid-October to the end of the first week of November. Seasons in some mountain units run mid-September through mid-November. Archery seasons run from the end of August through the third week of September, and muzzleloader season is held during the last week of November. IDFG estimates that hunters harvested 8,137 bulls and 3,957 cows (Table 3-48) in central Idaho during 1991. Approximately 13.7% of the pre-hunt elk population was harvested by hunters during 1991, including an estimated 40.7% of the bulls (>1 year old), and 7.7% of the cows (>1 year old).

Mule deer

Population distribution and statistics.--Mule deer winter along river bottoms of most major drainages in central Idaho, and are distributed throughout the primary analysis area in summer. Mule deer are the most abundant wild ungulate in the primary analysis area. Approximately 129,700 mule deer inhabit central Idaho hunting units (Table 3-48), but little information is available on population structure. In Idaho today, increases can be expected in some herds, but many populations appear to be at or near carrying capacity (Scott 1991), and some may be declining.

Management objectives.--Hunting is the primary factor influencing the size, growth rate, and structure of mule deer populations. Buck-only hunting has been successful in increasing many herds, but some other herds have experienced little growth in spite of 10 years of antlered-only regulations.

IDFG's mule deer management goals for 1991-1995 include: (1) maintain present population size in most units and allow increases in some units; (2) maintain or increase buck:doe ratios in all units; and (3) maintain or increase the mature buck portion of the mule deer population in most units (Scott 1991).

Hunting seasons and harvest.--IDFG's strategy for the general mule deer seasons in central Idaho during 1991-1995 will be to maintain standard 15 or 25 day seasons opening on October 5. Antlerless seasons will vary in length from 0-25 days to meet management objectives for total deer numbers in each hunting unit. Sixty-five day seasons in remote central Idaho units will open September 15 and be concurrent with elk seasons. Mule deer are legal game for archers in most units for 4 weeks beginning August 30, and hunters using muzzleloaders may harvest deer during 2 weeks between the middle of November and the middle of December, depending on the management unit.

From 1985 to 1988, statewide harvest of mule deer increased 68% from 30,786 to 51,706. Harvest of female mule deer increased 93%, and harvest of males increased 50%. Hunters harvested an estimated 15,774 mule deer (10.7% of pre-hunt population) in central Idaho management units (Table 3-48) in 1991, of which approximately 63% (approximately 9,938) were bucks.

White-tailed deer
Population distribution and statistics.--White-tailed deer are the most abundant big game species in northern Idaho, but because of development of habitat, it is unlikely that whitetails will ever again reach peak population levels of the 1940s and 1950s. Whitetails are abundant only in the northern management units in the primary analysis area, or roughly, the portion of the state north of the Salmon River (Rybarczyk 1991). Whitetails were historically more widespread in Idaho, but were apparently extirpated from other areas by over hunting and changes in land use during the early 1900s.

IDFG wildlife managers estimate approximately 29,900 whitetails are present in the primary analysis area (Table 3-48), and populations are stable or increasing. In areas experiencing rapid human population growth in Idaho today, white-tailed deer populations will probably decline, but in those portions of their range where they are found on large tracts of public land, white-tailed deer are expected to flourish indefinitely. Population size and structure information is difficult to collect for white-tailed deer, and may vary greatly among herds and between years. Consequently, reliable information is available only for a few well-studied herds.

Management objectives.--IDFG intends to maintain hunting opportunities by general, either-sex seasons beginning on the same day as general elk season whenever possible, and maintain availability of mature (4-point-plus) bucks. IDFG would like to maintain white-tailed deer populations under natural conditions on their traditional range and acquire crucial portions of whitetail range when possible. The IDFG's 5-year goals (Rybarczyk 1991) for 1991-1995 include: (1) Maintain white-tailed deer populations in north and north-central Idaho at current levels; (2) maintain harvest and increase recreational hunting opportunity in the major white-tailed deer management units; (3) manage all units north of the Salmon River, except Unit 14, with a season framework designed primarily for white-tailed deer; (4) manage all units south of the Salmon River, and Unit 14, with a season framework designed primarily for mule deer; and, (5) maintain at least 40% of the buck harvest in the 4-point-plus category.

Hunting seasons and harvest.--Most deer seasons north of the Salmon River are directed toward harvesting white-tailed deer and open on October 10, the same day as the general elk season. South of the Salmon River, deer seasons are directed toward harvesting mule deer, and many open October 5. Seasons in Region 2 units are either-sex until November 10 when they become antlered-only and continue through November 20. November seasons south of the Salmon River are controlled 15-day "quality" hunt opportunities that begin November 10. Thirty-day archery seasons begin August 24, and muzzleloader seasons begin November 10 or 25 and are 20 or 15 days in length, respectively. Idaho's statewide white-tailed deer harvest has increased more than 90% in the past 15 years (Rybarczyk 1991), and in 1991, hunters harvested an estimated 3,517 bucks and 1,709 does (total = 5,226 whitetails) in the primary analysis area (Table 3-48). Approximately 14.9% of the white-tailed deer population was harvested. Data on whitetail population size are difficult to collect, but most populations in Idaho are probably not being harvested as heavily as possible, in spite of liberal either-sex seasons that have been in place in some units for many years (Rybarczyk 1991).

Moose

Population distribution and statistics.--Dense cover, low moose densities, and the solitary habits of moose render population surveys ineffective in central Idaho. No herd composition or population trend work is currently being conducted specifically for moose. IDFG estimated moose would number about 1,700 in 1990 in management units in the central Idaho primary analysis area (Hayden 1985).

Management objectives.--Emphasis has been placed on providing hunters an opportunity to harvest an older bull. As a result, the number of permits offered annually is low, and hunter success is high.

Hunting seasons and harvest.--Moose permits are in great demand in central Idaho. To allow a fairer distribution of available permits, any person who kills a moose is prohibited from applying for a moose permit again. Anyone who draws a permit but is unsuccessful at killing a moose may not apply for another permit during the next 2 years. Presently, only Idaho residents and non-resident lifetime licensees may apply for a moose permit. Moose hunting season opens August 30 and extends through Thanksgiving weekend in central and northern Idaho.

In 1991, 149 of 185 permittees in central Idaho management units killed a bull moose (Table 3-49). About 8.1% of the pre-hunting season moose population was harvested by controlled-hunt permittees. In addition to moose harvested by permittees, Indian hunters killed at least 14 moose in central Idaho, 18 moose were known to be killed illegally, and 3 moose were killed by automobiles (Table 3-49). Moose harvest by Indians under treaty rights is not regulated by IDFG and may be an important mortality factor for some moose populations. Some Indian tribes regulate harvest of moose by tribal members to help improve management of affected moose populations.

Table 3-49. Harvest and known mortalities of moose in central Idaho hunting units in central Idaho gray wolf recovery area, 1991[a].

		1991 harvest					
Unit	Permits	Bulls	Cows	Total	Indian harvest	Illegal kill	Other
6	2	2	0	2			
7	4	4	0	4			
9	2	2	0	2			
10	25	18	0	18	0	4	1
12	44	38	0	38	2	2	1
15	35	32	0	32	11	4	1
16	8	8	0	8	0	1	0
16A	4	4	0	4	0	0	0
17	31	15	0	15	0	6	0
19	12	9	0	9	1	1	0
20	10	9	0	9	0	0	0
20A	2	2	0	2			
21	3	3	0	3	0	0	0
29	3	3	0	3	0	0	0
Total	185	149	0	149	14	18	3

[a] Data from 1992 Moose PR Report (Oldenburg 1992a).

Illegal killing of moose is a major problem. Statewide data indicate that about 50% of all known moose mortality is from causes other than the IDFG's controlled hunts (Leege 1990). Illegal kills account for a high percentage of these mortalities.

Bighorn sheep

Population distribution and statistics.--Idaho historically had 2 subspecies of bighorn sheep--the Rocky Mountain bighorn sheep (*Ovis canadensis*) and the California bighorn sheep (*Ovis canadensis californiana*). California bighorn sheep occupy canyon and mountain habitats in the Owyhee River and Bruneau River drainages in southwest Idaho outside the primary analysis area, and are not considered in this EIS. Rocky Mountain bighorns were, at one time, widespread throughout central Idaho. Reports by early explorers, settlers, and trappers suggest that bighorn sheep were one of the most abundant large mammals in the state (Hanna 1990).

In 1991 and 1992, IDFG biologists counted 1,780 Rocky Mountain bighorn sheep in central Idaho, including 442 rams, 1,187 ewes, and 141 lambs (Table 3-48). Ten animals could not be classified during the survey. The Rocky Mountain bighorn sheep population in the primary analysis area is estimated to be static (Hanna 1990), but disease outbreaks have resulted in recent population declines in some units (Oldenburg 1992b).

Management objectives.--IDFG's management goals for the 1991-1995 period (Hanna 1990) include: (1) Increase Idaho's current bighorn sheep population and allow a corresponding increase in harvest and recreational opportunity; (2) establish new herds by transplanting bighorn sheep; (3) recognize and promote the non-consumptive values of bighorn sheep; (4) survey all bighorn sheep populations with a helicopter at least every 5 years; (5) establish special hunts in areas where female bighorn sheep can be harvested; and (6) restructure the season framework for Rocky Mountain bighorn sheep. IDFG would like to see the statewide Rocky Mountain bighorn sheep population increase 10% above its 1990 estimated level by 1995.

Hunting seasons and harvest.--IDFG has restricted bighorn sheep harvest to limited entry hunts for 3/4 curl and larger rams since 1970. Regulations were modified in 1984 to allow harvest of older rams with broomed horns by including 3/4 curl and larger horns and/or rams over 4 years of age (Hanna 1990). Permit holders that are successful in killing either a Rocky Mountain or a California bighorn ram are prohibited from drawing for that sub-species again. Unsuccessful permittees may reapply after a 2-year waiting period.

Seasons in 1991 and 1992 opened on August 30 and remained open through October 13. Late hunts, which extended from October 21 through November 5, were also held (2 permits each) in units 19, 20, 21, 26, 27, 36A, 36B, and 50.

The IDFG offered 180 permits for Rocky Mountain bighorn sheep in central Idaho management units in 1991. Sixty-six hunters harvested an adult ram (approx 3.6% of the pre-hunt population, Table 3-48). In addition to rams killed by controlled hunt permit holders during the 1991-1992 season, at least 1 ram was harvested by an Indian under treaty rights, and 55 sheep were known to die of other causes in Region 7 management units (Units 21, 21A, 27, 28, 29, 30, 30A, 36, 36A, 36B, 37, 37A, 50, and 51, Oldenburg 1992b:67). Permits for Rocky Mountain bighorn sheep were decreased from 198 statewide in 1992 to 106 permits in 1993.

Mountain goats

Population distribution and statistics.--Mountain goats exist in a harsh environment. Soils are typically thin and rocky, terrain is steep, and growing seasons are short. Although some goats winter on high elevation ridgelines, most herds winter at low elevations on south-facing cliffs (Oldenburg 1992c). Goats move to higher elevations during summer where they prefer alpine, subalpine, and north slope habitats.

Central Idaho

Thirty-nine mountain goat populations have been identified in Idaho. Most populations contain fewer than 100 animals, and even the larger populations are fragmented into small sub-populations (Hayden 1990). Surveys conducted from helicopters during winter can provide useful information on minimum population size and distribution. Mountain goat surveys are scheduled at 5-year intervals, but goats may also be counted during annual elk sightability surveys. The most recent surveys indicate that about 2,000 mountain goats inhabit the central Idaho primary analysis area (Table 3-48).

Management objectives.--In areas with suitable habitat, mountain goat herds will continue to be managed with a conservative harvest strategy and an active transplant program. IDFG intends to maintain or increase the current level of recreational opportunity that mountain goats provide both consumptive and non-consumptive users.

Hunting seasons and harvest.--Mountain goat hunting is offered in Idaho as a controlled hunt. Hunters must draw a permit and can kill only 1 Idaho mountain goat in their lifetime. Mountain goat season opens August 30 and usually remains open for 75 days. IDFG restricts mountain goat hunting to herds that exceed 50 animals. Permit holders are encouraged to take billies, but they may take a goat of either sex. Nannies with kids may not be killed.

IDFG offered 41 permits in management units within the central Idaho primary analysis area in 1991. Hunters killed 35 goats (approx 1.7% of pre-hunt population) in these units (Table 3-48).

Small home range sizes and their high fidelity to specific areas makes goats vulnerable to hunting, especially in easily accessible areas. Illegal harvest may have a heavier impact than legal harvest in these areas.

CENTRAL IDAHO: DOMESTIC LIVESTOCK

The 10 central Idaho counties cover a total of 22,687,424 acres (91,900 km^2). The area is dominated by 13,331,296 acres (54,000 km^2) of contiguous USDA Forest Service lands in the center of the 10 counties. The Frank Church River-of-No-Return, the Selway-Bitterroot, and Gospel-Hump Wilderness Areas cover 3,908,501 acres (15,800 km^2) in the heart of central Idaho area.

During winter, most livestock are maintained on 3,405,107 acres (13,800 km^2) of private land surrounding the block of public land. During the summer grazing season, a portion of the cattle and most of the sheep are moved to public land. In addition, several thousand sheep are moved in from out-of-state areas to be grazed on central Idaho National Forests during the summer grazing season.

A total of 304,100 cattle and 51,500 sheep were distributed across the 10 central Idaho counties in January 1992 (Idaho Agriculture Stat. Serv. 1992c) (Table 3-50). With the addition of calves and lambs, and taking into consideration some slaughter during January through April, livestock numbers were estimated to grow to about 384,990 cattle and 100,713 sheep on private land in April.

Table 3-50. Number of livestock (cattle, sheep, hogs, and chickens) in ten counties comprising the general central Idaho area, January 1992[a].

Counties	No. cattle	No. sheep	No. hogs	No. chickens
Shoshone	500	100	0	124
Clearwater	4,600	100	0	628
Idaho	53,000	8,400	798	10,051
Boise	5,000	0	233	132
Elmore	116,000	12,500	220	699
Valley	5,500	700	15	1,596
Blaine	23,000	21,500	306	184
Camas	6,500	0	0	210
Custer	38,000	1,700	0	326
Lemhi	52,000	6,500	126	1,049
Total	304,100	51,500	1,698	14,999

[a] Source: Idaho Agr. Stat. Serv. 1992.

In addition to cattle and sheep, 1,698 hogs and 14,999 chickens were present in the 10 central Idaho counties in 1987 (Table 3-50).

During summer 1992, approximately 43,101 adult cattle and 101,552 adult sheep were distributed across 6 National Forests in the Idaho primary analysis area (Table 3-51). It is assumed that 90% of the cows have calves (90 calves:100 cows), and sheep have an average of 1.2 lambs per ewe (120 lambs:100 ewes). The proportion of lambs to adult sheep was assumed higher than calves to cows because sheep produce more sets of twins, offsetting adults who have not produced or have lost offspring. Total calves and lambs on allotments ere estimated at 38,792 calves and 121,971 lambs (Table 3-52). Throughout the primary analysis area, calves and lambs are born in late winter or early spring, before adults are turned onto allotments on national forest lands.

Seventy-six percent of all cattle and sheep graze seasonally on the 3 southern national forests, including the Boise, Sawtooth, and Challis (Table 3-51). No active cattle or sheep

Table 3-51. Number of cattle, sheep, and horses on livestock allotments on national forests in the central Idaho primary analysis area (1992).

National forest	Adult cattle	Calves[a]	Adult sheep	Lambs[b]	Horses
Boise	9,400	8,460	23,094	27,713	193
Challis	15,492	13,943	4,780	5,844	93
Sawtooth	7,875	7,088	49,005	58,806	3
Salmon	4,962	4,466	0	0	52
Payette	1,431	1,288	22,220	26,664	310
Nez Perce	3,634	3,271	2,453	2,944	448
Clearwater	0	0	0	0	0
Panhandle	307	276	0	0	10
Totals	43,101	38,792	101,552	121,971	1,109

[a] Assume 90 calves per 100 cows.
[b] Assume 120 lambs per 100 ewes.

allotments were located in the Clearwater National Forest, and only 307 cattle were present on Panhandle National Forest allotments (Table 3-51) located in the primary analysis area (Figure 3-25).

Cattle and sheep are present on most allotments in the primary analysis area some time between May 1 to October 31. Livestock grazing on all allotments on the Sawtooth, Salmon, Challis, and Payette National Forests falls into this period. About 700 head of cattle are on the Boise National Forest as early as April, and over 1,000 head graze in November, and 350 head remain until December 15. On the Nez Perce National Forest, about 3,000 sheep graze 1 allotment from October 20 to January 15. Another 1,500 sheep begin grazing in the same allotment on April 1. About 500 cattle are present on Nez Perce National Forest allotments in November and 10 cattle are on 1 allotment throughout the year.

CENTRAL IDAHO: LAND USE RESTRICTIONS

Wilderness Areas

Most of the Frank Church River-of-No-Return and the Selway-Bitterroot Wilderness areas were managed as primitive areas beginning in the 1930s. The Wilderness Act of 1964 created the National Wilderness Preservation System and gave statutory wilderness designation to the Selway-Bitterroot area and required that other primitive areas and adjacent lands be studied regarding their suitability for Wilderness designation.

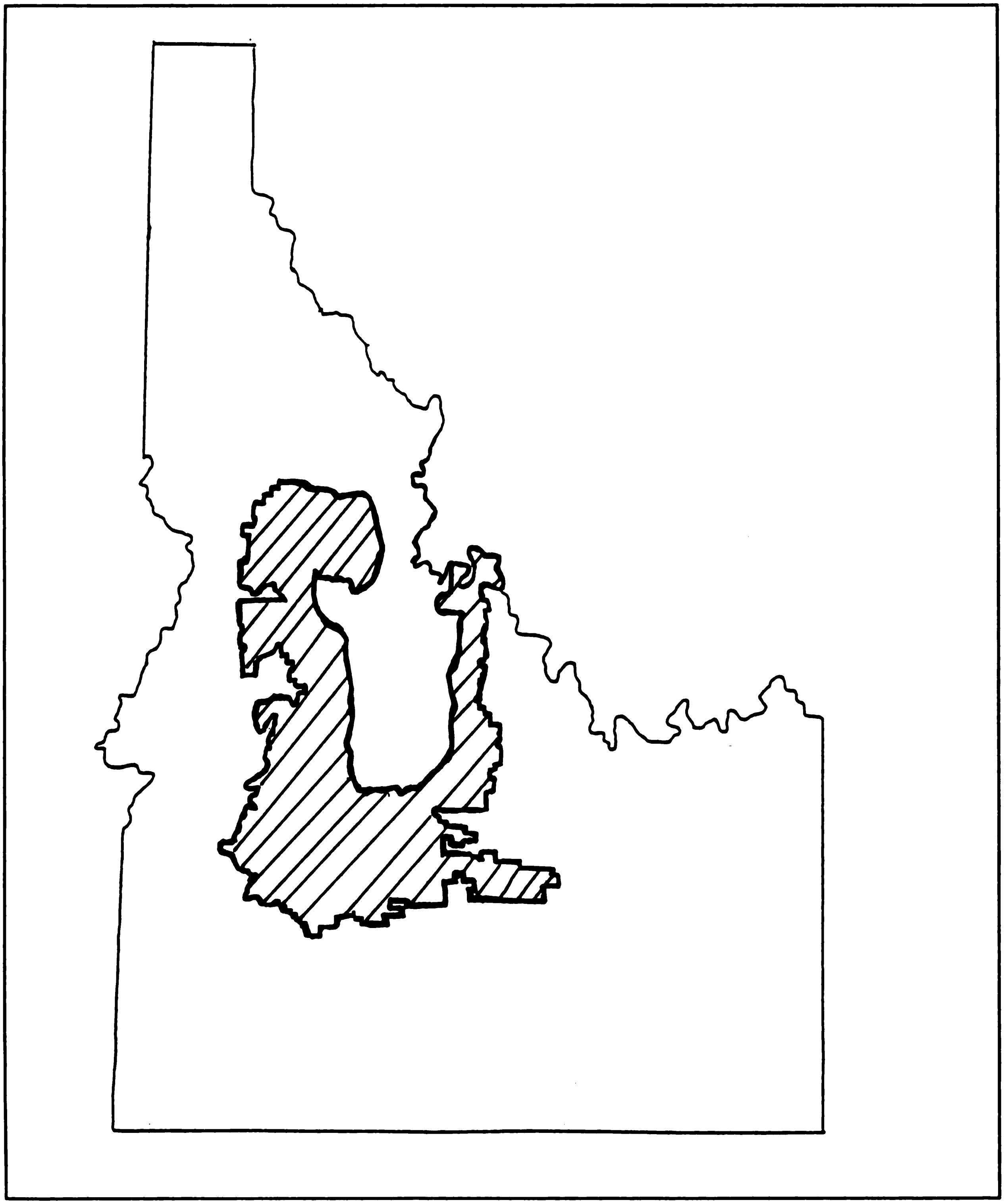

Figure 3-25. General area of livestock grazing allotments in the central Idaho primary analysis area.

Central Idaho

The Endangered American Wilderness Act of 1978 created the 200,464 acre (812 km^2) Gospel-Hump Wilderness Area. The Central Idaho Wilderness Act of 1980 established the 2,361,767 acre (9,565 km^2) River-of-No-Return Wilderness and added approximately 105,600 acres (430 km^2) to the Selway-Bitterroot Wilderness (bringing the total Selway-Bitterroot Wilderness acreage to 1,340,681 acres; 5,430 km^2). The name "Frank Church" was legislatively added to the River-of-No-Return Wilderness Area in 1984.

The Multiple Use-Sustained Yield Act of 1960 directed the management of national forests under the principles of multiple use, specifically endorsing wilderness as a proper use.

The Wilderness Act of 1964 states that wilderness areas shall be administered "for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character..."

The U.S. Department of Agriculture wilderness regulations (Title 36, Code of Federal Regulations, Part 293) specify that "National Forest Wilderness resources shall be managed to promote, perpetuate, and, where necessary, restore the wilderness character of the land and its specific values of solitude, physical and mental challenge, scientific study, inspiration, and primitive recreation. To that end, (a) natural ecological succession will be allowed to operate freely to the extent feasible; (b) wilderness will be made available for human use to the optimum extent consistent with the maintenance of primitive conditions; (c) in resolving conflicts in resource use, wilderness values will be dominant to the extent not limited by the Wilderness Act, subsequent establishing legislation, or the regulations" (36 CFR 293.2).

Section 4(c) of the Wilderness Act prohibits certain uses in wilderness, including "no commercial enterprise and no permanent road within any wilderness area... except as necessary to meet minimum requirements for the administration of the area...there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area." Special provisions of the Act permit the use of aircraft or motorboats where the uses were already established. Measures may also be taken as may be necessary to control fire, insects, and diseases.

Mining activities were allowed in wilderness areas to the same extent as in non-wilderness until January 1, 1984. At this time, minerals in wilderness areas (excluding valid existing mineral rights) were withdrawn from all forms of appropriations under existing mining laws and amendments. The Wilderness Act also gives private property owners the right of access and mining claim owners the right of egress and ingress. Livestock grazing, where established prior to the date of the Wilderness Act, was permitted to continue in wilderness areas.

The 1980 Central Idaho Wilderness Act contained several key provisions, including: (1) restrictions on closure of public airfields, (2) requirements for annual maintenance of the wilderness trails, (3) prohibition of dredge and placer mining in the Salmon River, the Middle Fork of the Salmon River, and tributaries of the Middle Fork of the Salmon River, (4) identification of the 40,000 acre (162 km^2) special Mining Management Zone (southeastern portion of the Frank Church-River-of-No-Return Wilderness Area), where wilderness constraints are not applicable relative to mining activities for cobalt and associated minerals, (5) requirements for a cultural resources management program in the wilderness, including inventory and management recommendations for historic cabins and other structures, and (6) requirements for a comprehensive management plan for wilderness.

Management plans have been completed for the Frank Church River-of-No-Return, Selway-Bitterroot, and Gospel Hump Wilderness Areas, and incorporated into forest plans of administrating forests. The "Limits of Acceptable Change" process was used to provide objectives for management. The Limits of Acceptable Change process gives primary attention to the wilderness conditions that exist and are judged acceptable.

Management plans provide guidelines for managing recreation, trails, airfields, fire, and other components of the wilderness ecosystem. Wilderness management has provided a shift from an emphasis on fire suppression to an emphasis on preserving natural processes and managing recreation.

National Forests

Under the Forest and Rangeland Renewable Resources Planning Act, the National Forest Management Act and its implementing regulations 36 CFR 219, the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations 40 CFR 1500-1508, forest plans and accompanying environmental impact statements have been finalized for every national forest in the central Idaho primary analysis area. The analyses in the forest plans and environmental impact statements are designed to ensure multiple-use and provide a sustained yield of goods and services from the forest to maximize long-term net public benefits and address public issues and management concerns in an environmentally sound manner.

Forest plans supersede all previous land and resource management plans prepared by the forest. They are directly linked to regional and national planning. The national program, required by the Forest and Rangeland Renewable Resources Planning Act, set national direction and output levels for national forest lands. Output levels are based on suitability and capability information provided by forest service regions. In Idaho, national forests north of the Salmon River are included in Region 1. National forests south of the Salmon River are included in Region 4. Each Region divides its share of the national production levels among the forests.

Central Idaho

Within each plan, goals and objectives for the forest are established and standards and guidelines are developed to guide all multiple-use activities. Although many activities take place on national forests, livestock grazing, timber harvest, and recreation involve the largest areas.

Livestock grazing is permitted on approximately 4,357,822 acres (17,650 km^2) across the central Idaho area (Table 3-52). Permits restrict type of livestock, stocking rate, and season of use. Outfitter and guide permits also allow seasonal grazing of horses. Grazing of recreational horses is allowed on National Forest lands throughout the central Idaho area. Restrictions on livestock grazing sometimes occur near riparian areas. Livestock are usually restricted from grazing in areas with newly replanted trees for about 5 years.

Table 3-52. Land use activities in central Idaho national forests. Information comes from forest 10 year plans. Projections cover the period from the middle 1980s to the middle to late 1990s.

	Number of acres			
National forests	Livestock grazing	Suitable for timber	Proj. mean annual harvest	Proj. mean annual harvest (MMBF)[a]
Boise	843,000	656,114	10,527	85.0
Challis	1,162,300	340,608	550	3.0
Clearwater	180,000	987,700	11,309	173.0
Payette	757,848	821,021	6,869	80.9
Nez Perce	316,000	1,070,414	4,540	108.0
Salmon	188,000	744,900	4,012	21.1
Sawtooth	910,674	99,211	1,392	10.5
Panhandle[b]	0	296,000	2,000	30.0
Bitterroot	0	0	0	0
Totals	4,357,822	5,015,968	41,199	511.5

[a] MMBF = Million board feet.
[b] Avery Ranger District only.

The central Idaho area contains about 5,015,968 acres (20,300 km^2) of forested land classified as suitable for timber production (Table 3-52). Timber will be harvested on about 41,199 acres (167 km^2) annually in the central Idaho area during the first decade of implementation of the national forest plans (Table 3-52). Expected volume of timber to be harvested in the central Idaho area ranges from 511.5 million board feet during the first decade of the forest plan to 858.4 million board feet during the fifth decade of the forest plan (Table 3-53).

Table 3-53. Projected annual timber harvest in central Idaho national forests over the next 5 decades from 10 year national forest plans covering the period from the middle 1980s to the middle to late 1990s[a].

	Timber harvest				
National forests	Decade 1	Decade 2	Decade 3	Decade 4	Decade 5
Boise	85.0	81.0	81.7	82.0	82.4
Challis	3.0	4.0	5.0	6.0	7.0
Clearwater	173.0	212.0	273.9	356.3	440.4
Payette	80.9	82.6	85.1	83.2	81.4
Nez Perce	108.0	138.0	180.0	210.0	210.0
Salmon	21.1	21.1	25.7	25.7	25.7
Sawtooth	10.5	11.2	11.5	11.5	11.5
Panhandle[b]	30	17.0			
Bitterroot	0	0	0	0	0
Totals	511.5	566.9	662.9	774.7	858.4

[a] Sources: USDA 1976, 1983a, 1983b, 1984, 1986, 1987a, 1987b, and 1992.
[b] Projected data not available for Avery Ranger District, Panhandle National Forest, decades 3 through 5.

Timber harvests have a significant effect on the physical and biological environment. The extent of these impacts depend on the specific methods of harvest, the area where the timber is harvested, and the rate at which it is harvested. Timber harvest activities may be restricted or modified because of standards designed to achieve specified fishery or wildlife objectives on the forest.

The central Idaho area contains about 20,346 miles (32,700 km) of system roads on national forests (Table 3-54). Most roads have been developed as the direct result of timber harvest. Besides serving timber harvest, roads are used for general forest administration, mineral exploration, fire protection, and recreation.

Approximately 9,541 miles (15,400) of these roads are open to unrestricted motorized travel year-round. The other 53% are subject to a variety of seasonal or yearly closures to motorized travel. Most restrictions and closures are for the protection of wildlife habitat and water quality. Other closures are for the prevention of road and trail damage during spring runoff, protection of administrative sites and other public facilities from vandalism,

Table 3-54. Miles of open, open with restrictions, and closed system roads on central Idaho national forests.

	Miles of roads		
National forests	Open system	Closed or restricted access	Totals
Boise	898	4,156	5,054
Challis[a]	915	60	975
Clearwater	2,492	2,519	5,011
Payette	700[b]	250	950
Nez Perce	776	1,980	2,756
Salmon	1,156	985	2,141
Sawtooth	1,836	67	1,903
Panhandle[c]	693	788	1,481
Bitterroot	75	0	75
Totals	9,541	10,805	20,346

[a] Includes estimated system roads on west side of forest.
[b] Some seasonally closed.
[c] Includes Avery Ranger District only.

protection of the public from unsafe conditions, and for the reduction in cost of road maintenance.

Section 7 Consultations and Requirements

Under Section 7 of the ESA, federal agencies are to use their authority to conserve threatened and endangered species and to take necessary steps to "insure that actions authorized, funded, or carried out by" an agency are "not likely to jeopardize the continued existence of any [listed] species or result in the destruction or adverse modification" of the species' critical habitat. No critical habitat for wolves has been designated under the ESA in the northern Rocky Mountain region (Wise et al. 1991).

The ESA requires that all federal agencies consider the effects of their proposals on listed species before acting. The agency proposing an action must first determine whether a listed species "may be present" in the area. If present in the area, the agency must determine whether the species "is likely to be affected" by the action. If the species is likely to be affected, the action agency must consult with the FWS. The FWS then prepares a biological opinion on whether or not the proposal will jeopardize the listed species. Any federal activity or other activity that requires a federal permit or federal funding is subject to the Section 7 consultation procedure.

Because of numerous wolf reports across central Idaho, the USDA Forest Service has consulted with the FWS on many proposed land-use activities. In 1985, the FWS issued a jeopardy opinion on the USDA Forest Service proposal to plow and open the South Fork Salmon River Road to uncontrolled winter access. The area was considered a critical big game winter range and a potentially important wintering area for wolves.

This jeopardy opinion was the only one issued on proposed USDA Forest Service activities in central Idaho. The FWS later issued a non-jeopardy opinion on a revised USDA Forest Service road management and access plan. A federal judge later enjoined the USDA Forest Service from closing the road. Wolf management along the South Fork road currently includes the construction of several informational signs in the area and monitoring and patrol activities by the USDA Forest Service during the winter.

Wolf management and Section 7 consultations in central Idaho have evolved from more access-related requirements in the 1980s to information and education activities in the 1990s. The FWS believes that if implemented "management actions prescribed by the USDA Forest Service, such as timber harvest and road restrictions to protect ungulates and their habitat, adequately protect wolves" (USFWS 1992).

The view of the FWS in central Idaho is that few restrictions on land use are necessary to promote wolf recovery, and that restrictions do not apply until wolves occupy an area (USFWS 1992). Restrictions include limiting activities within 1 mile (1.6 km) of active wolf dens or rendezvous sites from March 15 to July 1, and placing some restrictions on non-selective control methods of animal damage control within occupied wolf range (USFWS 1992).

Animal Damage Control Activities

USDA, Animal and Plant Health Inspection Service, Animal Damage Control (ADC) initiated a programmatic consultation in 1990 on the effects of the ADC program on threatened and endangered species. The FWS concluded that the use of snares, steel traps, and aerial shooting in the ADC program would not likely jeopardize the continued existence of the gray wolf. Under Section 7 of the ESA, the FWS authorized the incidental take of 1 wolf annually in each occupied state during legitimate ADC control actions. Terms and conditions in the Biological Opinion included the following: (1) an incidental take in excess of 1 wolf in any state (in a given calendar year) will result in cessation of the activity causing take and reinitiation of consultation, (2) all leghold traps shall be checked at least daily in areas known to be occupied by gray wolves, (3) neck snares shall not be used in areas known to be occupied by gray wolves except for areas where wolves may be a target species, (4) number 3 or smaller traps may pose a threat to juvenile wolves and therefore should not be used in proximity to occupied dens and rendezvous sites, (5) the FWS's Fish and Wildlife Enhancement Office, in the Regions of the species' occurrence, shall be notified within 5 days of the finding of any dead or injured gray wolf, (6) ADC personnel shall participate fully in interagency wolf monitoring programs, and (7) ADC personnel shall informally consult on an annual basis with the FWS on the current status of the wolf in areas where recolonization is occurring. The Draft Environmental Impact Statement on the ADC program concluded that the above-ground use of strychnine to control rodents and rabbits, the use of compound 1080 toxic collars to control coyotes, and the use of M-44s to control coyotes, could adversely affect the gray wolf. In accordance with the existing label, strychnine baits should not be used in the geographic range of the gray wolf except under programs and procedures approved by the Environmental Protection Agency (EPA). EPA label restrictions also do not allow the 1080 toxic livestock collar to be used in areas where gray wolves may occur. The use of 1080 toxic collars are not licensed in Idaho at this time. M-44s are prohibited in occupied gray wolf range due to EPA label restrictions. In the 10 county central Idaho area, M-44s were only used on private land and on 1 Bureau of Land Management (BLM) site in 1992. A breakdown of M-44 use in central Idaho counties includes Shoshone (2 private premises), Clearwater (5 private premises), Idaho (12 private premises), Boise (2 private premises), Valley (3 private premises), Custer (4 private premises), and Lemhi (2 private and 1 BLM premises). No M-44s were set in Elmore, Blaine, or Camas counties.

During an informal consultation on March 23, 1993, the USFWS identified 3 areas of "occupied gray wolf range" (subject to revision) in central Idaho where ADC activities should be conducted in accordance with the July 1992 biological opinion. In the biological opinion, "occupied gray wolf range" is defined as (1) an area in which gray wolf presence has been confirmed by state or federal biologists through interagency wolf monitoring programs, and the USFWS has concurred with the conclusion of wolf presence, or (2) an area from which multiple reports judged likely to be valid by the USFWS have been received, but adequate interagency surveys have not yet been conducted to confirm presence or absence of wolves. The 3 areas include (1) all lands east of State Highway 28 in the Salmon BLM district, (2) all lands within the North Fork drainage of the Clearwater River east of the confluence of the North Fork and Little North Fork Rivers, and (3) all lands in Valley county, south of Big Creek and east of the road between Deadwood Reservoir and Big Creek.

CENTRAL IDAHO: VISITOR USE

Idaho provides a diversity of high quality outdoor recreation resources enjoyed by both residents and nonresidents. The 1986/87 Pacific Northwest Outdoor Recreation survey provided estimates of annual "activity occasions" by Idaho residents for a variety of recreational activities (IDPR 1989). Nature study, hiking, walking, and camping activities were all projected to experience moderate to high growth to the year 2010. Hunting activities were projected to experience low growth to the year 2010 (IDPR 1989).

In 1991, an estimated 232,000 residents and 133,000 nonresidents fished in Idaho. An estimated 158,000 residents and 35,000 nonresidents hunted in Idaho. In addition, 194,000 residents and 188,000 nonresidents participated in primary nonurban (nonresidential nonconsumptive) activities in Idaho (USFWS 1992, Table 3-55).

Table 3-55. Number of days and number of participants in fishing, hunting, and nonresidential nonconsumptive activities in Idaho in 1991[a].

Activity	Resident participants	Resident days	Nonresident participants	Nonresident days	Total participants	Total days
Fishing	232,000	2,417,000	133,000	439,000	365,000	2,856,000
Hunting	158,000	1,941,000	35,000	226,000	193,000	2,167,000
Nonresidential Nonconsumptive	194,000	1,722,000	188,000	1,717,000	382,000	3,439,000
Totals	584,000	6,080,000	356,000	2,382,000	940,000	8,462,000

[a] Source: USFWS 1992.

In 1991, residents spent an estimated 2,417,000 days fishing in Idaho and nonresidents spent 439,000 days fishing (Table 3-55). Residents of Idaho also spent 1,941,000 days hunting and nonresidents hunted 226,000 days. Residents spent 1,722,000 days participating in nonurban activities in Idaho while nonresidents spent 1,717,000 days participating in nonurban activities (USFWS 1992, Table 3-55).

The central Idaho primary analysis area contains about 13,105 miles (21,100 km) of trails (Table 3-56). Trails provide for a variety of activities, including hiking, bicycling, motorcycling, horseback riding, nature study, backpacking, and four-wheeling. Trails exist on national forests both in wilderness and non-wilderness. Those in wilderness areas are restricted to nonmotorized, nonmechanized travel.

National forests in central Idaho contain 476 developed recreation sites and provide over 8,000,000 Recreation Visitor Days (RVDs) annually (Table 3-57). Based on figures for the Boise, Clearwater, Payette, Salmon, and Bitterroot National Forests, about 21% of the RVDs are associated with developed areas while about 79% of the RVDs are associated with dispersed (nondeveloped) and wilderness settings. RVDs are expected to continue to grow annually across the central Idaho primary analysis area. In 1992, 10,000 people floated the Main and Middle Forks of the Salmon River through central Idaho wilderness area. A total of 9,171 people signed in at trail heads in the Frank Church Wilderness Area. USDA Forest Service personnel met 21,230 visitors in the Frank Church Wilderness Area. Use in the Frank-Church Wilderness Area has increased rapidly in recent years.

Table 3-56. Miles of recreational trails on national forests in central Idaho.

	Miles of trails		
National forests	Open	Closed to motorized vehicles	Total
Boise	1,222[b]	296	1,518
Challis	484	919	1,403
Clearwater	890	639	1,529[a]
Payette			2,125
Nez Perce			2,342
Salmon	680	460	1,140
Sawtooth	917	851	1,768
Panhandle	600	90	690
Bitterroot	0	590[c]	590
Total			13,105

[a] About 23% of trails are in wilderness.
[b] Includes 150 miles of cross-country ski trails and 400 miles of snowmobile trails.
[c] All trails are in wilderness area.

In the 36 big game management units covering the central Idaho primary analysis area (Figure 3-24), 91,959 hunters spent a total of 688,175 days in the field in 1991. One hundred-two outfitters and guides operate in 36 big game management units in the central Idaho primary analysis area. In 1991, these 102 outfitters and guides provided big game tags to 4,614 nonresidents and 465 residents (Table 3-58). Most tag sales were for nonresident deer and elk hunters.

CENTRAL IDAHO: ECONOMICS

The 10 central Idaho counties that constitute the central Idaho area have a combined population of 92,400. These 10 counties are very sparsely populated with an average of 2.6 people per square mile (1.0/km^2). This average is compared to an average of 12.3 people per square mile (4.75/km^2) for Idaho, and 6.96 people per square mile (2.69/km^2) for the 3 state region. The population of the 10 county recovery area grew at a rate of approximately 1.8% per year in the 1970s and then declined at an average rate of -0.5% per year throughout the 1980s. Overall population growth for these counties between 1970 and 1990 was approximately 1.3% per year.

The sparse population in the Central Idaho recovery area is in a large part due to 2 factors: the ruggedness and inaccessibility of much of the land in the area, and the large percentage

Table 3-57. Recreation Visitor Days (RVDs) and number of developed recreation sites on national forests in central Idaho.

National Forests	RVDs				Number of Developed Recreation Sites
	Developed	Dispersed	Wilderness	Total	
Boise	494,900	1,598,100	0	2,093,000	72
Challis			234,600	648,400	55
Clearwater	293,600	459,100	30,700	783,400	23
Payette	47,100	677,200	173,100	897,400	36
Nez Perce			95,100	748,100	40
Salmon	120,080	439,922	114,100	674,102	53
Sawtooth				2,291,100	193
Panhandle[a]				211,800	
Bitterroot	12,000	10,000	45,900	67,900	4
Totals				8,415,202	476

[a] Includes Avery Ranger District only.

Table 3-58. Number of big game tags provided by 102 outfitter and guides in 36 big game management units in the central Idaho primary analysis area. Numbers from 1991 license year.

Species Tags	Idaho Residents	Nonresidents	Total Tags
Deer	198	1,763	1,961
Elk	219	2,202	2,421
Bear	46	637	683
Mountain Lion	2	12	14
Totals	465	4,614	5,079

of the land in the area administered by federal or state agencies. The 10 counties which constitute the central Idaho area consist of approximately 22.5 million acres (91,100 km^2). This area represents 43% of Idaho's total land area. Federal and state agencies manage approximately 84% of the total land in these 10 counties.

Per capita income in the 10 county area for 1990 was $15,552, or roughly equal to the regional average (Table 3-44). Total personal income was $1.43 billion in 1990. This represents approximately 4% of the 3 state regional total personal income. In 1990 income from farming sources and agricultural services accounted for approximately 8% of the total personal income in this 10 county area. This 1990 percentage is approximately equal to the sector's share of total personal income in the early 1970s. Livestock accounted for about 65% of the value of farm products sold in these counties in 1987. This percentage is somewhat higher than the 52% livestock share for the 3 state region. This greater reliance on livestock in the farming sector is likely due to the generally rough topography and high altitude of central Idaho which makes cropping impractical in much of this area. Sources of personal income that showed growth in the period 1970-1990 were services (which increased from 7.6% to 10.8% of total income) and income other than earnings (which increased from approximately 19% in 1970 to 33% in 1990). Other industry, in general, has become relatively less important as a component of personal income in the last 2 decades, falling from 41% to 25% of total personal income. Mining, manufacturing, and construction have all decreased as a percentage of total personal income during this time period.

Table 3-59. A summary of the key characteristics of the primary analysis area (PAA) that were analyzed as potentially being impacted by wolf recovery in and around Yellowstone National Park (includes parts of 17 adjacent counties) and in central Idaho (includes parts of 10 adjacent counties).

		Yellowstone	Central Idaho
People/Land			
Acres		16,000,000	13,300,000
% Federal Ownership		76%	99%
% Private ownership		21%	trace
% National Park, Wilderness, or Wildlife Refuge		41%	30%
Regional Population (including surrounding communities)		288,000 5.2 people/ mi.[2]	92,400 2.6 people/mi.[2]
Recreational visits to federal land/year		14,500,000	8,000,000
Public land uses[a]			
Open to grazing (acres)		4,000,000	4,357,822
Suitable for timber harvest (acres)		1,500,000	5,015,968
Timber harvested or planned for harvest/year (acres)		28,000	41,199
Total miles of system trails/roads on public land		13,457	20,346
Roads/trails open to motor vehicles (mi.)		8,057	9,541
National Forest area not open to motorized use (includes wilderness and roadless areas)		44%	44%
Estimated miles of hiking trails		4,643	13,105
Current active sites for M-44 use (coyote cyanide devices)		185 ranches	31 ranches
People/Land Economy (including surrounding counties)			
Total income		$4.2 billion	$1.43 billion
Per capita income		$14,676	$15,552
Farm		6.4% (55% by livestock)	8.0% (65% by livestock)
Services		39.5%	34.6%
Other Industry		19.8%	24.8%
Other non-earned[b]		34.3%	32.6%
Livestock			
Peak numbers of livestock on PAA including the surrounding counties-	(spring) cattle	354,000	384,990
	(spring) sheep	117,000	100,713
On USDA Forest Service in PAA (May through October)			
Adult cattle and calves		145,658	81,893
Adult sheep and lambs		265,152	223,523
Horses		1,270	1,109
Total livestock grazed on national forests		412,080	306,525
Estimated current livestock mortality in the PAA and surrounding counties from all causes per year based upon spring cattle/sheep numbers:	cattle	8,340 2.36% loss (67% calf)	12,314 3.2% loss (69% calf)
	sheep	12,993 11.1% loss (74% lambs)	9,366 9.3% loss (72% lambs)
	horses	Unknown, very low	unknown, very low

Central Idaho

	Yellowstone	Idaho
Ungulates (after hunting season)		
Elk	56,100	76,300
Deer (mule & white-tailed)	29,500	159,600
Moose	5,800	1,700
Bighorn sheep	3,900	1,800
Bison	3,600	0
Mountain goat	few	2,000
Pronghorn antelope	400	0
Total	99,300[c]	241,400
Hunter harvest/year	14,314	33,358
Estimated ungulates dying/year (all causes)[d]	48,559	153,539
Other Animals		
Black bears	3,000	abundant
Grizzly bears	228	none
Mountain lions	some	abundant
Coyotes	abundant	common

[a] A wide variety of land use restrictions (seasonal and permanent) are employed on public lands throughout the Yellowstone and central Idaho areas for protection of natural resources and public safety including: on motorized vehicles, construction of structures, Animal Damage Control activities, big game winter range, calving areas, security and migration habitat, raptor nest sites, endangered species (including grizzly bears), erosion control, wetland protection, to provide a variety of outdoor experiences (motorized or nonmotorized, wilderness or developed, etc.).
[b] Non-earned income represents investments, entitlements, and retirement income that often does not depend on where a person lives. The growth of this segment of the economy from 25% to 34% over the last 2 decades results from people with this type of income moving into the central Idaho or Yellowstone area because these areas are perceived to have a lifestyle that people want to participate in (wild spaces, abundant wildlife, less crowding, low crime, clean air, etc.).
[c] Including only ungulate herds at least partly associated with Yellowstone National Park. Estimated over twice that number using public and private lands in overall Yellowstone area.
[d] Including hunting, crippling loss, poaching, road kill, predation, disease, starvation, drowning, winter kill, accidents, fighting, etc. (Appendix 10).

CHAPTER IV
ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

In the analysis of environmental consequences, the impacts of each alternative are presented for each recovery area (the Yellowstone area and the central Idaho area) separately. The impacts of each alternative are discussed first for the Yellowstone area and then for the central Idaho area. Thus, total impacts of each alternative are the sum of the impacts of the 2 areas.

ENVIRONMENTAL CONSEQUENCES ALTERNATIVE 1. REINTRODUCTION OF EXPERIMENTAL POPULATIONS

YELLOWSTONE

Impacts on Ungulate Populations

Background Information for Analysis.--The Yellowstone area is a multiprey system and wolves will likely prey on several different wild ungulate species. Elk are the most abundant wild ungulate in the Yellowstone area and they will likely be the primary prey for wolves (Garton et al. 1990, Koth et al. 1990, Vales and Peek 1990, Singer 1991a, Boyce and Gaillard 1992, Mack and Singer 1992b). Based on prey availability and vulnerability, wolves may take fewer deer, moose, and bison compared to elk (Mack and Singer 1992b). Bighorn sheep, pronghorn, and mountain goats were not predicted to be significant prey for wolves because of their low numbers relative to other wild ungulates, their use of escape terrain to avoid predators, and their use of areas close to human habitation (Boyce and Gaillard 1992, Mack and Singer 1992b, Boyce 1990, Koth et al. 1990, Mack et al. 1990). Because of the above factors, analyses of wolf predation on wild ungulates were limited to species that might be most affected: elk, deer, moose, and bison. Wolf predation on bighorn sheep living east of Yellowstone National Park was examined because some of these sheep herds may be more vulnerable to wolf predation than sheep in other portions of the Yellowstone area (J. Talbott, Wyoming Game and Fish Department, Cheyenne). Wolves may kill about 11 bighorn/year or about 0.4% of the bighorn sheep population east of the park (Mack 1993).

The Yellowstone Area.--The following analysis focuses on the effects a recovered wolf population (10 packs, about 100 wolves) might have on ungulate populations and hunter harvests in the Yellowstone area. Under this alternative, wolf recovery would be attained in about 8 years (2002), much sooner than the Wolf Management Committee Alternative (2010) or the Natural Recovery (No Action) Alternative (2025). Two computer models examined the effects a recovered wolf population might have on wild ungulates in 3 different areas, Yellowstone National Park, the Jackson, Wyoming area, and the North Fork Shoshone River area in Wyoming. Mack and Singer (1992b) estimated that 78 to 100 wolves (about 10 packs) living on Yellowstone's northern range might reduce the northern range elk herd 5%-30% (from about 17,300 in 1990 to between 12,100 and 16,400 elk) if antlerless elk harvests were reduced 27%. They also estimated northern range mule deer would increase in the presence of wolf predation if the antlerless deer harvest of 122 antlerless deer/year was eliminated. Moose numbers were 13% smaller to 12% larger if moose harvests were reduced in the presence of wolf predation.

Boyce and Gaillard (1992) modeled the effects of wolves on ungulates in the Yellowstone area (Yellowstone National Park, Jackson, Wyoming area, and North Fork Shoshone River area) and found wolves would reduce elk numbers 5%-20% from an estimate of 36,726 to between 29,381 and 34,890 elk. From their model, they did not find any circumstances in which wolves would have a devastating effect on elk populations in the Yellowstone area.

Boyce and Gaillard (1992) estimated wolves would reduce the mean population sizes of mule deer 3%-19% from about 10,300 to between 8,343 and 9,991. They estimated moose might decline less than 7% from about 5,900 to 5,487 (although local effects may be higher in Montana where moose are heavily harvested), and the bison population might decline less than 15% from about 2,700 to 2,295.

A total of about 95,000 elk, deer, moose, and bison live in the Yellowstone area in and near Yellowstone National Park. A recovered wolf population of 100 wolves (10 packs) would kill about 1,200 wild ungulates at a predation rate of 12 ungulates/wolf/year (Mack and Singer 1992b). If elk, deer, moose, and bison were preyed upon according to the abundance and vulnerability predicted in Mack and Singer (1992b), 100 wolves might kill about 913 elk, 219 deer, 19 moose, and 16 bison/year, representing about 1% of the total elk, deer, moose, and bison living in the Yellowstone area. The remaining 33 ungulates in the wolf kill would depend upon the availability and vulnerability of wild ungulates available to wolves and might be any combination of elk, deer, moose, bison, bighorn sheep, or pronghorn.

Under this alternative, some protection would be provided for wolves outside national parks and wildlife refuges so wolves and their effects on ungulate populations might be more dispersed throughout suitable habitats in the Yellowstone area and not concentrated in national parks or wildlife refuges (for example Yellowstone National Park or the National Elk Refuge). This alternative also provides for translocation of wolves if wolves severely impact ungulate populations. Because of this provision, wolf effects on some ungulate populations may be less than presented in these analyses. Throughout the Yellowstone area, ungulate populations can be quite different from one another in terms of population numbers, hunter harvests, and other physical and biological characteristics. These differences might result in individual populations reacting differently to wolf predation. Because it cannot be predicted exactly where wolves might establish territories within the Yellowstone area, additional analyses examined what effects wolves might have on wild ungulate populations (primarily elk, deer, and moose) living in more localized areas within the Yellowstone area. These additional analyses predicted effects similar to those previously mentioned (Mack 1993).

The analyses were limited to ungulate herds associated with Yellowstone National Park which represents only a fraction of the ungulates available in the entire Yellowstone area. Because wolves could prey on wild ungulates from other herds living within the Yellowstone area, the overall effects of wolves on ungulate herds could be less than presented in these analyses. This alternative also provides for wolf translocation in the rare event wolf predation severely impacts ungulate populations or causes movements of ungulates to increase conflicts with private property. Because of the wolf translocation provision, wolf effects on some ungulate populations may be less than presented in the analyses.

Conclusions.--A recovered wolf population (about 100 wolves) is predicted to kill about 1,200 wild ungulates (primarily elk, deer, moose, and bison) each year, representing about 1% of the estimated 95,000 elk, deer, moose, and bison in the Yellowstone area. Bighorn sheep, pronghorn antelope, and mountain goats are not predicted to be significant prey for wolves. Using computer models, a recovered population was predicted to reduce wild ungulate population numbers from current high population numbers. A recovered wolf population was predicted to reduce elk numbers at least 5% and possibly as much 20%-30% for elk herds in some areas. Boyce and Gaillard's (1992) models did not predict any conditions in which wolf predation had devastating effects on elk populations. Three deer populations were predicted to decline 3%-19%. Moose populations were predicted to decline about 7%--13% for heavily harvested herds. Bison populations were predicted to decline no more than 15% from about 2,700 to about 2,300 animals.

Impacts on Hunter Harvest

In reference to the background information presented under Impacts on Ungulate Populations, this analysis focuses on the effects a recovered wolf population could have on hunter harvests of elk, deer, and moose. Computer models predicted 78 to 100 wolves would reduce the northern range elk herd 5%-30% provided antlerless elk (females and young) harvests were reduced 27% from an average of 994 antlerless elk/year to 714 antlerless elk/year (Mack and Singer 1992b). Mack and Singer (1992b) also found the northern range mule deer herd could increase under wolf predation if the antlerless portion of the deer harvest (122 antlerless deer/year) was eliminated. Antlered (male) harvests of elk and deer were not predicted to be affected. For the relatively small but heavily hunted northern range moose herd, hunter harvest may need to be reduced 1/2 (from an average of 31 moose/year to 16 moose/year) in the presence of a recovered wolf population.

Boyce and Gaillard (1992) did not expect a recovered wolf population to affect the hunter harvests of elk in Montana, but they did predict hunter harvests to decline 5%-10% (from about 3,300 elk/year to between 2,970 and 3,135 elk/year) for the Jackson herd in Wyoming. They also predicted hunter harvests would decline 1%-2% (from about 640 elk/year to between 627 and 634 elk/year) for the North Fork Shoshone elk herd.

Boyce (1990) and Boyce and Gaillard (1992) concluded wolf predation would not reduce hunting opportunities for deer and some moose herds in the Yellowstone area. However, moose hunting may be reduced for smaller heavily hunted herds such as the northern range moose herd in Montana (Boyce and Gaillard 1992, Mack and Singer 1992b).

In the Yellowstone area, hunters annually harvested an average of 14,172 elk, deer, and moose during the 1980s (see Chapter 3, Ungulate Populations and Hunter Harvest). Bison removals, although more sporadic, averaged 142 bison/year (see Chapter 3). A recovered wolf population would kill about 1,200 ungulates/year which represents 8% of the total average hunter harvest of elk, deer, moose, and bison in the Yellowstone area during the 1980s.

These analyses examined the effects a recovered wolf population would have on a portion of the wild ungulates available in the Yellowstone area. If wolf predation were distributed across a larger portion of the ungulate herds available in the Yellowstone area, wolf effects on hunter harvests may be lower than predicted in these analyses. This alternative provides for wolf translocation if ungulate populations were being severely impacted. Under the wolf removal provision, hunter harvests may not be affected to the degree predicted in the previous analyses.

Conclusions.--A recovered wolf population (about 100 wolves) in the Yellowstone area may reduce hunter harvests of antlerless ungulates (females and young) for some ungulate herds. Computer models predicted the high antlerless harvest for the northern range elk herd may be reduced as much 27% from about 994 antlerless elk/year to 714 antlerless elk/year. The antlered (male) elk harvest would likely be unaffected. Elk harvests for the Jackson herd may be reduced 5%-10% from about 3,300 elk/year to between 2,970 and 3,135 elk/year. Elk harvests for the North Fork Shoshone herd may be reduced 1%-2% (from about 640 elk/year to between 627 and 634 elk/year) in the presence of a recovered wolf population. Wolf predation will likely not affect deer and moose harvests in many herds.

In the Yellowstone area, hunters annually harvested 14,314 elk, deer, moose, and bison. A recovered wolf population would kill about 1,200 wild ungulates/year, representing 8% of the average hunter harvest during the 1980s.

Impacts on Domestic Livestock

Summary of Wolf Depredation on Domestic Livestock in Other Areas of North America

Alberta.--In Alberta, estimates of cattle (including adults and calves) within wolf range varied from 300,000 from 1974-1979 (Gunson 1983) to about 235,000 from 1980 to 1991 (M. J. Dorrance, Alberta Agriculture, pers. commun.). Published estimates of the total number of sheep within wolf range in Alberta are not available, but are substantially fewer than cattle, perhaps in the range of 10,000 head (M. J. Dorrance, Alberta Agriculture, pers. commun.). An estimated 1,500 wolves live in the area in which wolves and livestock both range. Alberta has a wolf control program in which wolves that kill livestock are controlled by provincial personnel. Landowners also may kill wolves on their property at any time.

Losses of livestock to wolves were highly variable among years, between areas, and among operators. Cattle killed or injured annually by wolves in Alberta ranged from 22 adults and 34 calves to 217 adults and 296 calves for an average of 76 adults and 159 calves per year from 1974 to 1990 (Table 4-1). These levels represent 0.29-1.65 cattle killed/1,000 available or 0.029%-0.165% with an annual average of 0.089% of the cattle living within wolf range (Mack et al. 1992b). Wolves apparently selected calves and yearlings over adults. Calves represent 49%-87% of cattle killed by wolves.

All major predators selected calves over adults. However, unlike bear depredation which peaked in early spring (coinciding with bear emergence from dens) or coyote depredation which peaked coincident with calving, wolf depredation peaked in August and September. This coincides with wild ungulate calves and fawns maturing and increased food demands from growing pups before they are completely mobile and can hunt with the pack (Dorrance 1982).

Wolf depredation on livestock other than cattle is extremely low in Alberta, primarily because other types of livestock are not exposed to depredation within wolf range (M. J. Dorrance pers. commun.). Sheep (including adults and lambs) killed or injured by wolves in Alberta ranged from 1-127, or an average of 31 per year from 1974 to 1990. Numbers of sheep in wolf range are not available but are roughly estimated at around 10,000 head (see above).

From 1974 to 1980, swine, goats, and poultry comprised 4% of the total livestock killed by wolves for which farmers were compensated (J. R. Gunson unpubl. data) and 1% of total livestock killed by wolves from 1981 to 1990 (M. J. Dorrance unpubl. data). Coyotes were responsible for 99.98% of the losses of these classes of livestock (primarily poultry) during 1990-1991 (M. J. Dorrance pers. commun.). In Alberta, density of swine, poultry, and other classes of livestock are more similar to those in the Yellowstone area than those in Minnesota, and Alberta husbandry practices, terrain, and weather are also more similar to those around Yellowstone.

In Alberta, livestock operators are compensated for livestock (food producing livestock classes) killed by wild predators. Losses are compensated up to 100% of commercial value for confirmed kills and up to 50% of commercial value for probable kills. From 1972 through 1989 the number of approved claims ranged from 22 in 1972 to 79 in 1975 with an annual average of 53 claims. Compensation paid under this program during the same period ranged from $14,993 in 1972 to $115,296 in 1982 with an annual average of $46,227 (Alberta Forestry, Land and Wildlife 1991).

The Simonette River experimental area involved remote wooded grazing leases on provincial lands in west central Alberta. Moose, elk, white-tailed and mule deer were common, as were coyotes, black bear and wolves. Pastures were small and isolated and were in, or adjacent to, territories of 4 wolf packs. The evaluation was conducted from 1975 through 1980. There was no wolf control during the first 4 years and livestock operators were compensated for 100% of value for livestock killed by predators and 80% for missing

Table 4-1. Number of livestock (cattle and/or sheep) killed or injured by wolves and the number of livestock in Alberta and British Columbia within wolf range[a].

		Cattle				Sheep			
		Killed or injured				Killed or injured			
Province	Year	Adults	Calves	Available	Killed/1,000 available	Lambs	Adults	Available	Killed/1,000 Available
Alberta[b]	1974	32	109	300,000	0.47	12[c]			
	1975	217	269	300,000	1.62	67			
	1976	120	200	300,000	1.07	56			
	1977	166	199	300,000	1.22	2			
	1978	65	198	300,000	0.88	19			
	1979	73	296	300,000	1.23	43			
Alberta[d]	1980	22	150	235,000	0.73	1			
	1981	57	225	235,000	1.20	45			
	1982	135	252	235,000	1.65	80			
	1983	63	181	235,000	1.04	127			
	1984	106	160	235,000	1.13	27			
	1985	66	64	235,000	0.55	20			
	1986	44	167	235,000	0.90	18			
	1987	29	71	235,000	0.43	5			
	1988	35	34	235,000	0.29	8			
	1989	30	46	235,000	0.32	4			
	1990	27	80	235,000	0.46	0			
Mean		76	159		0.89	31			
Simonette River, Alberta[e]	1976	7[f]		2,288	3.06				
	1977	6		2,023	2.97				
	1978	16		1,784	8.97				
	1979	27		1,558	17.33				
	1980	11		1,772	6.21				
	1981	1		1,804	0.55				
Mean		11		1,872	5.88				
British Columbia[g]	1978	47	81	587,750[h]	0.22	6	27	48,000	0.69
	1979	53	98	587,750	0.26	3	21	48,000	0.50
	1980	32	101	587,750	0.23	15	5	48,000	0.42
Mean		44	93	587,750	0.23	8	18		0.54

[a] Adapted from Mack et al. 1992b.
[b] Cattle and sheep depredation data (1974-1979) are from J. Gunson pers. commun., cattle availability are from Gunson (1983).
[c] Include lambs and adults.
[d] Data are from M. J. Dorrance (Alberta Agriculture, Plant Industry Division, unpubl. data) and M.J. Dorrance pers. commun. Cattle availability is from 1986 estimate of cattle numbers in wolf range.
[e] Data are from Bjorge and Gunson (1983, 1985). Cattle were the only livestock available and killed.
[f] Numbers of calves and adult cattle lost to wolves were not given, but 54% of all cattle killed or injured between 1976 and 1980 were calves (Bjorge and Gunson 1983).
[g] Data are modified from Tompa (1983).
[h] Cattle numbers include 209,500 calves and 378,250 adults. Numbers are from average stock populations between July 1980 and January 1981, Minn. Dept. of Agri., B.C. and from B.C. Cattlemen's Assoc. (Tompa 1983).

cattle. Government wolf control was resumed in the winter of 1979/1980. Estimated wolf numbers were 14-15 in 1975 and 39-40 wolves in 1979/1980; wolves were reduced to 12-13 in the winter of 1979/80.

Total cattle deaths from all causes (including missing animals), from an average of about 2,000 cattle present, increased from 2.9% in 1976 to 3.7% in 1979; total cattle mortality was 2.5% in 1980 following wolf control. Of 38 cases where cause of death was known, 42% was due to wolf depredation, 11% from black bear depredation, and 47% from non-predator causes. Losses due to wolf depredation ranged from 1-27 per year with an annual average of 11. Loss rates due to wolf depredation ranged from 0.55 to 17.33/1,000 head of livestock available with an annual average of 0.59% (Table 4-1). These rates may be representative of loss rates in remote wooded situations where cattle are unattended and no wolf control is conducted on wolves that depredate on livestock.

British Columbia.--British Columbia administers a wolf control program. Depredation complaints are investigated and wolf control is conducted on a reactive site-specific basis. Wolf control is not initiated if faulty husbandry practices result in wolf conflicts (Tompa 1983). British Columbia has no monetary compensation program for wolf depredation on livestock. Approximately 6,300 wolves inhabited British Columbia in the early 1980s (Mack et al. 1992b). However, livestock do not occur throughout the entire province so the number of wolves in livestock range is unknown but is likely to be substantially less than the provincial population estimate.

In British Columbia from 1978 to 1980, confirmed losses ranged from 32-53 adult cattle and 81-101 calves annually from an estimated cattle population of 587,750 or an overall loss rate of 0.023%. Province wide, an average of 93 calves and 44 adult cattle were killed or injured each year by wolves from 1978-1980 (Table 4-1). Of those killed by wolves, 68% were calves and 32% were adults. Wolf depredations on cattle averaged 0.12/1,000 adults or 0.012% and 0.44/1,000 calves or 0.044% of those in wolf range (Tompa 1983). As in Alberta, calves constituted a majority of cattle killed by wolves. During the same period (1978-1980) the British Columbia Cattlemen's Association reported an average of 158 calves (73%) and 59 adult cattle (27%) lost to wolves. From these statistics, the average depredation rate was 0.37/1,000 or 0.037% of those available (Tompa 1983).

Sheep reported killed or injured by wolves averaged 8 lambs (31%) and 18 adult sheep (69%) from 1978 to 1980 (Table 4-1). Depredation rates ranged from 0.42/1,000 to 0.69/1,000 or an annual average of 0.054%. As with other predators and other areas, depredation rates for sheep were typically higher than cattle.

Minnesota.--Wolves frequently encounter livestock in Minnesota without depredations occurring (Fritts and Mech 1981). In Minnesota, the USDA, (ADC) administers a wolf control program in response to complaints of wolf depredation on domestic livestock.

Wolves are controlled on a reactive site-specific basis where complaints of livestock depredation by wolves are verified (Fritts 1982). The estimated population of wolves in Minnesota is about 1,500-1,750 (Fuller et al. 1992).

From 1979 to 1991, of cattle taken by wolves an average of 23 calves and 4 adult cattle were lost each year (Mack et al. 1992b, Table 4-2). Calves comprised 85% and adults 15%. Depredation rates for cattle ranged from 0.04/1,000 to 0.18/1,000 with an annual average of 0.12/1,000 or 0.012% of those available.

Table 4-2. Number of cattle and sheep lost to wolves, and cattle and sheep available in wolf range in northern Minnesota, 1979-1991.[a]

	Cattle				Sheep		
	Killed or Injured						
Year	Adults	Calves	Available[b]	Killed/1,000 Available	Killed or Injured[c]	Available	Killed/1,000 Available
1979	5	12	220,970	0.08	1	30,839	0.03
1980	4	12	225,244	0.07	56	32,950	1.70
1981	6	24	241,291	0.12	110	39,569	2.78
1982[d]	1	23	241,724	0.10	12	34,698	0.35
1983	3	32	242,156	0.15	29	29,827	0.97
1984	2	8	242,589	0.04	92	24,956	3.69
1985	4	19	243,021	0.10	75	20,085	3.73
1986	7	19	220,141	0.12	13	15,904	0.82
1987	5	19	220,141	0.11	9	15,904	0.57
1988	3	28	220,141	0.14	68	15,904	4.28
1989	9	31	220,141	0.18	47	15,904	2.96
1990	2	35	220,141	0.17	112	15,904	7.04
1991	5	30	220,141	0.16	31	15,904	1.95
Mean	4	23	229,065	0.12	50	23,719	2.11

[a] Losses are verified wolf caused kills and maulings, and include verified "probable" wolf losses. Data are from S. H. Fritts (unpubl. data), and W. J. Paul (1991) unpubl. annual prog. report. Adapted from Mack et al. 1992b.
[b] Available livestock are based on Minnesota agricultural statistics for 1979, 1980, 1981, 1985 and 1986 (S.H. Fritts unpubl. data).
[c] Includes only total sheep. Lambs and adult sheep lost to wolves were not tabulated in the available datasets.
[d] Interpolation was used between 1981 and 1985 to estimate cattle and sheep availability.

Sheep losses from 1979-1991 ranged from 1 to 112/year and averaged 50/year in Minnesota. The rate of sheep killed or injured ranged from 0.03/1,000-7.04/1,000 with an annual average of 2.11/1,000 or 0.211% of those available (Table 4-2). A higher proportion of lambs than adults were killed. Compensation payments averaged 22.5/year for adult sheep versus 51.5/year for lambs or a 1:2.3 adult to lamb ratio (Fritts et al. 1992).

Depredations varied widely among years. Annual variation in verified livestock losses in Minnesota ranged from 1-9 adult cattle and 8-35 calves with an average of 4 adults and 23 calves. Annual variation for sheep was greater. High annual variation was also shown for losses in Alberta and British Columbia (Tables 4-1 and 4-2).

Average number of animals killed or wounded per verified complaint was 1.2 for cattle and 4.4 for sheep. Annual variation in the number of cattle reported killed by wolves ranged from 1-17 adults and 12-98 calves with an annual average of 27 cattle killed or wounded per year. Reported sheep losses ranged from 1-242 with an annual average of 50 sheep verified as killed by wolves. On average, 55% of the reported claims of losses, to wolves could be verified (Fritts et al. 1992).

Verified complaints of depredations averaged 30 per year and affected an average of 21 farms (0.33% of producers) annually. Conflicts were highly seasonal and involved primarily cattle (mainly calves), sheep, and turkeys. Number of operators affected also varied considerably from year to year. In Minnesota from 1976 to 1980, 10-35 farms reported wolf depredations. This represented less than 1% of the farms with livestock within wolf range (Fritts 1982).

Livestock producers in Minnesota are compensated for verified complaints of wolf depredation on livestock by the Minnesota Department of Agriculture. From 1977 through 1989, compensation payments have ranged from a low of $8,668 in 1977 (the first year of the program) to a high of $43,664 in 1989 with an annual average of $23,715 (Fritts et al. 1992). During 1990, 1991, and 1992, $42,739, $32,206, and $17,922 ($11,340 pending) were paid in compensation, respectively. During 1989, 1990, and 1991, turkeys comprised a large portion of the losses (as discussed above) with 1,866, 1,170, and 1,075 turkeys confirmed dead as a result of wolves in those years (often turkeys mass in corners of pens and many suffocate, W. J. Paul, ADC, Annual Report).

Northwestern Montana.--A small population of wolves has been recolonizing northwestern Montana since the early 1980s. The first reproduction was documented in 1986 within Glacier National Park, Montana. From 1987 to 1992 wolves killed an average of 3 cattle and 2 sheep per year (Table 4-3). Depredation rates on cattle ranged from 0 to 0.08/1,000 with an average of 0.04/1,000 or 0.004% of those available. Depredation rates on sheep ranged from 0 to 0.88/1,000 with an average of 0.18/1,000 or 0.018% of those available (Mack et al. 1992b).

Summary.--A review of several biogeographical areas in North America (Mack et al. 1992b) indicates that wolf depredation is highly variable among years and within areas. Overall,

Table 4-3. Wolf depredation on cattle and sheep in northwestern Montana, 1987-1991[a].

	Numbers of Livestock							
	Available[b]		Confirmed Killed		Possible additional killed[c]		Losses/1,000 Available	
Year	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep
1987	75,000	11,000	6	10	0	0	0.08	0.88
1988	75,000	11,000	0	0	0	0	0	0
1989	75,000	11,000	3	0	7	0	0.04	0
1990	75,000	11,000	5	0	0	0	0.07	0
1991	75,000	11,000	2	2	0	2	0.03	0.18
1992	75,000	11,000	1	0	0	0	0.01	0
Mean	75,000	11,000	2.8	2.0	1.2	0.3	0.04	0.18

[a] Data are from S. H. Fritts, unpubl. data. Adapted from Mack et al. 1992b.
[b] Livestock available are based on 1989 Montana agricultural statistics for portions of 9 northwestern Montana counties. A correction factor was used for each county to estimate numbers of livestock available to wolves within possible wolf range. If more livestock were available, the depredation rate would be lower. Numbers rounded to the nearest 1,000.
[c] Suspected wolf involvement, no physical evidence of wolf depredation.

the rate of wolf depredation on domestic livestock across large geographic areas is very low, averaging usually less than 0.1% of livestock within wolf range.

Cattle and sheep are the species most affected in Alberta, British Columbia, and Minnesota (with the exception of turkeys in Minnesota). Recent development of large free ranging turkey growing operations within wolf range in Minnesota has resulted in turkeys constituting about 75% of the livestock losses to wolves in some recent years and accounting for most of the increase in losses (Fritts et al. 1992). In all areas, losses of adult cattle are much lower than that of calves. The loss of adult sheep versus lambs varies by area and by year, and ranged from 31% lambs in B.C. (Tompa 1983) and 42% lambs in Alberta (Gunson 1983) to 70% lambs in Minnesota (Fritts et al. 1992). Losses of sheep per capita available are higher than cattle losses.

On average, wolf depredation affects a small number of available livestock and a small percentage of livestock operators, usually less than 1% of the livestock operators in an area each year. In most areas where livestock live with wolves, few operators experience loss of livestock to wolves; the vast majority do not. However, this means that, while on an industry-wide basis the loss of livestock to wolf depredation is very small, a few individual operators may be quite adversely affected in any one year because these few operators may sustain a large portion of the annual loss within a large geographic area.

Wolf Depredation on Domestic Dogs.--Wolves on rare occasions kill domestic dogs. Tompa (1983) indicated that in British Columbia from 1978-1980 there were 13 wolf/dog related complaints with 29 dogs killed or injured by wolves. During the 3 years, all 29 dogs killed or injured were attacked between October and March.

Fritts and Paul (1989) reported on wolf/domestic dog interactions in Minnesota. Generally, rural residences and those at the edge of small communities in areas of high wolf populations seemed most likely to experience problems. No seasonal pattern was evident in Minnesota. In an area with about 68,000 households with dogs that may be exposed to wolves, 47 complaints of wolf-dog interaction were received from 1979 through 1987. In 60% of the reports, wolf killing or wounding of dogs was verified. In all other incidents it was verified that either no damage resulted or wolves were not involved. Verified complaints ranged from 1-6 reports per year with an annual average of 3.1. This would be an incident rate of 0.0004 incidents per 1,000 households or 1 per 22,000 households per year.

Impacts on Domestic Livestock in the Yellowstone Area.--Elements of this alternative that will likely influence impacts on domestic livestock include reintroduction of wolves into Yellowstone National Park and management as a nonessential experimental population under Section 10(j) of the ESA; intensive monitoring and then capture and return of dispersing animals to Yellowstone National Park as needed; immediate control by public agency personnel of any wolves depredating on livestock; and ability of private landowners to kill wolves that are attacking or killing domestic livestock on private land and allowing harassment of wolves near livestock on both public and private land.

During the first 5 years, few wolves will be outside of Yellowstone National Park or in areas that contain livestock. Approximately 7.5 million acres (30,400 km^2) surrounding the reintroduction area have no livestock grazing. Wolf populations would be recovered in the Yellowstone area, probably within about 10 years, and would be removed from protection under the ESA. States and tribes would assume management outside of national parks and national wildlife refuges.

Because of the low numbers of other classes of livestock in the primary analysis area, and experience in other areas, cattle and sheep will likely constitute 95%-100% of livestock killed or injured by wolves.

Projections of depredation rates from other areas should be done with great caution, because terrain, vegetation, weather, size of farms, husbandry practices, and prey populations differ between areas (Fritts et al. 1992). However, to provide some estimate of potential impacts of a recovered wolf population on livestock, the following equation was developed to standardize depredation rates from other areas in relation to total livestock in wolf range and wolf numbers:

$$\frac{\text{No. of livestock in Analysis Area}}{\text{No. of livestock in Other Area}} \times \frac{\text{No. wolves in Analysis Area}}{\text{No. wolves in Other area}} \times \text{Average annual depredation rate in other area} = \text{Estimated annual depredations in Analysis Area}$$

Application of this equation to comparable data from Alberta, Minnesota, and northwestern Montana results in estimates of about 19 cattle (range 3-32) and 30 sheep (range 17-48) killed or injured by (100) wolves per year in the Yellowstone primary analysis area. Calves will likely constitute the majority of cattle losses. Depredation rates on sheep are expected to be higher and more variable than depredation rates on cattle. Losses of lambs and adult sheep will vary widely, but on average, will be nearly the same.

Depredations will be highly variable between years and within areas. Most livestock operators will incur no losses, others may incur small sporadic losses, and a few could sustain chronic losses. Although the loss of livestock to wolf depredation will be very small on an industry wide basis, annual losses to wolf depredation likely will not be evenly divided among operators. A few individual operators may be quite adversely affected in any one year because these few operators may sustain a large portion of the annual loss within any large geographic area.

About 146,000 cattle and calves and about 265,000 sheep and lambs are grazed on the 6 national forests in the Yellowstone analysis area during the summer. Comparison with livestock numbers in the primary analysis area indicates that a substantial number of cattle remain on private or other public land during this season whereas a substantial number of sheep are brought in from other areas to graze on national forests. Consequently, the number of cattle and calves grazed in national forests are lower than the overall number of cattle and calves which occur during the remainder of the year in the entire primary analysis area. However, the number of sheep grazed in national forests during the summer is much greater than the number available during the remainder of the year in the primary analysis area. Application of the above formula to livestock grazed seasonally on national forests results in estimates of average annual livestock depredation by wolves of about 8 cattle (range 1-13) and 68 sheep (range 38-110). In some allotments that were very remote, were within the home range of several wolf packs, and where livestock were not tended or checked for long periods of time, depredation rates may approach those observed in the Simonette River experimental area in Alberta for short periods of time.

Evidence from the other areas of North America indicate that most of the wolf depredation occurs during the summer and early fall. Most of the depredations are likely to occur on public lands which have the higher density of livestock during this period and where most wolves are projected to occur.

All areas show a wide variation in rates of depredation among years and within particular areas, but a relative consistency in the general overall rates. A similar situation should be expected in the Yellowstone area with wolves present. Some years will have no or few depredations; others will have substantially increased depredations and concern will rise dramatically. Consequently, not only wide variation in depredation rates should be expected, but also wide variation in public perception, expectations, and tolerance of wolf depredation on livestock.

Expected depredations on pets (dogs).--Wolves occasionally kill pets, particularly dogs. Although this is a fairly uncommon event, it is often a very emotional impact because it often happens at or near the home and results in the death or serious injury of a family pet. Typically, rural residences and those at the edge of small rural communities in areas of high wolf populations seem most likely to experience these problems.

In Minnesota, wolves attack dogs at a rate of about 1 incident per 22,000 households per year and incidents range from 1-6 per year. Possibly, several incidents are not reported in both areas. British Columbia has about 4 reported incidents per year. Both of these areas have over 1,500 wolves in areas occupied by people and an area of over 20,000 mi^2 (51,800 km^2). In the primary analysis area there are an estimated 1,700 farms or rural residences in about 25,000 mi^2 (64,700 km^2). Wolf depredation on domestic dogs is expected to be very infrequent but will be emotionally disturbing to people who lose pets.

Conclusions.--During the first 5 years after beginning reintroduction, livestock losses to wolves would likely be very few, if any, because of the intensive wolf monitoring and management. During the next 5 years or so, as packs become established and begin to reproduce, dispersing animals will try to establish new packs and territories; some in the park, some in wilderness areas, and others on public or private land. During this period loss rates may be similar to those in northwestern Montana. As recovery levels are approached and achieved, depredation rates are expected to be within the range of those experienced in other areas of North America. Depredations of domestic livestock by wolves are estimated to average 19 cattle and calves (range 1-32) per year with the majority (85%) being calves. Depredations on sheep are estimated to average 68 sheep and lambs (range 17-110). Because of the influx of large numbers of sheep to the national forests during the summer grazing season, more of the sheep losses are expected to occur there. Wolf depredation on domestic dogs is expected to be very infrequent, but will be emotionally disturbing to some of those affected.

Impacts on Land Use

Elements of this alternative that will likely impact land use include reintroduction of wolves into Yellowstone National Park and management as a nonessential experimental population, agency control of wolves that are involved in livestock, working animal, or pet depredation allowing livestock operators to kill wolves that are attacking or killing livestock on private land and allowing harassment of wolves near livestock on both public and private land. The proposal calls for no public land use restrictions to facilitate wolf recovery.

Wolves would be placed in 1-3 temporary confinement facilities for "soft release". After an acclimation period they would be released and monitored. Confinement facilities would require the construction of pens suitable to contain wolves, likely 10 foot (3.0 m) high chain link fence with a ground apron. These would be up to 3 acres (1.2 ha) with variation of topography, some forested area for cover and security, and a water supply. Archeological clearances would be completed prior to construction; previously disturbed sites would be used if available. During the confinement, some trampling of ground vegetation and digging is expected, however, no long tern changes to the vegetation community are expected after removal and rehabilitation.

Public access to the confinement and release sites would be restricted to prevent harm to the confined animals and to avoid habituation to humans. This would likely involve an area about 1 mile (1.6 km) around the facilities. The facilities would be located in semi-remote areas away from visitor facilities and would not be expected to result in changes in normal visitor use of park areas.

Great amounts of public attention will be focused on reintroduced wolves during initial establishment of wild populations. Members of the public will aggressively seek opportunities to view wolves and photograph them, especially during early population establishment. These opportunities most readily present themselves at den sites and rendezvous areas early in the spring (mid-April to mid-June) when wolves are least mobile. During the first several days of life wolf pups cannot regulate their own body temperature. Consequently, they are very vulnerable if disturbance result in adults moving the pups to more secure areas during this period. Therefore, during the first several years of reintroduction, active den sites within Yellowstone National Park would be closely monitored.

Within the park, snowmobile activity is restricted to the established routes (main roads that are closed to wheeled vehicles during winter). The road from Gardiner, Montana, to Cooke City, Montana, remains open year-round. Wolves would be exposed to vehicle and snowmobile traffic and noise and would likely select denning areas to avoid traffic and noise. Snowmobile activity ceases during March because of poor snow conditions at the lower elevations and road plowing which begins in early March and continues through April. Most roads are open to wheeled vehicle traffic by the end of April. Visitor activity during

May and June is low, mostly confined to the main roads and the few open visitor facilities. (see Chapter III, Land Use and Visitor Use sections). Because of snow and poor trail conditions at higher elevations, little backcountry activity occurs until late June with commercial outfitting beginning after July 1. Consequently, no adverse effects to reintroduced wolves are expected from visitor use in national parks.

The proposed action calls for no restrictions or modification of land management practices on lands other than around wolf confinement and release sites in national parks.

Current land management in national parks and national forests places restrictions on human use of important ungulate and grizzly bear seasonal ranges, primarily during spring. These restrictions occur at the same time and in habitats similar to those that would be used by denning wolves. No additional land use restrictions are expected to occur.

Activities to control damage by wildlife to livestock or property are conducted primarily by private individuals or ADC. Most control activities are for coyote depredation on cattle and sheep, using a variety of techniques. Aerial shooting is limited by of weather, terrain, and cost, and is not permitted by private individuals on federal land. Other techniques include leg-hold traps and neck snares.

Only 2 toxicants are registered by the Environmental Protection Agency for control of coyotes. These are Compound 1080 toxic collars and M-44s. Toxic collars are placed on the necks of sheep, and when bitten by a coyote, they expel Compound 1080 (sodium fluoroacetate). These devices are registered for limited experimental use and receive extremely limited application. M-44s may be used by private owners on private land after operator certification. However, there are no certified operators in the primary analysis area now (ADC pers. commun.). Use of M-44s is not authorized on any public land around Yellowstone.

M-44s are primarily used by ADC to control coyotes on private land in response to landowner requests. Use of M-44s by ADC through cooperative agreement with landowners on private lands in the primary analysis area may involve up to 185 ranches (see Chapter III, Land Use). The devices are not used on every ranch every year or on any ranch all year, but may be used based on the particular situation (ADC personnel, pers. commun.).

Impact on use of M-44s is expected to be very limited for 2 reasons. First, they are not authorized for use in national parks, national wildlife refuges, or on national forests in the analysis area. Further, they cannot be used in areas where they may kill a threatened or endangered species, and are not used in most of the area because of the risk to grizzly bears. Consequently, their use is mostly restricted to low elevation private lands on the periphery of the primary analysis area and in several major river valleys. Second, the provisions in this alternative to control wolves that depredate on livestock, the provision that would allow livestock operators to harass wolves near livestock, and the likelihood that most wolves would avoid low elevation areas with high levels of human activity all suggest few wolves will occupy areas where M-44s are currently used.

However, it is possible that wolves may frequent some valleys and while they are there, use of M-44s in that locality may be suspended. For example, in northwestern Montana where a population of wolves lives, use of M-44s is not limited where single wolves may show up. Rather, where a group of wolves is known to live, M-44 use is restricted in the area at the time wolves are there.

Conclusions.--Construction of temporary confinement facilities would disturb up to 3 sites within Yellowstone National Park. Public access would be restricted up to 1 mile (1.6 km) around the facilities during the confinement period. Facilities would not be in association with normal visitor use areas so overall visitor use would not be affected.

There may be temporary limitations in a few areas on the use of M-44s for the control of coyotes. No other land use restrictions are proposed and no changes in public land use levels or patterns are expected. Overall land use would be slightly restricted in the use of M-44s.

Impacts on Visitor Use

Visitors to Yellowstone National Park and the Yellowstone area will know wolves live there, and will have the opportunity to see or hear wolves, or see their sign. In Denali National Park, Alaska, an estimated 15% of park visitors see wolves (Mech et al. 1991), and the concentrations of wildlife in open areas in Yellowstone National Park are expected to attract wolves to those places (Koth et al. 1990) where they will be observable.

A small percentage of potential backcountry users could be inconvenienced by temporary travel restrictions in the vicinity of wolf confinement and release sites. April-June visitation to Yellowstone makes up 26% of annual park use (Table 3-35); April-June backcountry use made up 19.2% of the April-October backcountry visitor use nights, and involved 1.4% of stock use nights in 1992 (Table 3-36). Day use by a few hikers in Yellowstone National Park could be directed to alternative trails if wolf release sites were adjacent to 1 of 4 popular trails in the northern part of the park--roughly 240 hikers could be so affected (Table 3-39).

Of 6,151 commercially outfitted backcountry visitor use nights recorded in Yellowstone National Park April-October 1992, none were recorded in April or May, and just 215 in June, representing 3.5% of the April-October total. Stock use nights for April-May were zero, and June stock use nights amounted to 1.5% (90 of the April-October total of 6,194). Consequently, no adverse effect is expected on outfitter operations in Yellowstone National Park (Table 3-38).

Assuming monthly distribution of general recreational use on the 6 greater Yellowstone national forests (Table 3-43) would be similar to those of the national parks, few visitors would be using the backcountry April-June. Monthly breakouts of outfitter use on greater Yellowstone national forests were not available, but snowy or muddy trails and high stream levels in higher elevations would normally prevent much use April-June, when travel might be restricted near wolf dens.

Conclusions.--Visitors to Yellowstone would have opportunity to see or hear wolves or see their sign. A slight increase of visitor use (5%-10%) may occur in part for this purpose. No change in visitor use patterns or use by commercial outfitters is projected.

Impacts on Economics

Background Information for Analysis.--An economic analysis of the effects of wolf reintroduction into the Yellowstone area entails examining each potential source of economic costs or benefits and estimating its net economic effect. The analysis contained here follows the outline presented by Duffield (1992). The areas of potential economic effects examined are the following: (1) effects on hunter harvest, (2) effects on livestock depredation, (3) effects on land use restrictions, (4) effects on visitor use, and (5) effects on existence values.

Value of Foregone Benefits to Hunters.--A reduced number of big game animals available for harvest directly affects the available hunting opportunities. Reduced hunting opportunities translates into a reduced number of hunters and hunter days spent in the field. This reduction in big game hunting activity represents a social cost associated with wolf reintroduction.

Two independent studies examined the projected effect of a recovered wolf population in the Yellowstone area on ungulate populations and hunter harvest. Mack and Singer (1992b) estimated that the hunter harvest of big game species on the Northern Yellowstone Range may be reduced by about 27% for antlerless elk, 100% for antlerless mule deer and 100% for antlerless moose. If these reductions are primarily achieved through reductions in existing special permit hunts for antlerless animals, deer populations could be expected to increase, elk populations could decline by 5%-30%, and moose populations could be expected to remain stable. Reduction of hunter harvest of other types of big game due to wolf recovery would be negligible.

Boyce and Gaillard (1992) estimated that a recovered wolf population in the Yellowstone area would reduce hunter elk harvest in 2 specific areas. Boyce and Gaillard (1992) predict that elk harvests would decline by 5%-10% for Wyoming's Jackson elk herd (a decline of 165 to 330 elk harvested) and 1%-2% for the North Fork Shoshone elk herd (a decline of 6 to 13 elk harvested). They predict that reduced hunting opportunities associated with wolf reintroduction will be limited to elk in the 2 areas noted above. The estimates of reduced hunting opportunities provided by Boyce and Gaillard (1992) and Mack and Singer (1992b) are presented together to offer a range of expected value losses to big game hunters associated with wolf recovery in the Yellowstone area.

A relatively simple methodology was used to estimate the reduced net social benefits and reduced hunter expenditures that could be associated with wolf recovery. This methodology is likely to overstate these reductions as described below. Given harvest reductions, reductions in hunter days are based on hunter success and days hunted per hunter (Montana Department of Fish, Wildlife and Parks 1988) as detailed in the notes to Table 4-4. The simplifying assumption is made that the reduction in hunter days equals the reduction in harvest, divided by success rate, times the average number of days per hunter. This assumption may be appropriate for special permit hunts but will likely overstate the reduction in hunter days during the general season if hunters continue to hunt but with lower success rates. The total expected reduction in hunter days due to wolf recovery is 2,439 to 4,879 days (Table 4-4). The estimated hunter days per hunter for antlerless deer special permit hunts (4.9 days per hunter) are based on Montana hunt district 313 and 314 averages for both antlerless and antlered deer hunts. It is possible that this leads to an overstatement of the hunt effort associated with antlerless mule deer hunts, particularly if deer hunting in these districts is incidental to elk hunting.

As shown in Table 4-4, reduced hunter harvest of elk, mule deer, and moose in the Yellowstone area due to wolf recovery could result in lost net social benefits on the order of \$187,000 to \$465,000 per year. Additionally, an estimated \$207,000 to \$414,000 in hunter expenditures would be lost to the 3-state region.

Lost Value Due to Livestock Depredation.--A second area of potential costs associated with wolf reintroduction to the Yellowstone area is livestock depredation. The calculation of lost value due to this depredation is straightforward. The lost value per year is equal to the estimated number of lost animals per year times the market value of those animals.

Wolf depredation on domestic livestock would likely be minimal during the first 5 years after the beginning of reintroduction. After that period, as recovery levels are approached and achieved, depredation losses are expected to be in the range of 1 to 32 cattle per year and 17 to 110 sheep per year. Table 4-5 shows the estimated economic value of the projected losses associated with wolf depredation in the Yellowstone area. It is estimated that between \$1,888 and \$30,470 in livestock depredation losses would occur under Alternative 1.

Lost Value Due to Land Use Restrictions.--It is expected that any land use restrictions due to the reintroduction of wolves into the Yellowstone area will not result in lost economic value. While some area visitors may be inconvenienced due to restrictions placed on

Table 4-4. Annual economic values and expenditures associated with reduced hunting opportunities arising from wolf reintroduction to the Yellowstone area.

Area/Species	Boyce and Gaillard	Mack and Singer
Northern Yellowstone Range		
Reduced Antlerless Elk		280[a]
Reduced Antlerless Deer		122
Reduced Antlerless Moose		9
Jackson Herd		
Reduced Elk Harvest	165-330	
N.F. Shoshone Herd		
Reduced Elk Harvest	6-13	
Reduced Elk Hunting Days	2,439-4,879[b]	1,020[b]
Reduced Moose Hunting Days	0	65[b]
Reduced Deer Hunting Days	0	1,213[b]
Reduced Value of Elk, Deer, and Moose Hunting (1992 dollars)	232,437-464,935[c]	187,335[c]
Total Reduced Expenditures Associated with Big Game Hunting (1992 dollars)	206,998-414,081[e]	257,870[d]

[a] The 280 antlerless elk reduction is assumed by Mack and Singer (1992b) to be split between 27 elk reduction in general season and 253 elk reduction in the late season hunt.
[b] For Mack and Singer, calculation of hunting days based on success ratio for Montana hunt district 313 general season antlerless elk of 0.396 and late season 0.71 (Duffield 1989). Antlerless mule deer success ratio is 0.493 for Montana hunt districts 313 and 314, and moose success is 0.85 based on hunting statistics for Montana Region 3 (Montana Department of Fish, Wildlife, and Parks 1988). Days per hunter are 5.48 for hunt district 313 general season, and 3.0 for late season (Duffield 1989). Days per hunter for deer in Montana hunt districts 313 and 314 is 4.9. Montana Region 3 moose hunters averaged 6.1 days per hunter (MT DFWP 1988). For Boyce and Gaillard, calculation of hunting days is based on 1991 success rate for Jackson elk herd of 0.37 and days per hunter 5.47 for this herd (Wyoming Game and Fish, 1992).
[c] Based on estimates of net economic value per day of $95.30 for elk hunting (Duffield 1988), and $64.09 for deer hunting (Brooks 1988). Moose hunting is assumed to be twice as valuable as elk hunting.
[d] Based on average expenditures per day of $131.07 for elk and moose hunting and $95.35 for deer hunting.
[e] Based on average expenditures for elk hunting in Wyoming of $84.87.

visitation in areas of high sensitivity confinement and release sites, this inconvenience is unlikely to result in any appreciable loss of economic value. Therefore, the net economic cost due to land use restrictions is estimated to be zero.

Economic Effect of Changes in Visitor Use.--Wolves are a high profile species with interest nationwide (Duffield 1992). Reintroduction of wolves under Alternative 1 will further

Table 4-5. Annual economic costs associated with livestock depredation in the Yellowstone area[a].

	Low estimate	High estimate	Average estimate
Cattle lost	1	32	19
Ave. value per cow[a]	715	715	715
Sheep lost	17	110	68
Ave. value per sheep[a]	69	69	69
Total lost value/year	1,888	30,470	18,277

[a] Average value per head figures are based on an average of the Montana, Idaho, and Wyoming value for all cattle and all sheep in the states as of January 1, 1993 (personal communication, Montana, Idaho, and Wyoming Departments of Agricultural Statistics).

increase national awareness of the presence of wolves in Yellowstone National Park. One possible effect of this increased awareness is increased visitation to the park. Table 4-6 shows how different groups of respondents answered the question "if wolves were present in the GYA, would you visit the area more frequently, less frequently, or the same frequency as you currently do?" Except for one group with a very small sample size, all groups reported that a larger percentage would visit more frequently than would visit less frequently. It should be pointed out however that for a majority of respondents the presence of wolves would not change their visitation patterns.

A 1993 national and regional survey sponsored by FWS found that a recovered population of wolves in the Yellowstone area would lead to an estimated 10.4% increase in visitation from residents of Montana, Idaho, and Wyoming, and an increase of 4.8% from out of region residents. It is estimated that there would also be a commensurate percentage increase in visitor expenditures. Based on the model of Duffield (1992), estimated increased expenditures in the Yellowstone area due to wolf reintroduction would be $3.35 million per year for 3-state residents and $19.65 million per year for out of region residents (Table 4-7). It should be noted that the standard errors on the estimates of percentage changes in visitation are quite large, and in all cases a 95% confidence interval on these estimates includes zero. Therefore, the estimates presented in Table 4-7 should be viewed as indicators of the likely direction of change in visitation rather than predictions of the percentage change.

Economic Effects on the Value Potential Visitors Place on Wolves.--A final area of potential change in economic value associated with wolf reintroduction is the value potential visitors and others place on having a recovered wolf population. There are 2 components to this value. There is value associated with hearing or seeing wolves. There is also what is called

Table 4-6. Comparison of anticipated visitation patterns with wolf reintroduction in the Yellowstone area, by population group.

Sample	% who would visit more	% who would visit the same	% who would visit less
(A) Residents of Mont., Idaho, Wyo.			
Who visited Yellowstone area in 1992 n = 79 or 24.5% of sample	21.5	69.6	8.9
Who had ever visited Yellowstone area n = 281 or 87% of sample	21.0	68.3	10.7
Who had not visited Yellowstone area n = 42 or 13% of sample	33.3	42.9	23.8
(B) Out of 3-state region residents			
Who visited Yellowstone area in 1992 n = 5 or 1.6% of sample	0.0	80.0	20.0
Who had ever visited Yellowstone area n = 81 or 27.1% of sample	16.0	74.1	9.9
Who had not visited Yellowstone area n = 218 or 72.9% of sample	35.3	44.0	20.6

"passive use" or "existence value". Existence value is the value a person associates with the knowledge that a resource exists, even if that person has no plans or expectations of ever directly using that resource (Krutilla 1967).

The methodology used follows that of Duffield (1992) and Duffield, Neher, and Patterson (Duffield et al. in prep.). The basic idea is to ask individuals how much they would be willing to contribute to a fund to help or oppose wolf recovery. Two random samples of potential respondents were drawn: one from all listed phone numbers in the U.S., and the other from all listed phone numbers in the 3 state region (Idaho, Montana, and Wyoming). Because wolf reintroduction is a potentially contentious and divisive issue, it was anticipated that 2 distinct groups of respondents would respond to the survey: those who support wolf recovery and attach a value to their existence in the Yellowstone area, and those who oppose recovery and attach a value to the absence of wolves.

The key survey question asked respondents if they would be willing to buy a lifetime membership in a trust fund established to support or oppose efforts to reintroduce wolves to the Yellowstone area. Respondents were presented with varying dollar costs for trust fund membership. The responses as to respondents' willingness to pay for membership in the trust funds were analyzed in order to estimate the average amount those favoring or

Table 4-7. Estimates of increased visitation and expenditures in the Yellowstone area due to wolf reintroduction.

Response/Statistic	Mont., Idaho, Wyo. Residents	Out of Region Residents
Current trips/year for sample	577	166
Sample extra trips	99	17
Sample fewer trips	39	9
Net change in trips	60	8
% increase in trips and expenditures	+10.4%	+4.8%
Estimated change in expenditures in Idaho, Mont., and Wyo. (millions of dollars)[a]	+3.35	+19.65

[a] Calculation of the increase in expenditures in the Yellowstone area due to wolf reintroduction draws from Duffield (1992) adjusted to 1992 price levels.

opposing wolf recovery in the Yellowstone area would be willing to pay to support or oppose wolf recovery (Table 4-8). The total net economic existence value per year of wolf reintroduction to the Yellowstone area is about $8.3 million (Table 4-8).

Conclusion.--It is estimated that wolf recovery in the Yellowstone area under Alternative 1 will lead to total benefits of $6.67 million-$9.85 million per year and total costs $667,000 to $973,000 per year. The largest component of total costs would be the wolf management costs of $480,000 per year. Considering the estimated costs and benefits associated with this alternative it is estimated that under Alternative 1 wolf reintroduction in the Yellowstone area will result in net benefits of $6.01 million to $8.88 million per year (Table 4-9).

Adverse Effects

Some elk, deer, moose, and bison populations would be reduced from 3%-30% from current high population levels. Levels of change would vary widely by species and population. Effects on elk populations would range from a projected decrease in the northern range elk herd of 5%-30% (from about 17,300 to between 12,100 and 16,400 elk) to an overall change in the Yellowstone, Jackson, and North Fork Shoshone river populations of 5%-20% (from about 36,726 to between 29,381 and 34,890 elk). Mean populations for mule deer would be 3%-19% lower than current high population levels and moose might be less than 7% lower. Bison populations might decline less than 15%. Bighorn sheep, pronghorn, and mountain goats are not predicted to be significant prey for wolves because of their low numbers relative to other wild ungulates, their use of escape terrain, and their use of areas close to human habitation. Wolf recovery will likely not affect these ungulates.

Table 4-8. Estimated mean values of wolf reintroduction in the Yellowstone area to potential visitors and others under Alternative 1.

Welfare measure/statistic	Mont., Wyo., Idaho residents	Out of region residents	All
Mean value for those[a] supporting reintroduction (Standard Error)[c]	20.50 (1.43)	8.92 (0.74)	
Mean value for those opposing reintroduction (Standard Error)	10.08 (1.48)	1.52[d] (0.55)	
Population supporting wolf reintroduction	391,204	50,152,416	
Population opposing wolf reintroduction	340,522	25,774,280	
Aggregate net economic value/year[b]	321,201	28,572,785	
Calibration[e]	0.286	0.286	
Estimated net economic value/year (Standard Error)	91,863 (9,179)	8,171,817 (811,470)	8,263,680 (956,437)

[a] The mean values are calculated as a truncated mean with the truncation level at $50 for 3-state residents and at $25 for out of region residents. The truncated mean valuation calculation included both responses from people with directory listed phone numbers and non-listed numbers, contacted through a random dialing procedure. In the aggregation of mean values an assumption was made of no difference in willingness to pay between those respondents with listed phone and those not listed. This assumption was tested by making a nonparametric comparison of the responses from a small random digit dialing sample with the listed sample. The mean values from the random digit sample were higher than those from the listed sample.

[b] Values are calculated assuming a perpetual benefit stream from a one time trust fund deposit amortized at a 7% real interest rate.

[c] All standard errors on estimates of mean net willingness to pay were estimated using a simulation procedure with 5000 iterations (Krinsky and Robb 1986).

[d] The sample size for the out of region respondents opposing wolf reintroduction to the Yellowstone area was not adequate to estimate willingness to pay. A nonparametric comparison of the Yellowstone area and central Idaho, out of region, oppose responses yielded quite similar means. $1.16 for Idaho vs. $1.67 for Yellowstone area. Because of the closeness of the estimates, the estimated Idaho mean of $1.52 was also used to estimated the Yellowstone area out of region, oppose willingness to pay.

[e] This factor is an estimate of the ratio of the amount individuals would actually contribute to the amount they state they would contribute, based on Duffield and Patterson (1991) and Ward and Duffield (1992).

Table 4-9. Annual net social benefits associated with wolf recovery in the Yellowstone area under Alternative 1.

	Annual impact (thousands of 1992 dollars)	
	Low estimate[c]	High estimate[c]
(A) Benefits associated with wolf recovery		
Annual net economic value of wolf recovery	6,673.1	9,854.3
(B) Costs associated with wolf recovery		
Foregone value to hunters[a]	187.3	464.9
Value of livestock losses	1.8	30.5
Annual wolf management cost until recovery[b]	478.0	478.0
Total costs	667.1	973.4
Net benefits of wolf recovery in the Yellowstone area[c]	6,006.0	8,880.9

[a] Lost value to hunters could possibly be overstated as this figure is based on hypothetical willingness to pay and has not been calibrated in any way as have the net economic benefits estimates.
[b] Note that one half of the total management costs of wolf recovery to both the Yellowstone area and central Idaho are included in the costs associated with this alternative. This cost will only be incurred until wolf recovery is achieved, which varies between alternatives. Other costs and all benefits will continue into perpetuity making annual net benefits significantly higher in many cases once recovery is achieved.
[c] For the benefits estimates, the low and high estimates represent a 95% confidence interval on the estimates of net willingness pay for the alternative. For each category of costs, the low and high estimates represent the best estimates of minimum and maximum costs associated with an alternative. The final net benefits figures do not represent a confidence interval but rather a plausible range of benefits associated with the alternative.

Hunter harvests of antlerless big game may also change for some ungulate herds. Mack and Singer (1992a) estimated that if antlerless elk harvests were reduced 27% (from an average of 994 antlerless elk/year to 714 antlerless elk/year) effects would be as described above. They also found northern range mule deer would increase in the presence of wolf predation if the antlerless deer harvest of 122 antlerless deer/year were eliminated. Moose numbers ranged from 13% smaller to 12% larger if moose harvests were reduced 1/2 (from 31-16 moose/year) in the presence of wolf predation. Boyce and Gaillard (1992) did not project wolf recovery to affect the hunter harvest in Montana, but they did predict the harvests to decline 5%-10% for Wyoming's Jackson elk herd (from about 3,300 elk/year to between 2,970 and 3,135 elk/year) and 1%-2% for the North Fork Shoshone elk herd (from about 640 elk/year to between 627 and 634 elk/year).

Some livestock will be killed by wolves. Estimates of average annual depredation by 100 wolves are about 19 cattle (range 1-32) and 68 sheep (range 17-110). It is not expected to have a measurable effect on livestock production for the livestock industry as a whole, but the few livestock operators that are affected each year could sustain most of the loss projected for the year.

Visitors would be restricted from about 3 mi^2 (7.8 km^2) around wolf confinement and release facilities. No measurable affect on overall pattern of visitor use is expected. There will be short-term impacts to vegetation in the confinement facilities during the reintroduction phase.

Adverse effects of this alternative include foregone benefits to hunters of $190,000-$460,000 per year and an associated reduction in hunter expenditures in the recovery area of $210,000-$410,000 per year. Additionally, losses to area ranchers due to livestock predation by wolves may be on the order of $1,800-$30,500 per year. These livestock losses could, however, be mitigated to a large degree by a private compensation fund, such as the one currently administered by Defenders of Wildlife. Those individuals who oppose wolf reintroduction to the Yellowstone area will also suffer adverse economic effects from reintroduction.

Short-term and Long-term Effects

During the early stages of wolf recovery and wolf reintroduction, the short-term effects of wolf predation on wild ungulates would be undetectable. Short-term effects on hunter harvests would also be undetectable. As the wolf population reached the recovery level (10 packs, about 100 wolves), long-term effects of wolves on wild ungulate populations would include a reduction of ungulate numbers of 3%-30% from current high population levels. Hunter harvests of antlerless big game may also be reduced for some ungulate herds in the long term. Harvests of antlered big game animals should not be affected. Because this alternative provides for flexibility in managing wolves and federal and state wildlife agencies can and already use various programs and strategies to enhance and manage wild ungulate populations, a recovered wolf population could have reduced long-term effects on wild ungulate populations and hunter harvest.

Reestablishment of the wolf to the system would reestablish more complete long-term predator/prey relationships. Computer simulations predict ungulate populations would fluctuate in response to winter severity, habitat condition, hunter harvest, predation, and other environmental factors, just as they have in the past. Population highs are projected to be lower; but population lows will not be as low. Winter mortality of ungulates, particularly young animals, is projected to be less than past trends without wolves.

Reintroduction of wolves into Yellowstone National Park and establishment of a recovered wolf population would result in few short-term effects on livestock. As the wolf population became established, wolves dispersing to areas beyond the park to areas that have livestock grazing, would likely encounter livestock on either public or private land. Some wolves will kill some livestock. Wolf related losses are not expected to have a measurable effect on livestock production from an industry standpoint, but the few livestock operators that are affected could sustain substantial loss in a given year. Use of toxicants that are lethal to wolves will be more restricted than at present in the short term because of the presence of an experimental population of wolves.

Visitor access to about 3 mi^2 (7.8 km^2) around wolf confinement facilities in Yellowstone National Park would be restricted during the confinement periods. This would be for several months for 3-5 years. Because these areas will not be in normal visitor use areas, no measurable effects on visitor use patterns are expected. Some short-term effects to vegetation in the confinement facilities are expected during the reintroduction phase. After completion of the reintroduction and rehabilitation and revegetation of the sites, there will be no long-term affects. No short-term adverse effects are expected outside of national parks. No long-term effects on land use have been identified. The presence of wolves will represent a significant restoration of a missing component of the ecological system. A slight (up to 5%) long-term increase of visitor use is projected because people will want to have the opportunity to see or hear wolves or see their sign in a wild setting.

In the short-term there will be management costs on the order of $478,000 dollars per year and these will continue to the projected date of recovery of 2002. Losses to livestock and hunters are likely to be less than predicted in the short-term and rise to the predicted level in the long-term (after full recovery). The total estimated economic benefits per year apply to both the short-term and the long-term.

Irreversible and Irretrievable Commitments of Resources

Because this alternative provides for flexibility in managing wolves and federal and state wildlife agencies can and already use various programs and strategies to enhance and manage wild ungulate populations, a recovered wolf population should not have irreversible effects on wild ungulate populations or hunter harvests. For ungulate herds where the primary management objective is to sustain higher big game populations to maximize hunter harvest, wolf recovery could reduce the number of animals available for harvest on a sustained basis. However, this alternative allows for relocation of wolves in circumstances where wolf predation causes significant reductions in ungulate populations.

Some wolves will kill some livestock. Wolves are not expected to have a measurable effect on the livestock industry but a few livestock producers could sustain substantial loss in a given year. Average annual depredation of livestock by a recovered population of wolves is projected to be about 19 cattle (range 1-32) and 68 sheep (range 17-110). The number of depredations will vary widely among years, but over the long term some livestock losses will be an irreversible commitment of resources. Any compensation paid by either state agencies or private groups to livestock operators for loss of livestock to wolves will be irretrievable by the group paying the compensation. No long-term effects or any irreversible or irretrievable commitments of resources regarding land use have been identified.

From an economic perspective, the only irreversible and irretrievable commitments of resources lie with the wolf management costs and the hunter and livestock losses as they occur. The program could at any time be modified to mitigate or eliminate these losses.

Cumulative Effects Analysis

Ungulate Populations and Hunter Harvest.--In general, all 3 state wildlife management agencies use hunter harvest as the primary tool to meet population number and harvest level objectives for big game ungulate populations. While all agencies have good hunting mortality data, and use this data as a guide to regulate the ungulate populations, little data is available quantifying other mortality sources such as wounding loss, illegal harvest, overwinter mortality, vehicle collisions, disease, and mountain lion, coyote, black bear, and grizzly bear predation. However, the outcome of these losses is inherently incorporated into other population parameters such as age/sex compositions (particularly reproductive success), and population trend counts.

Indeed, many modeled ungulate populations (particularly in Wyoming) have mortality from predators and other sources incorporated into them by default without identification of cause specific mortality because the models attempt to mimic the observed dynamics of the population. None of the models investigating wolf predation on ungulates in the Yellowstone area compared wolf predation to other predators. Boyce (1990) and Boyce and Gaillard (1992) noted other predators preyed on ungulates but considered those predator effects as a component of the dynamics of the ungulate population without wolves. Mack and Singer's (1992a) models mimic observed ungulate population parameters and estimate population numbers without quantifying mortality from other wild predators. Their models estimated wolf predation as a worst case scenario, because they considered wolf predation additive to the population. Functional and numerical responses of wolves to increasing or decreasing ungulate populations or compensatory responses of ungulates to wolf predation were not included in Mack and Singer's (1992a) models and they noted "... ungulate populations may be larger than we predicted and hunter opportunities and harvests may not be affected to the degree proposed in our models."

Overall, a recovered wolf population (10 packs, about 100 wolves) may kill about 1,200 ungulates/year (primarily elk, deer, moose, and bison) in the Yellowstone area. This wolf kill represents about 1% of the 95,000 elk, deer, moose, and bison living in the area and 8% of the annual hunter harvest of 14,314 elk, deer, moose, and bison.

Since most models investigating wolf predation attempted to mimic ungulate populations under past conditions, mortality from other sources such as predators was already included. All models predicted wolves would decrease ungulate populations. Hunter harvests were predicted to decline in some situations (Garton et al. 1990, Boyce and Gaillard 1992, Garton et al. 1992) and in most cases this decline was limited to the antlerless harvests (Vales and Peek 1990, Mack and Singer 1992b).

Recovered wolf populations living in 3 areas (Yellowstone National Park, Jackson Hole, and North Fork Shoshone) were predicted to reduce the elk population 5%-20% (Boyce and Gaillard 1992). Subsequent to wolf recovery, hunter harvests may be reduced 2% for the North Fork area and as much as 10% for the Jackson Hole area. No reduction in hunter harvests were predicted for the northern range herd. Wolves living only on Yellowstone's northern range were predicted to reduce elk numbers 5%-30%. Following wolf recovery, hunter harvests of northern range elk may be reduced slightly (Garton et al. 1990) or only the antlerless harvest may be reduced 27% (Mack and Singer 1992b).

With mortality from wolf predation, deer populations from 3 areas were predicted to decline 3%-19% (Boyce and Gaillard 1992). For a recovered wolf population living only in Yellowstone's northern range, deer populations were predicted to increase if hunter harvest of 122 antlerless deer/year were discontinued (Mack and Singer 1992b). Moose were predicted to decline no more than 7% (possibly more on the heavily hunted northern range, Boyce and Gaillard 1992). Mack and Singer (1992b) found the moose population on the northern range could remain stable with additional wolf predation if the antlerless harvests were discontinued. Bison populations in Yellowstone and Grand Teton National Parks were predicted to decline no more than 15% with a recovered wolf population (Boyce and Gaillard 1992).

One study in the North Fork Flathead river drainage in and near Glacier National Park is investigating cause specific mortality on ungulates in a multipredator-multiprey system. Of the 113 adult female ungulates (38 elk, 40 deer, and 35 moose) collared between 1989 and 1993, 43 have died. Of the 43, wolves killed 9 (21%). This compares to mountain lions killing 13 (30%), bears 7 (16%) humans 7 (16%), and coyotes 3 (all deer, 7%). The remaining 4 (9%) died of unknown causes or old age (D. Pletscher, unpubl. data). Inferring from this study, wolf predation on ungulates within site specific areas of the Yellowstone area is not expected to comprise more than 21% of the total predator caused mortality on adult female elk, deer, and moose in any 1 area.

Livestock.—Within Idaho, Montana, and Wyoming, about 200,000 cattle and calves and about 300,000 sheep and lambs die annually from a variety of causes, prior to market (Table 4-10). Total mortality of cattle from all causes in Idaho, Montana, and Wyoming ranges from 1.1%-1.3% per year and total calf mortality ranges from 4.3%-4.7% per year. Total mortality of sheep from all causes in the 3 states range from 4.6%-6.6% and total lamb mortality ranges from 14.9%-18.8% (National Agricultural Statistics Service 1992).

Losses of adult cattle, due to factors other than predators, range from 98.8%-99.5%. Calf mortality, due to factors other than predators, ranges from 96.0%-97.6%. Factors other than predators cause from 67.0%-75.2% of the total adult sheep losses and lamb mortality, due to factors other than predators, ranges from 39.5%-69.5% (Table 4-10).

Table 4-10. Total livestock mortality rates (percent of total deaths) from specific non-predator and predator causes in Idaho[a], Montana, Wyoming.[b]

Mortality Causes	Cattle			Calves			Sheep			Lambs		
	Idaho	Montana	Wyoming	Idaho	Montana	Wyoming	Idaho	Montana	Wyoming	Idaho	Montana	Wyoming
Total losses	22,000	26,000	15,000	50,000	60,000	30,000	14,000	42,000	33,000	36,000	100,000	81,417
Weather	2.3	13.8	17.3	9.0	15.0	29.0	1.5	10.5	8.7	11.9	17.1	13.6
Health	30.9	30.8	35.4	51.4	42.8	41.0	26.4	32.2	31.1	14.3	10.9	7.3
Birthing	7.7	11.5	10.0	13.4	22.3	20.0	10.0	8.8	9.3	14.6	21.3	8.7
Poison	8.2	5.4	17.3	1.0	0.7	2.3	5.5	4.0	10.5	1.2	0.9	3.6
Theft	1.4	1.2	3.3	1.0	0.7	1.0	1.7	3.3	7.2	0.9	2.7	1.9
Other	49.0	36.1	16.0	21.8	15.5	2.7	21.9	16.4	5.1	26.6	12.6	4.4
Non predator subtotal	99.5	98.8	99.3	97.6	97.0	96.0	67.0	75.2	71.9	69.5	65.5	39.5
Coyotes	0.1	0.1	0.0	1.8	2.0	3.3	25.3	18.1	20.9	25.0	26.1	44.6
Bobcats	[c]	[c]	[c]	[c]	[c]	[c]	[d]	0.0	0.1	[d]	0.1	0.3
Dogs	0.0	0.2	0.0	0.1	0.2	0.2	2.9	4.8	2.2	1.6	1.5	1.1
Bears	[d]	[d]	0.0	[d]	[d]	0.0	3.4	0.7	1.5	1.7	0.3	0.7
Eagles	[d]	[d]	0.0	[d]	[d]	0.0	[d]	0.3	0.6	[d]	1.2	5.8
Fox	[d]	[d]	0.0	[d]	[d]	0.0	[d]	0.2	0.3	[d]	4.8	5.6
Lions	0.2	0.4	0.7	0.1	0.3	0.3	[d]	0.2	2.5	[d]	0.5	2.2
Other	0.2	0.5	0.0	0.4	0.5	0.2	1.4	0.5	0.0	2.2	0.0	0.2
Predator subtotal	0.5	1.2	0.7	2.4	3.0	4.0	33.0	24.8	28.1	30.5	34.5	60.5

[a] Idaho calf and lamb numbers based on Montana-Wyoming averages of calf/cattle and lambs/ sheep.
[b] Idaho Agric. Stat. Serv. 1992a, 1992b; Montana Agric. Stat. Serv. 1992, 1992b; Nat. Agric. Stat. Serv. 1992; Wyoming Agric. Stat. Serv. 1992a, 1992b, 1992c.
[c] Included in the mountain lion mortality rate.
[d] Included in the other predator mortality rate.

Losses due to all predators range from 0.5%-1.2% of the total mortality of adult cattle, and calf mortality due to predators ranges from 2.4%-4.0%. Of the total mortality of sheep, losses due to all predators range from 24.8%-33.0%, and lamb mortality due to predators ranges from 30.5%-60.5% (Table 4-10).

Depredation by coyotes constitutes the largest predator factor. Estimated losses to wolves would likely be in the range of 0.004% of total cattle deaths and 0.02% of total sheep deaths. Losses of livestock from wolf depredation is not expected to comprise on average more than 0.1% of any class of livestock in the analysis area and no cumulative impact on livestock populations are expected.

Land Use.--Current limits on visitor access in Yellowstone National Park are described in Chapter III. Limits on visitor access under this alternative would include up to 3 mi^2 (5 km^2) around each of up to 3 confinement and release facilities during the reintroduction phase. These areas would not be located in normal visitor use areas and would represent about 0.08% of Yellowstone National Park. No additional land use restrictions are proposed.

During April to the middle of June approximately 107,190 acres (167 mi^2, 434 km^2) are closed to visitor use for grizzly bear management reasons (see Chapter III, Land Use). This area represents 4.8% of the park's area.

There are an estimated 8,274 farms in the 17 counties around Yellowstone, with an estimated 4,673 farms larger than 160 acres (65 ha; U.S. Department of Commerce 1989a,b,c). Within the Yellowstone primary analysis area there are an estimated 1,713 farms larger than 160 acres (65 ha) and an estimated total of 3,073. Use of M-44s is possible on about 185 farms and ranches. The presence of wolves prior to recovery may limit the use of M-44s on several of these 185 farms and ranches during any one year. No cumulative effects on the public use of public land or on the use of M-44s are expected.

Economics.--A cost-benefit analysis of this alternative shows total economic benefits to outweigh total costs. A cumulative net economic benefit of $6.0 million-$8.8 million per year is predicted from wolf reintroduction to the Yellowstone area under Alternative 1.

CENTRAL IDAHO

Impacts on Ungulate Populations

Impacts of a recovered wolf population (about 100 wolves) on elk populations in central Idaho were projected based on a POP-II (Bartholow 1985, Mack and Singer 1992a) computer simulation model. Population models were developed to predict the impact of wolves on elk populations, but because available information on population numbers and parameters was insufficient to model populations of other species, impacts on other species were extrapolated from elk models where possible.

At a predation rate of 15 ungulates/wolf/year plus 10% for occasional excessive killing (Carbyn 1983:971, Boyce 1990, Mack and Singer 1992b), 100 wolves would kill 1,650 ungulates per year (approximately 0.59% of central Idaho's pre-harvest total ungulate population). Based on availability and vulnerability of prey species, 100 wolves are predicted to kill about 495 elk and 1,155 deer (combination of mule deer and white-tailed deer) annually. Wolves will kill other ungulates occasionally, but wolf experts expect them to rely most heavily on deer and elk as prey.

Overall impacts of a recovered population of about 100 wolves are expected to be minimal. The expected increase in mortality because of wolf predation may affect the elk population so that a 10%-15% reduction in cow elk harvest (396-594 fewer cows harvested in central Idaho than in 1991) may be required if the current level of bull elk harvest is to be maintained, and the elk population and bull:cow ratio is to remain within acceptable limits. Wolf predation is not expected to affect mule deer or white-tailed deer populations enough to require changes in current season structure or harvest levels. Impacts on moose are expected to be minimal. Extent and impact of predation on Rocky Mountain bighorn sheep sub-populations is more difficult to predict, but some herds with low productivity may be vulnerable to wolf predation when on winter range with inadequate escape terrain, and may be impacted significantly. Mountain goats would rarely be vulnerable to wolf predation. Agencies would be permitted to capture and relocate wolves if were being negatively affected by wolf predation.

Elk--The central Idaho elk population was modelled based on data from annual elk sightability surveys. Model assumptions included:

1. Starting population of 76,300 elk with structure of 25 bulls:100 cows:35 calves (Table 3-48). The model assumes these parameters accurately reflect the real population.

2. Population is stable to slightly increasing.

3. Current (1991) level of harvest in central Idaho would be maintained (8,137 bulls, 3,957 cows).

4. Ten percent wounding loss (i.e., 8,137 bulls and 3,957 cows were harvested legally by hunters in 1991; an estimated 814 bulls and 396 cows were mortally wounded but not retrieved by hunters).

5. Deer are estimated to be 1.13 times more vulnerable to predation by wolves than elk (Mack and Singer 1992b:4-51). After correcting for availability (76,300 elk vs. 159,500 deer), 2.36 deer are predicted to be killed for every 1 elk (i.e., 30% elk, 70% deer).

6. Predation rate of 15 ungulates/wolf/year plus 10% to account for occasional excessive killing by wolves (16.5 ungulates killed/wolf/year).

7. Wolves prey disproportionately on bull elk during winter because bulls may enter winter in a weakened condition following the rut (e.g., 56.5% bulls vs. 43.5% cows, Mack and Singer 1992b; 60% bulls vs. 40% cows, Boyd et al. in prep.). To account for sex-differential predation rates and adjust for availability of bulls in the population, wolf predation was modelled at 60% bulls and 40% cows if the bull:cow ratio was ≥25 bulls:100 cows; 50% bulls and 50% cows if the bull:cow ratio was 20-25 bulls:100 cows; 40% bulls and 60% cows if the bull:cow ratio was 15-20 bulls:100 cows; and 35% bulls and 65% cows if the bull:cow ratio fell below 15 bulls:100 cows. Twenty percent of all elk killed by wolves are expected to be calves (Boyd et al. in prep.).

After model parameters were initialized, natural mortality was adjusted to make the model simulate a stable to slightly increasing (population increases 0.4% per year for 10 years, or 0.8% per year for 15 years) elk population prior to wolf predation (Table 4-11). Predation by 100 wolves was then added into the model to predict impacts on the elk population.

A predation rate of 15 ungulates/wolf/year plus 10% to account for occasional excessive killing was used in the model based on consumption and kill rates presented in several studies (Keith 1983, Boyce 1990, Vales and Peek 1990, Mack and Singer 1992b), and adjusted for the comparative size of ungulates in central Idaho. This predation rate is near the moderate kill rate of 13.4 elk/wolf/year used by Vales and Peek (1990), and is slightly higher than the 12 ungulates/wolf/year predation rate expected in Yellowstone (Mack and Singer 1992b, this document), because in central Idaho, wolves are expected to rely more heavily on smaller ungulates (i.e., deer) than in Yellowstone.

The central Idaho elk population models have several recognized shortcomings:
1. Recent change in elk hunting season structure which may result in more older bulls in the population (elk season was moved out of the rut period) is not reflected in 1992 estimates of population structure.

2. Elk and deer were the only prey considered in assessment of impact on elk, but wolves will also kill other ungulates occasionally. Hence, impact on elk and deer may be slightly less.

3. Wolves are expected to feed heavily on animals injured (or killed but not retrieved) during hunting season. Consequently, predation would be lower when crippled or unretrieved dead ungulates were available.

4. Models consider wolf predation to be completely additive to other sources of mortality. In reality, an unknown proportion of elk killed by wolves would have died from some other cause.

Table 4-11. Projected 10-15 year impacts of wolf predation (100 wolves) on central Idaho elk population under different management scenarios. One hundred wolves are expected to kill 15 ungulates/wolf/year plus 10% excessive kill (70% deer:30% elk).

	Time 0		10 years		15 years	
	Pop[a]	Bull:Cow:Calf	Pop[a]	Bull:Cow:Calf	Pop[a]	Bull:Cow:Calf
No Wolves Maintain current elk harvest levels (10% wounding loss assumed)[b]	76,300	25:100:35	79,094	14:100:35	86,131	16:100:35
100 wolves kill 15 ungulates/wolf/yr[c] + 10% excessive kill (70% deer: 30% elk)[d] Maintain current elk harvest levels	76,300	25:100:35	69,056	6:100:35	66,665	0:100:35
100 wolves 5% reduction in cow harvest	76,300	25:100:35	74,782	9:100:35	78,436	8:100:35
100 wolves 10% reduction in cow harvest	76,300	25:100:35	80,506	11:100:34	90,195	15:100:34
100 wolves 15% reduction in cow harvest	76,300	25:100:35	86,227	14:100:34	101,941	20:100:34

[a] Pop = Population size.
[b] Estimated 1991 harvest = 8,137 bulls and 3,957 cows.
[c] Predation rate based on Vales and Peek (1990) and Mack and Singer (1992b) and adjusted for smaller ungulate size in Idaho compared to Yellowstone.
[d] Species-specific predation rate derived from availability (159,375 deer: 76,300 elk) and vulnerability ratios (1.13 deer : 1 elk) (Mack and Singer 1992b).

5. These models do not incorporate stochastic variation. Density-dependent functional and numerical responses of elk and wolves (e.g., wolves switching to alternative prey when 1 prey species declines or another is particularly abundant), increased or decreased reproductive success of elk and/or wolves in response to favorable or unfavorable weather, habitat, or physical condition, etc.) are difficult to predict and were not incorporated into the models.

6. If bull:cow ratios decrease, hunter success will decrease and fewer bulls will be harvested. Current (1991) harvest level of bulls is not likely to be maintained if bull:cow ratios decline significantly.

For these reasons, actual impacts of wolf predation may be somewhat less than predicted by the model.

Impact on population size, parameters, and trend.--The central Idaho elk model predicted that without wolves, the central Idaho elk population will continue to grow at a low rate (r = 0.004 for 10 years, or r = 0.008 for 15 years). Although the population increased over time, the model predicted the bull:cow ratio would decline during the same period because more bulls die each year than are being replaced in the population. This model suggests that at current productivity (35 calves:100 cows), the 1991 level of bull harvest cannot be sustained without reducing the bull:cow ratio. Alternatively, it is possible that the initial population structure entered into the model may have been inaccurate because of misclassification of bulls:cows:calves during winter sightability surveys. Misclassification of calves as cows would result in a lower bull:cow ratio than exists in reality and result in a lower estimate of productivity. If productivity of central Idaho's elk population was higher than 35 calves:100 cows, more bulls would be replaced into the model population annually. Additionally, recent changes in elk hunting regulations that moved the hunting season after the rut may result in more adults bulls in the population in the future, and possibly a lower bull harvest and higher productivity. The predicted decrease in the bull:cow ratio is further compounded because the model does not incorporate a functional response component to reflect a decrease in hunter success resulting from fewer bulls being available in the population.

One hundred wolves are predicted to kill 1,650 ungulates/year, of which 30% (495) are expected to be elk (approximately 0.55% of the pre-harvest elk population). If the population model accurately mimics the dynamics of central Idaho's elk population without wolf predation (i.e., an elk population heavily regulated by hunting), the elk population cannot sustain the current level of bull and cow harvest with the added predation of 100 wolves (Table 4-11). More bulls would be killed by hunters, wolves, and other natural causes than are being replaced annually. To maintain population size and a satisfactory bull:cow ratio under the current bull harvest and compensate for the added mortality from wolf predation, harvest of cow elk may have to be reduced 10%-15% (396-594 fewer cows killed in central Idaho then in 1991, Table 4-11). A reduction in cow harvest by 10% (396 cows) will allow for predation of 100 wolves, an acceptable bull:cow ratio, and a population that is increasing faster (*r* = 0.005 for 10 yrs, or *r* = 0.011 for 15 yrs) than the population without wolves (Table 4-11).

Mule Deer.--Mule deer comprise about 81% of central Idaho's deer population (19% white-tailed deer). Based on availability and vulnerability, and a predation rate of 15 ungulates/wolf/yr (plus 10% excessive killing), 100 wolves are expected to kill approximately 495 elk and 1,155 deer per year. If mule deer are killed in proportion to their abundance, wolves will kill about 936 mule deer annually (approximately 0.64% of the pre-harvest population). Mortality of these additional 936 mule deer is not anticipated to cause any observable or measurable impact on the central Idaho mule deer population. No changes in season structure or harvest strategy are expected to be necessary because of wolves.

White-tailed Deer.--White-tailed deer account for about 19% of deer in central Idaho. If wolves prey on white-tailed deer in proportion to their abundance and vulnerability, 100 wolves are expected to kill approximately 219 white-tailed deer per year (approximately 0.61% of the pre-harvest population). The white-tailed deer population appears to be increasing throughout its range in central Idaho, and it is unlikely that predation of 100 wolves will have any measurable impact on white-tails in the primary analysis area. No changes are expected to be necessary in the Idaho Department of Fish and Game's (IDFG) management strategy because of wolves.

Moose.--Moose are an important prey animal for wolves in many areas where the species are sympatric (e.g., Gasaway et al. 1983, Ballard et al. 1987, Gasaway et al. 1992), and wolves will kill some moose in central Idaho. In the North Fork of the Flathead River drainage in northwestern Montana and southeastern British Columbia, wolves inhabit a multi-prey system similar to that in central Idaho. Wolves in the North Fork of the Flathead River drainage prey on moose occasionally (6.6% of ungulates killed), but rely most heavily on white-tailed deer (63.8% of ungulates killed) and elk (29.7% of ungulates killed) (Boyd et al. in prep.).

Moose numbers are believed to be increasing, but populations are continuing to be managed with a conservative bulls-only harvest. Because of their relatively sparse population density and the abundance of other, smaller prey species, it is doubtful that wolves will rely heavily on moose as a significant food source. Impact on the moose population is expected to be minimal. No changes in IDFG management are expected to be necessary to compensate for wolf predation.

Rocky Mountain Bighorn Sheep.--Rocky Mountain bighorn sheep are not expected to be vulnerable to predation by wolves during summer when they inhabit high elevation sub-alpine and alpine habitat. In winter, however, bighorn sheep in central Idaho move to lower elevations where they typically occupy shrub/grass and ponderosa pine/Douglas-fir/grass habitats where snow accumulation is minimal (Hanna 1990). Wintering areas are often in areas with steep, rocky terrain in which sheep can escape predators, but some sub-populations that winter at lower elevations in areas with inadequate escape terrain may be susceptible to predation by wolves.

It is difficult to predict the effect of wolf predation on the overall sheep population in central Idaho, but smaller sub-populations of bighorn sheep that are vulnerable to predation during winter may be impacted significantly. The current mature-ram-only harvest of bighorn sheep is conservative, but productivity of many herds is very low (Table 3-48), and any additional source of mortality may result in significant declines in these herds.

Under this alternative, the FWS and the IDFG could capture and relocate wolves if they were severely impacting sheep herds.

Mountain Goat.--Predation by wolves is not expected to impact mountain goat populations in central Idaho. Mountain goats typically summer at high elevations in alpine and sub-alpine areas where they will not be vulnerable to predation by wolves. Although most mountain goats move to lower elevations in winter (Oldenburg 1992c), their selection of steep, rocky terrain in proximity to cliffs protects them from predation by wolves.

Conclusions.--A recovered population of wolves in central Idaho is predicted to kill approximately 1,650 ungulates per year. Composition of ungulates killed by wolves is expected to be about 30% elk (approximately 495 elk) and 70% deer (an estimated 936 mule deer and 219 white-tailed deer). Wolves will occasionally kill moose and bighorn sheep, but deer and elk are expected to comprise most of their diet. Wolf predation is not expected to result in measurable or observable changes in populations of deer, moose, or mountain goats, but changes in management of elk in central Idaho may be required to prevent population declines. Some bighorn sheep populations that winter at low-elevation in areas without adequate escape terrain may be vulnerable to predation by wolves, and could suffer significant declines. However, under this alternative, wolves that severely impact important big game populations, or jeopardize state big game management objectives, could be captured and moved to another location. As a result of this flexibility in the experimental rule, it is unlikely that wolves would be permitted to reduce bighorn sheep populations significantly. Wolves will kill some healthy ungulates, but a large percentage of prey killed by wolves will be very young, very old, sick, injured, or otherwise disadvantaged. Consequently, fewer ungulates will die from malnutrition associated with winter stress annually. To a small extent, competition among ungulates for food and space will be reduced, and the health of surviving ungulates may be increased an undetermined, but probably minimal, amount.

Impacts on Hunter Harvest

To continue the current level of bull elk harvest (8,137 in 1991) in central Idaho while maintaining the current population size (postharvest population of 76,300 elk) and an acceptable bull:cow ratio, harvest of cow elk may have to be reduced 10%-15% (396-594 fewer cows harvested in central Idaho than in 1991). A reduction in cow harvest by 10% (396 cows) will allow for predation of 100 wolves, an acceptable bull:cow ratio, and an elk population that is increasing faster than the current elk population without wolves (Table 4-11).

No modifications in harvest of deer, moose, bighorn sheep, or mountain goats are expected to be required to accommodate for predation by 100 wolves.

Conclusions.--Harvest of cow elk may have to be reduced by 10%-15% in central Idaho (396-594 fewer cows killed than in 1991) to accommodate for predation by 100 wolves. No changes in management of harvest for deer, moose, bighorn sheep, or mountain goats are expected to be necessary.

Impacts on Domestic Livestock

Elements of this alternative that will likely influence impacts on domestic livestock include (1) reintroduction of wolves into central Idaho, with management as a nonessential experimental population under Section 10(j) of the ESA, (2) intensive monitoring of wolves with attempted capture and return of dispersing wolves to the central Idaho area, (3) control by public agency personnel of any wolves depredating on livestock, (4) the option allowing private landowners to kill wolves that are attacking or killing domestic livestock on private land and allows harassment of wolves near livestock on both public and private land, and (5) the option for livestock operators to receive a permit to kill depredating wolves on public land allotments (when ADC personnel are not able to resolve the problem).

Wolves would be released in central Idaho in areas that have will have low densities of livestock. During the first 5 years after this alternative is implemented, wolf numbers and depredations of livestock are expected to be low. Wolf populations are expected to be recovered in the central Idaho area about 10 years after reintroductions begin. Upon recovery, wolves would be removed from the ESA and the state of Idaho would continue to manage wolves.

Most livestock depredations by wolves in the 10 central Idaho counties are expected to occur in the 14,446,331 acre (58,500 km^2) block of contiguous USDA Forest Service land. In addition, depredations are expected in a thin band of surrounding private land. In general, the acreage of the band of private land is expected to include about 1/3 or 1,135,035 acres (4,600 km^2) of the 3,405,107 acres (13,800 km^2) of private land existing in the 10 central Idaho counties.

During the summer grazing period (most public lands grazing takes place between May 1 and October 31), approximately 182,925 adult cattle and calves and 223,523 adult sheep and lambs are distributed across the 14,466,331 acre (58,500 km^2) central Idaho primary analysis area (Table 4-12 and Figure 3-25). About 1/3 or 101,032 of the cattle remaining on 3,405,107 acres (13,800 km^2) of private land surrounding the USDA Forest Service land are also believed to be susceptible to wolf predation.

Table 4-12. Mean livestock depredation rates, livestock numbers, and wolf numbers from other study areas (Mack et al. 1992b) compared to Idaho.

Study Area	Size (acres)	No. Wolves	No. Cattle	No. Sheep	Mean Annual Cattle Depredation	Mean Annual Sheep Depredation
Alberta	34,346,450	1,500	257,941	10,000	235	31
Minnesota	14,578,700	1,460	229,064	23,719	27	50
Montana	4,826,269	44	75,000	11,000	3	2
Idaho	14,466,331	100[a]	182,925	223,523	10[a]	57[a]

[a] Projected.

Wolf depredation on livestock is highly variable between years (Mack et al. 1992b) and among areas (Table 4-12). Projection of depredation rates from other areas (i.e., Minnesota, Alberta, and Montana) is difficult because terrain, vegetation, size of farms, livestock husbandry practices, and prey populations (big game) differ among areas (Fritts et al. 1992).

However to provide an estimate of potential impacts of a recovered wolf population (about 100 wolves) on livestock in Idaho, the following equation (also used in the Yellowstone area analyses) was developed to standardize depredation rates from other studies in relation to total livestock and wolf numbers (Table 4-12):

$$\frac{\text{Number of cattle/sheep (Idaho)}}{\text{Number of cattle/sheep (other study area)}} \times \frac{\text{Number of wolves (Idaho)}}{\text{Number of wolves (other study area)}} \times \text{Mean annual depredations (other study area)} = \text{Estimated annual depredations (Idaho)}$$

Application of this equation to comparable data from Alberta, Minnesota, and northwestern Montana results in mean estimates of about 57 sheep (range 32-92) and 10 cattle (range 1-17) taken annually by a recovered wolf population in Idaho (Table 4-13).

Table 4-13. Estimated standardized sheep and cattle depredation rates in central Idaho based on a comparison of standardized rates from other study areas. Rates are standardized according to the estimated number of cattle, sheep, and wolves in each area.

Comparison Study Area	Idaho Annual Depredation Estimates Sheep	Idaho Annual Depredation Estimates Cattle
Alberta	46	11
Minnesota	32	1
Montana	92	17
Mean	57	10

Cattle and sheep will likely constitute 95%-100% of annual livestock depredations in central Idaho, both because of the low numbers of other types of livestock (Table 3-51) in the central Idaho area and because of similar results in other study areas (Table 4-13).

Depredation rates on sheep are expected to be higher than depredation rates on cattle in central Idaho. Depredations on sheep usually involve more individuals killed over a shorter period of time than cattle (Fritts 1990). Sheep on central Idaho allotments are tended by herders who keep the animals moving throughout the summer. The presence of herders may reduce or deter depredations by wolves (Curnow 1969).

Wolves are expected to prey on more calves than adult cattle in central Idaho. In other areas, calves comprise 68%-85% of cattle losses (Mack et al. 1992b). Because most calving takes place before cattle are placed on allotments in the central Idaho area, depredations on calves should be reduced. Most calves will be past the size of greatest vulnerability when they are moved to allotments (Fritts 1990).

Data from other areas concerning depredation on lambs verses adult sheep are varied. Because most lambing in central Idaho takes place before sheep are placed on allotments, lambs will be past the size of greatest vulnerability. Wolves are not expected to significantly select lambs over adult sheep in central Idaho.

Most wolves living near livestock areas where native prey is available are not expected to prey on livestock as is true in other areas. Lone wolves may have a slightly greater tendency to prey on livestock (USFWS 1987).

Wolf depredations on livestock are expected to be variable between areas and between years. Only a small percentage of livestock owners can be expected to be affected by depredations annually, although a few owners could sustain serious losses in a given year.

Most livestock (both cattle and sheep) depredations in central Idaho are anticipated in mid to late summer, when elk calves and deer fawns are maturing and becoming less vulnerable and wolf pups are demanding more meat but are still unable to hunt effectively with the pack. In remote wooded allotments where cattle are unattended, depredation rates could occasionally approach those recorded in the Simonette River Valley in Alberta, where 38-40 wolves killed or injured 27 cattle in 1 year (Table 4-1).

Expected depredations on pets (dogs).--Wolves will infrequently kill dogs. In Minnesota, wolves attack dogs at a rate of about 1 incident per 22,000 households per year. Incidents per year range from 1-6. About 4 wolf/pet (dog) incidents are reported from British Columbia per year. Minnesota supports about 1,500-1,750 wolves while British Columbia wolf populations number more than 6,300.

The 10 county central Idaho area (22,687,424 acres; 91,900 km^2) contains about 2,527 farms with an average human population density of 2.6 people/mi^2 (1.0/km^2). Wolf depredations on domestic dogs are expected to be infrequent in central Idaho but will probably be emotionally disturbing to dog owners affected. Most likely sites of dog depredations will be rural residences along the edge of national forests containing wolf populations.

Conclusions.--During the first 5 years after reintroductions begin, livestock depredations by wolves should be minimal because of intensive monitoring and management of radio-collared wolves. As wolves become established, depredation rates will begin to approach those from other areas in North America. About 10 cattle (range 1-17) and 57 sheep (range 32-92) are expected to be taken annually by a recovered population of 100 wolves in central Idaho.

Impacts on Land Use

This alternative includes the reintroduction of a non-essential experimental population of wolves into central Idaho. Federal agencies would only have to confer with the FWS on activities that may jeopardize the species (outside of national parks and national wildlife refuges) and such determinations would not prohibit the federal agency from proceeding with the activity. No constraints on private actions and private lands would apply.

No land use restrictions would occur under Alternative 1. This alternative will not impact any ADC activities other then those affected by existing EPA label restrictions on the use of M-44s. Existing Section 7 terms and conditions on the use of leg-hold traps and neck snares in "occupied wolf range" would no longer apply.

Central Idaho--Alternative 1

Implementation of Alternative 1 may have a slight impact on the use of M-44s in some areas in the 10 county central Idaho area. During 1992, M-44s were used on 30 private premises and 1 BLM site in the 10 county central Idaho area. Label restrictions on M-44s restrict their use in national forests and in areas where threatened or endangered species may be adversely affected.

If wolves showed up on private land in Idaho where M-44s were currently being used to control coyote depredations, their use may be suspended. However, because livestock operators can harass wolves near livestock, it is likely that wolves would avoid low elevation private lands, and impacts on the use of M-44s would be slight.

Conclusions.--Reintroduction of an experimental population of wolves into central Idaho is not expected to impact existing land uses. Due to existing label restrictions, a slight impact on the use of M-44s to control coyotes could occur in some areas as "occupied wolf range" in central Idaho expands. Existing Section 7 terms and conditions on the use of leg-hold traps and neck snares in "occupied wolf range" would no longer apply.

Impacts on Visitor Use

Under Alternative 1, wolves in central Idaho would be expected to recover just after the turn of the century (about 10 years after initiation of reintroductions).

Visitors to the backcountry of Idaho will have an opportunity to hear and observe wolves or their sign in the next decade. Wolf howling programs in Algonquin Provincial Park have been popular to visitors since 1963 (Strickland 1988).

Nature study, hiking, walking, and camping activities in Idaho are all projected to experience moderate to high growth to the year 2010. Hunting activities in Idaho are projected to experience low growth to the year 2010 (IDPR 1989).

Tourism and outdoor recreation are growing in Idaho. Wolves are a high profile species with interest and support nationwide. Reintroduction of wolves under Alternative 1 will further increase national awareness of the presence of wolves in central Idaho.

It is possible but not certain that the establishment of wolves could attract increased visitors to central Idaho in the next decade and beyond. Although some people may not venture into the Idaho backcountry because of a fear of wolves, others will probably visit central Idaho hoping to hear or observe wolves or their sign.

A slight reduction in the number of cow elk tags for sale will preclude some hunters from visiting the central Idaho backcountry. A few people who now hunt big game may be reluctant to do so in the future if they perceive that wolves are reducing big game populations in that area.

Conclusions.--Reintroduction of wolves may attract increased visitors to central Idaho in the next decade and beyond. It is also possible visitation may decrease. Although some people will not venture into central Idaho's backcountry because of a fear of wolves or because there may be fewer cow elk tags, more people may visit because of the widespread high interest in the wolf and because of the uniqueness of the animal in the lower 48 states.

Impacts on Economics

Background Information for Analysis.--An economic analysis of the effects of wolf reintroduction into central Idaho entails examining each potential source of economic costs or benefits and estimating its net economic effect. This analysis follows the outline presented by Duffield (1992). Areas of potential economic effects examined are the following: (1) effects on hunter harvest, (2) effects of livestock depredation, (3) effects on land use restrictions, (4) effects on visitor use, and (5) effects on existence values.

Value of Foregone Benefits to Hunters.--A reduced number of big game animals available for harvest directly affects the available hunting opportunities. Reduced hunting opportunities translates into a reduced number of hunters and hunter days spent in the field. This reduction in big game hunting activity represents a social cost associated with wolf reintroduction. Based on a recovered population of 100 wolves in the central Idaho area, it is predicted that a reduction of 396-594 cow elk harvested per year may be necessary to stabilize populations and sustain the current bull elk harvest levels (see preceding discussion on effects on ungulate populations for derivation of these estimates).

A relatively simple methodology was used to estimate the reduced net social benefits and reduced hunter expenditures that could be associated with wolf recovery in central Idaho. This methodology is likely to overstate these reductions as described below. Given harvest reductions, reductions in hunter days are based on hunter success and days hunted per hunter as detailed in the notes to Table 4-14. The simplifying assumption is made that the reduction in hunter days equals the reduction in harvest divided by success rate, times the average number of days per hunter. This assumption may be appropriate for special permit hunts but will likely overstate the reduction in hunter days during the general season if hunters continue to hunt but with lower success rates. Total expected reduction in hunter days due to wolf recovery is 14,619 to 21,928 days (Table 4-14).

Reduced hunter harvest of elk in central Idaho due to wolf recovery could result in lost net social benefits totalling $756,810 to $1,135,214 per year.

Lost Value Due to Livestock Depredation.--A second area of potential costs associated with wolf reintroduction to central Idaho is the possibility of depredation on livestock. The calculation of lost value due to depredations is straightforward. The lost value per year is equal to the estimated number of lost animals per year times the market value of those animals.

Table 4-14. Annual economic values and expenditures associated with reduced hunting opportunities arising from wolf reintroduction to central Idaho.

Area/Species	Low estimate	High estimate
Reduction in antlerless elk harvest	396	594
Reduced elk hunting days[a]	14,619	21,928
Value per day of elk hunting[b]	$51.77	$51.77
Reduced value of elk hunting	$756,810	$1,135,214
Expenditures per day associated with elk hunting[b]	$39.10	$39.10
Total reduced expenditures associated with big game hunting	$571,591	$857,386

[a] Calculations based on average success rate for central Idaho units of 21.4% (Idaho Fish and Game, unpubl. data 1991) and average number of days per Idaho elk hunting trip of 7.9 (McLaughlin et al. 1989).
[b] Sorg and Nelson (1986) inflated to 1992 price level.

Wolf depredation on domestic livestock would likely be minimal during the first 5 years after the beginning of reintroduction. After that period, as recovery levels are approached and achieved, depredation losses are expected to be in the range of 1 to 17 cattle per year and 32 to 92 sheep per year. The estimated economic value of the projected losses associated with wolf depredation in central Idaho range from $2,923 to $18,503 with the average estimate of $11,083 (Table 4-15).

Lost Value Due to Land-Use Restrictions.--It is expected that any land-use restrictions due to the reintroduction of wolves to central Idaho will not result in lost economic value. While some area visitors may be inconvenienced due to temporary restrictions placed on visitation in areas of high sensitivity (release sites), this inconvenience is unlikely to result in any appreciable loss of economic value. Therefore, the net economic cost due to land-use restrictions is estimated to be zero.

Economic Effect of Changes in Visitor Use.--Wolves are a high profile species of national interest (Duffield 1992). Reintroduction of wolves under Alternative 1 will further increase national awareness of the presence of wolves in central Idaho. This increased awareness may affect visitation to the area. Table 4-16 shows how different groups of respondents answered the question "if wolves were present in central Idaho, would you visit the area more frequently, less frequently, or the same frequency as you currently do?". The groups reported that a larger percentage would visit more frequently than would visit less frequently. It should be pointed out, however, that to a majority of respondents said the presence of wolves would not change their visitation patterns.

Table 4-15. Annual economic costs associated with livestock depredation in central Idaho under Alternative 1.

	Low estimate	High estimate	Average estimate
Cattle lost	1	17	10
Average value per cow[a]	$715	$715	$715
Sheep lost	32	92	57
Average value per sheep[a]	$69	$69	$69
Total lost value/year	$2,923	$18,503	$11,083

[a] Average value per head figures are based on an average of the Montana, Idaho, and Wyoming value for all cattle and all sheep in the states as of January 1, 1993 (per. commun., Idaho, Montana, and Wyoming Departments of Agricultural Statistics).

Note: The estimates above are based on a 3-state average of livestock values for consistency with the Yellowstone area analysis. Idaho average values are $755 per head for all cattle and $66 per head for all sheep.

Table 4-16. Comparison of expected changes in visitation patterns to central Idaho due to wolf reintroduction.

Sample	Percent who would visit more	Percent who would visit the same	Percent who would visit less
(A) Residents of Mont., Idaho, Wyo.			
Who visited central Idaho in 1992 n = 71 or 21.7% of sample	22.5	67.6	9.9
Who had ever visited central Idaho n = 167 or 51% of sample	16.2	73.1	10.8
Who never had visited n = 160 or 48.9% of sample	30.0	35.6	34.4
(B) Out of 3-state region residents			
Who visited central Idaho in 1992 n = 2 or 0.6% of sample	0.0	100.0	0.0
Who had ever visited central Idaho n = 28 or 8.9% of sample	28.6	64.3	7.1
Who never had visited n = 286 or 91% of sample	36.4	43.0	20.6

A 1993 national and regional survey (J. Duffield, et al., Univ. of Montana, Missoula, unpubl. data) found that a recovered population of wolves in central Idaho would lead to an estimated 8.2% increase in visitation by out of area residents. However, the effect of wolves on visits by Idaho, Wyoming, and Montana residents may be positive or negative depending on the interpretation of several possible outlier responses in the sample (see notes to Table 4-17). Depending on the change in visitation, there would be an estimated commensurate change in expenditures by visitors to the area. There was insufficient data available to estimate the dollar change in expenditures in central Idaho. Table 4-17 details the calculation of the estimated percentage changes. It should be noted that the standard errors on the estimates of percentage changes in visitation are quite large, and in all cases a 95% confidence interval on these estimates includes zero. Therefore, the estimates presented in Table 4-17 should be viewed as indicators of the likely direction of change in visitation rather that predictions of the percentage change.

Table 4-17. Estimates of increased visitation and expenditures in central Idaho, due to wolf reintroduction.

Response/statistic	Montana, Idaho, Wyoming residents without outliers[a]	Montana, Idaho, Wyoming residents with outliers	Out of region residents
(A) Estimated increase in visitation			
Current trips/year for sample	992	992	98
Sample extra trips	79	79	11
Sample fewer trips	60	203	3
Net change in trips	19	-124	8
% change in trips and expenditures	+1.9%	-12.5%	+8.2%

[a] For this column two outlying observations were deleted from the analysis of Idaho, Montana, and Wyoming residents' changes in visitation to central Idaho. These observations dramatically skewed the average number of fewer trips to the area from the 3.78, used in the above calculations to 11.27 and thus exerted a large influence on the percentage change estimates. With the 2 observations included, visits from Idaho, Montana, and Wyoming. residents were predicted to decrease by 12.5%. Because the results are sensitive to these extreme responses, the analysis showing average changes both with and without outliers are shown above.

Economic Effects on the Value Potential Visitors Place on Wolves.--We have previously presented the theory and methodology involved in estimating net willingness to pay for wolf reintroduction. The total net economic existence value per year of wolf reintroduction to central Idaho is about $8.4 million (Table 4-18).

Table 4-18. Estimated mean values of wolf reintroduction in central Idaho to potential visitors and others under Alternative 1.

Welfare Measure/Statistic	Montana, Wyoming, Idaho residents	Out of region residents	All
Mean value for those[a] supporting reintroduction	15.60	8.73	
(Standard Error)	(1.36)	(0.71)	
Mean value for those opposing reintroduction	8.19	1.52	
(Standard Error)	(1.39)	(0.55)	
Population supporting wolf reintroduction	369,822	52,215,096	
Population opposing wolf reintroduction	327,059	24,721,833	
Aggregate net economic value/year[b]	216,196	29,259,317	
Calibration[c]	0.286	0.286	
Estimated net economic value/year	$61,832	$8,368,165	$8,429,997
(Standard Error)	(7,233)	(807,208)	(807,240)

[a] The mean values are calculated as a truncated mean with the truncation level at $50 for 3-state residents and at $25 for out of region residents. The truncated mean valuation calculation included both responses from people with directory listed phone numbers and non-listed numbers, contacted through a random dialing procedure. In the aggregation of mean values an assumption was made of no difference in willingness to pay between those respondents with listed phone and those not listed.
[b] Values are calculated assuming a perpetual benefit stream from a one time trust fund deposit amortized at a 7% real interest rate.
[c] See explanation and citations on calibration in Table 4-8.

One issue not investigated is whether individuals would be willing to pay the stated amounts for both wolf recovery in the Yellowstone area and in central Idaho. This question was not examined in this study. A conservative way to look at this issue is to compare the benefits of wolf recovery in either the Yellowstone area or Idaho to the combined costs of recovery in both areas. Either of these values when compared against the estimated combined economic costs to both the Yellowstone and central Idaho areas still show large positive net social benefits associated with wolf reintroduction in either of the 2 areas.

Conclusion.—It is estimated that wolf recovery in central Idaho under Alternative 1 will lead to total benefits of $6.85 million-$10.01 million per year and total costs of about $1.24 million-$1.63 million per year. Considering the estimated costs and benefits associated with

Table 4-19. Annual net social benefits associated with wolf recovery in central Idaho under Alternative 1.

	Annual impact (thousands of 1992 dollars)	
	Low estimate[c]	High estimate[c]
(A) Benefits associated with wolf recovery		
Annual net economic value of wolf recovery	6,847.8	10,012.2
(B) Costs associated with wolf recovery		
Foregone value to hunters[a]	756.8	1,135.2
Value of livestock losses	2.9	18.5
Annual wolf management cost until recovery[b]	478.0	478.0
Total costs	1,237.7	1,631.7
Net benefits of wolf recovery in central Idaho[c]	5,610.1	8,380.5

[a] Lost value to hunters could possibly be overstated as this figure is based on hypothetical willingness to pay and has not been calibrated in any way as have the net economic benefits estimates.
[b] Note that one half of the total management costs of wolf recovery to both the GYA and central Idaho are included in the costs associated with this alternative. This cost will only be incurred until wolf recovery is achieved, which varies between alternatives. Other costs and all benefits will continue into perpetuity making annual net benefits significantly higher in many cases once recovery is achieved.
[c] For the benefits estimates, the low and high estimates represent a 95% confidence interval on the estimates of net willingness pay for the alternative. For the individual costs, the low and high estimates represent the best estimates of minimum and maximum costs associated with an alternative. The final net benefits figures do not represent a confidence interval but rather a plausible range of benefits associated with the alternative.

this alternative it is estimated that under Alternative 1 wolf reintroduction in central Idaho will result in net benefits of $5.61 million-$8.38 million per year (Table 4-19).

Adverse Effects

No adverse effects are expected on deer, moose, or mountain goat populations in central Idaho, but modifications in cow elk harvest may be required to prevent significant declines in elk some populations. Some herds of bighorn sheep with low productivity and inadequate escape terrain on winter range could potentially suffer substantial declines.

The reintroduction of an experimental population of wolves into central Idaho will result in the loss of about 10 cattle (range 1-17) and 57 sheep (range 32-92) annually. An occasional dog will also be killed by a recovering population of wolves in central Idaho.

An expansion of occupied wolf range, due to the reintroduction of an experimental population of wolves, may lead to a slight reduction in the use of M-44s in the control of coyotes in central Idaho.

As wolves approach recovery in the next decade, some people will not venture into the central Idaho backcountry because of a fear of wolves.

Adverse effects of this alternative include foregone benefits to hunters of $760,000 to $1,135,000 per year and an associated reduction in hunter expenditures in the recovery area of $570,000 to $860,000 per year. Additionally, losses to area ranchers due to livestock depredation by wolves may be $3,000 to $19,000 per year. These livestock losses could, however, be mitigated to a large degree by a private compensation fund, such as is currently administered by Defenders of Wildlife. Individuals who oppose wolf reintroduction will also suffer adverse economic effects if wolves are reintroduced to central Idaho.

Short-term and Long-term Effects

Establishment of a recovery-level wolf population would have some short-term and long-term effects on ungulate populations. A population of 100 wolves would kill approximately 495 elk and 1,155 deer and small numbers of moose and bighorn sheep per year. No measurable or observable effect is expected on deer, moose, or mountain goat populations, but some adjustments in management of elk may be required if current bull harvest level is to be maintained. Decreases in some populations of bighorn sheep that winter on low-elevation areas with inadequate escape terrain are possible. Fewer ungulates may die of malnutrition associated with winter stress. Surviving ungulates may benefit slightly from reduced competition for food and space.

The reintroduction of an experimental population of wolves is expected to result in the loss of about 10 cattle (range 1-17) and 57 sheep (range 32-92) annually. Losses of livestock are expected to be variable between years and between areas. No long-term effects on overall livestock production in central Idaho is expected. In the short term, an individual livestock producer could sustain a substantial loss of livestock (most likely sheep) in a given year. The continuation of an existing private compensation program will help reduce monetary losses of individual livestock operators.

Reintroduction of an experimental population of wolves is expected to have few short-term or long-term effects on land use in central Idaho. A slight reduction in the use of M-44s to control coyotes may occur as "occupied wolf range" expands.

In the short term, the reintroduction of wolves into central Idaho will be controversial and will attract nationwide attention. Initially reintroduced wolves that are collared will be "famous" and people can be expected to venture into central Idaho hoping to hear or see them. In the long term, the presence of wolves in central Idaho will continue to attract some people to the state and to the backcountry who would otherwise not visit and will continue to preclude some people from visiting the central Idaho backcountry because of fear of wolves.

The reintroduction of wolves can also be expected to lead to a minor long-term reduction in the annual sale of cow elk tags. Many people who would have otherwise bought these tags may not visit the central Idaho backcountry.

In the short-term there will be management costs of approximately $478,000 per year and these will continue to the projected date of recovery of 2002. Losses to livestock and hunters are likely to be less than predicted in the short-term and rise to the predicted level in the long-term (after full recovery). The total estimated economic benefits per year apply to both the short-term and the long-term.

Irreversible and Irretrievable Commitments of Resources

There are no anticipated irreversible or irretrievable commitments of big game resources or hunting opportunity in central Idaho.

The reintroduction of an experimental population of wolves into central Idaho is expected to lead to the loss of about 10 cattle (range 1-17) and about 57 sheep (range 32-92) annually. Any livestock losses will be irreversible and irretrievable. Any compensation paid by private groups to livestock operators will reduce the monetary loss.

The reintroduction of an experimental population of wolves into central Idaho is not expected to lead to any irreversible or irretrievable commitment of land uses or visitor uses in central Idaho.

From an economic perspective, the only irreversible and irretrievable commitments of resources lie with the wolf management costs and the hunter and livestock losses as they occur. The program could at any time be modified to mitigate or eliminate these losses.

Cumulative Effects Analysis

Ungulate Populations and Hunter Harvest.--One hundred wolves are predicted to kill about 1,650 ungulates per year, or approximately 0.59% of central Idaho's total ungulate population. Wolves are predicted to annually kill 0.55% of the elk population and 0.63% of the total deer population (mule deer and white-tailed deer combined). In comparison, in 1991 hunters harvested an estimated 33,000 ungulates (12.0% of the total prehunt ungulate population) in central Idaho, including 13.7% of the elk population and 11.5% of the deer population.

In the North Fork of the Flathead River drainage in northwestern Montana and southeastern British Columbia, wolves exist in a multi-predator-prey ecosystem similar to that in central Idaho (Ream et al. 1991). Wolves killed 4.1% of female elk (Bureau 1992) and 6.7% of female white-tailed deer (Rachael 1992, Rachael and Pletscher in prep.) annually. Comparatively, wolves did not impact ungulates more than other predators. Mountain lions annually killed 13.4% of female elk (Bureau 1992) and 4.9% of female white-tailed deer (Rachael 1992, Rachael and Pletscher in prep.). Bears (both black and grizzly bears) are important predators in Montana and British Columbia, and bears killed an estimated 1.5% of female elk (Bureau 1992) and 3.4% of female white-tailed deer (Rachael 1992, Rachael and Pletscher in prep.) annually.

Mountain lions and black bears are also common predators throughout central Idaho, and will continue to prey on ungulates in central Idaho in the presence of wolves. However, it is important to note that the density of 100 wolves in the 17,502,720 acre (70,900 km^2) central Idaho primary analysis area (1 wolf/175,027 acres; 1/709 km^2) would be considerably lower than the density of wolves in the North Fork of the Flathead River drainage in Montana and British Columbia. Mountain lion and black bear populations are extremely difficult to estimate, and estimates are not currently available for central Idaho. However, predation of 100 wolves would be significantly less than predation of current populations by lions and bears.

Domestic Livestock.--In Idaho, 22,000 cattle, 50,000 calves, 14,000 sheep, and 36,000 lambs are lost annually to non-predator and predator causes (Table 4-10). Most livestock are lost to non-predator causes, including weather, health, birthing, poison, theft, and other causes.

Predators account for 0.5% of annual cattle losses, 2.4% of annual calf losses, 33% of annual adult sheep losses, and 30.5% of annual lamb losses.

Coyote depredation accounts for 25.3% of annual sheep losses and 25% of annual lamb losses. About 3,542 sheep and 9,000 lambs are lost to coyotes annually.

Under all alternatives, average annual loss of cattle and sheep to wolves is expected to fall within the range of 1-17 cattle and 32-92 sheep. A recovered wolf population would be expected to contribute between 0.003% and 0.029% of total annual cattle and calf losses and between 0.064% and 0.184% of total annual sheep and lamb losses in Idaho.

Within the 10 county central Idaho area, approximately 12,314 cattle and calves and 9,336 sheep and lambs are lost annually to a variety of causes (Table 4-20). Of these losses, approximately 224 cattle and calves and 2,913 sheep and lambs are lost to predators. Estimated annual losses of 10 cattle and calves and 57 sheep and lambs to wolves would increase annual estimated total livestock losses in the 10 county central Idaho area by 0.31% and increase annual estimated predator caused livestock losses by 2.1% (Table 4-20).

Land Use.--National forest lands in central Idaho contain 4,125,589 acres (16,700 km^2) of wilderness and about 5,900,000 acres (26,600 km^2) of roadless areas. Of 20,346 miles (32,373 km) of system roads on national forest lands, approximately 10,805 miles (17,385 km) are closed or are restricted in use in some way (Table 3-54).

Table 4-20. Central Idaho cumulative effects of estimated wolf depredations on livestock with all other estimated livestock losses. Ten county central Idaho area. Livestock losses pro-rated to 10 county area from total livestock losses in Table 4-10.

Livestock Numbers (April)	Estimated annual livestock losses	Estimated annual livestock losses to predators	Estimated annual livestock losses to wolves	Increase in annual livestock losses from wolf depredation (percent)	Increase in Predator caused losses of livestock from wolf depredation
Cattle & calves 384,900	12,314	224	10	0.08%	4.5%
Sheep & lambs 100,713	9,336	2,913	57	0.61%	2.0%
Totals	21,650	3,137	67	0.31%	2.1%

Livestock grazing is sometimes restricted near riparian areas on public land allotments. Livestock are usually restricted from areas with newly replanted trees for about 5 years. The impact of the recent listing of salmon species in Idaho as threatened or endangered is not known at this time, although some grazing restrictions are expected. A 58% reduction in grazing in the Stanley Basin area on the Sawtooth National Forest was recently recommended. Many of the reductions were associated with allotments containing prime Chinook salmon spawning habitat.

Label restrictions on M-44s prohibit their use in areas occupied by threatened or endangered species that would be susceptible. Consequently, use of M-44s is prohibited in occupied gray wolf range. Expansion of the wolf population in central Idaho may also lead to a reduction in the use of M-44s on farms located near wolf range. In the 10 county central Idaho area, M-44s were used on 30 private premises and on 1 Bureau of Land Management (BLM) site in 1992.

Visitor Use.--In 1991, an estimated 232,000 residents and 133,000 nonresidents fished in Idaho and an estimated 158,000 residents and 35,000 nonresidents hunted in Idaho. In addition, 194,000 residents and 188,000 nonresidents participated in primary nonresidential nonconsumptive activities in Idaho (USFWS 1992, Table 3-55).

In 1991, residents spent an estimated 2,417,000 days fishing in Idaho while nonresidents spent 439,000 days fishing (Table 3-55). Residents of Idaho also spent 1,941,000 days hunting and nonresidents hunted for 226,000 days. In addition, residents spent 1,722,000 days participating in nonresidential nonconsumptive activities in Idaho while nonresidents spent 1,717,000 days participating in nonresidential nonconsumptive activities (USFWS 1992, Table 3-55).

In the 36 big game management units covering the central Idaho Primary Analysis Area (Figure 3-24), 91,959 hunters spent a total of 688,175 days in the field in 1991.

A total of 102 outfitters and guides operate in 36 big game management units in the central Idaho Primary Analysis Area. In 1991, these 102 outfitters and guides provided big game tags to 4,614 nonresidents and 465 residents (Table 3-58). Most tag sales were for nonresident deer and elk hunters.

Nine national forests in central Idaho provide over 8,000,000 Recreation Visitor Days (RVDs) annually (Table 3-57). About 47% of the RVDs are associated with developed areas, while about 53% of the RVDs are associated with dispersed (nondeveloped) and wilderness settings. RVDs are expected to continue to grow annually across the central Idaho Primary Analysis Area.

In 1992, 10,000 people floated the Main and Middle Forks of the Salmon River through central Idaho wilderness areas. A total of 9,171 people signed in at trail heads in the Frank-Church Wilderness Area. USDA Forest Service rangers met 21,230 visitors in the Frank-Church Wilderness Area. Use in the Frank-Church Wilderness area has increased rapidly in recent years.

Tourism and outdoor recreation are growing in Idaho. Wolves are a high profile species with interest and support nationwide. Reintroduction of wolves under Alternative 1 will further increase national awareness of the presence of wolves in central Idaho.

It is likely that the recovery of wolves will attract increased visitors to central Idaho in the next decade and beyond. Although some people will not venture into the Idaho backcountry because of fear of wolves, others will visit central Idaho hoping to hear or see wolves or their sign.

A few people who now hunt big game may be less likely to do so in the future if they perceive that wolves are reducing game populations.

Economics.--A cost-benefit analysis of this alternative shows total economic benefits to outweigh total costs. The effect of wolf reintroduction to central Idaho under Alternative 1 is expected to be a net economic benefit of $5.6 million-$8.4 million per year.

ENVIRONMENTAL CONSEQUENCES ALTERNATIVE 2. NATURAL RECOVERY (NO ACTION) ALTERNATIVE

YELLOWSTONE

Impacts on Ungulate Populations

In this alternative wolves would be listed as endangered throughout the northern Rocky Mountain area and managed without the flexibility of an experimental population rule. Wolf recovery would be attained through wolf dispersal into the Yellowstone area. Wolves would most likely disperse from areas in northwest Montana or northern Idaho. Under this alternative wolf recovery could take decades and may not occur until 2025 (30 years).

Before recovery, dispersing wolves could colonize areas and form packs throughout the Rocky Mountains but outside the Yellowstone recovery area. Predicting where these wolves would occur and how they might affect ungulate populations outside the recovery area is too speculative and is not attempted by this EIS.

Migratory wolves may colonize areas within the Yellowstone area as individuals and some individuals may form isolated packs (at least 2 breeding individuals). Individual wolves and isolated packs may continue to appear and disappear for many years, maybe decades, because of the high mortality associated with individual dispersing wolves and the susceptibility of isolated packs to become extinct because of various biological and human caused mortality factors.

During the early stages of wolf appearance and disappearance, wolf predation effects on ungulate populations would probably be undetectable because so few wolves would occur in the Yellowstone area at any one time. Once several packs establish in areas providing high security and survival in or near the Yellowstone recovery area, wolf numbers may increase rapidly and reach recovery goals in as little as 10 years. During this rapid increase in wolf numbers, and when recovery is attained, wolf predation effects on ungulate populations might be similar to those found in Alternative 1. This alternative does not provide for wolf relocation if wildlife management agencies are not able to meet big game management objectives. Therefore, a rare case might exist where wolves may impact some ungulate populations to a greater degree than what was predicted for Alternative 1.

Conclusions.--Under this alternative, wolves would be listed as endangered throughout the northern Rocky Mountains and wolf recovery (10 packs, about 100 wolves) in the Yellowstone area would be attained through wolf dispersal from northwest Montana or northern Idaho. Wolf recovery would likely not occur until 2025 (30 years). For many years and possibly decades, individual dispersing wolves or packs (2 breeding individuals) may appear and disappear because of high mortality associated with dispersing wolves. During these early years of wolf appearance and disappearance, wolf predation effects on ungulate populations in the Yellowstone area would likely be undetectable. Once several packs are able to establish in the Yellowstone recovery area, wolf recovery levels may be reached in as little as 10 years. During this rapid increase in wolf numbers, wolf predation effects on ungulates might be similar to those found in Alternative 1. Alternative 2 does not provide for wolf relocation and a rare case could exist where wolves may impact some ungulate populations more than predicted in Alternative 1.

Impacts on Hunter Harvest

As described under Impact on Ungulate Populations, wolf recovery will take many years, possibly decades. During the early years of wolf recovery, individual wolves and packs may appear and disappear because of high mortality associated with dispersing wolves. Wolf effects on hunter harvest will likely be undetectable during the early stages of recovery. After several packs of wolves become established and the wolf population approaches recovery levels, wolf effects on hunter harvest may be similar to those described in Alternative 1. This alternative does not provide for wolf relocation if wolves are affecting a state's ability to meet its big game populations. Consequently, a rare case might exist where wolves could impact an ungulate herd and the associated hunter harvest more than predicted in Alternative 1.

Conclusions.--Under this alternative, wolf recovery could take many years, possibly decades. During the early years, a few wolves may appear and disappear from the Yellowstone area and wolf effects on hunter harvest would be undetectable. After several packs become established and the wolf population reaches recovery, wolf predation may affect hunter harvest in a manner similar to Alternative 1. Alternative 2 does not provide for wolf relocation and a rare case may exist where wolves could impact an ungulate herd and the associated hunter harvest more than predicted in Alternative 1.

Impacts on Domestic Livestock

Elements of this alternative that will likely influence impacts on domestic livestock include retention of wolves as an endangered species throughout the northern Rocky Mountains, no reintroduction of wolves, intensive monitoring of wolves dispersing from northwestern Montana that will be relied upon to establish populations in Yellowstone National Park, and control by public agency personnel of wolves depredating on livestock. The public would not be allowed to legally kill wolves that are attacking or killing domestic livestock. Wolves would recolonize the recovery areas but would also recolonize other areas throughout the northern Rocky Mountains and would be allowed to remain if conflicts were few. However, wolves would not recover rapidly. The probability that populations would establish in the Yellowstone area in the near future is extremely low; in the next several decades, substantially higher. Recovery would take a long time, perhaps 30 years.

Yellowstone Area--Alternative 2

Wolves would slowly recolonize areas throughout the northern Rocky Mountains and eventually reach the Yellowstone area. Livestock depredations would likely be comparable to that in northwestern Montana, averaging 0-6 cattle and 0-10 sheep per year. As new areas are occupied by wolf packs, sometimes in areas of high livestock density, this rate could be seen in each comparable area. Because of the long period likely required to reach recovery in the Yellowstone area, these conditions could continue for some time.

Wolves would likely occur in a number of locations in western Montana and northern Idaho prior to establishing populations in the Yellowstone area. The number of areas they would settle is unknown. Livestock depredations would occasionally occur in these areas. Wolves may initially establish at lower elevations in the Yellowstone area, potentially in areas with higher livestock densities. This would likely increase the level of livestock depredation over those estimated for Alternative 1.

A likely scenario for establishment of a wolf population in the Yellowstone area would be sporadic occurrences of single animals with occasional reproduction. Because of the high mortality of dispersing animals and the high susceptibility of very small pioneering populations to fail to establish, sporadic establishment, reproduction, and failure could occur several times. After pairs are established in secure areas and persistent, successful reproduction occurs, growth of the population to recovery levels would occur fairly rapidly, perhaps in 10 years. Livestock depredations in the Yellowstone area may then be similar to those described under Alternative 1. If wolves occupy lower elevational areas during population establishment, this could bring them into closer association with rural residences and increase depredation on domestic dogs.

Conclusions.--Uncertainty about where wolves would establish and how long wolf recovery would take are major factors of this alternative. Wolves would probably establish in several areas in Montana and Idaho prior to Yellowstone. Livestock losses would likely average 0-6 cattle and 0-10 sheep per year in each area where packs established during this period. Wolf populations may attempt to establish but fail several time before sustaining populations are established in Yellowstone. After establishment wolf recovery would take about 10 years. At wolf recovery, livestock depredations would be similar to Alternative 1. These would average about 19 cattle (range 1-32) and about 68 sheep (range 17-110) per year in the Yellowstone area. Recovery could take up to 30 years.

Impacts on Land Use

Elements of this alternative that will influence impacts on land use include retention of wolves as a fully protected endangered species throughout the northern Rocky Mountains and no reintroduction of wolves. Wolves dispersing from northwestern Montana and northern Idaho will be relied upon to establish populations. Agencies would control wolves that depredate on livestock, working animals, or pets, but the public could not kill or harass wolves.

Management actions to protect wolves could include seasonal closure of public land up to 1 mile (1.6 km) around active wolf den sites from March 15 to July 1 during population establishment. This would result in limits on recreational use of areas near wolf dens, may limit access if roads or trails are closed to protect wolves at den sites, and delay other activities such as livestock grazing or timber harvest until after this period. Application of toxicants that are lethal to wolves would be precluded in areas occupied by wolves.

Because wolves would slowly recolonize areas throughout the northern Rocky Mountains, eventually reaching the Yellowstone area, effects on land use on public lands would be greater than projected for Alternative 1. As new areas are occupied by wolf packs, sometimes in areas of higher human activity, and because of the potential of wolves to occupy lower elevation areas during the establishment period, this could bring them into closer association with human activities. Because of the long period likely required to reach recovery in the Yellowstone area, these conditions could continue for some time. Perhaps the biggest factor of the natural recovery alternative regarding land use is the lack of predictability.

During the early stages of population establishment, active den sites within Yellowstone National Park would be closely monitored. Because of the requirement to aggressively protect the first wolves denning in Yellowstone National Park in more than half a century, people would be precluded from using areas within 1 mile (1.6 km) of wolf den sites, based on the type of human use and the physical features of the terrain. This would occur from March 15 to July 1.

If most of the territories of the recovering wolf population were near areas used by people these area restrictions would affect a total of 21-35 mi^2 (54-91 km^2). However, this period is the lowest season of recreational use. Early season visitors mainly use the main roads and primary developed facilities, and not the backcountry. Also, some of the denning areas will likely be located in areas already under visitor use limitations for grizzly bear management. In northwestern Montana during early stages of population establishment road closures have been extended for short periods of time (2-4 weeks) to provide security for wolf dens close to roads that would have opened. No areas have been closed for long periods of time. Restrictions would be also increased substantially if human activity caused wolves to abandon dens resulting in wolf pup mortality, or if illegal killing of wolves, facilitated by public access, resulted in wolf mortality that precluded population recovery. In the absence of these factors, effects on recreational use and public access would not likely be measurable.

The limits on public land use to protect den areas from March 15 to July 1 would likely not affect initiation of grazing on livestock allotments where the likelihood of conflict was low or there was no history of depredation. However, it is possible that grazing may be delayed or suspended on areas with active dens or with a history of depredation. Wolf control guidelines under this alternative preclude capture and relocation or killing of wolves or wolf pups prior to August 1. Consequently, livestock on allotments where depredations occur prior to August 1 may be moved to alternative allotments or out of the area.

Lack of predictability of the frequency of these situations makes quantification difficult. In early stages of population establishment the potential impacts will be much lower and will vary widely over the period of recovery. Average allotment size on national forests in the Yellowstone area is about 15 mi^2 (39 km^2) and average about 1.5 permits per allotment. At the maximum range, if all 10 territories of a recovered wolf population were on public land livestock allotments, up to 10 allotments totalling about 150 mi^2 (390 km^2) involving about 15 permits could be affected. The probability that all wolves would den outside of the park on livestock allotments is low, so the actual affects are more likely toward the lower end of the range.

Effects on timber harvest activities would likely be somewhat greater than to those described for Alternative 1. The closure of a 1 mile (1.6 km) area around dens may delay some timber harvest or preclude access to some timber harvest areas from March 15 to July 1. However, in other areas where wolves live, and where standards and guidelines to provide for other resources such as ungulate winter ranges and birthing area have been adequately applied in sale design, there has been little effect on levels and timing of timber harvest activities. Additionally, most access roads have use and weight restrictions for protection of road beds during spring so use is already limited during most of this period.

Effects on ADC activities would likely be greater than those projected for Alternative 1. Use of techniques such as aerial shooting, trapping, and snaring are used only on a limited basis on public land, and would likely be further limited or curtailed in areas occupied by wolves, particularly during spring and early summer, and especially near wolf dens or rendezvous areas. Snaring would likely not be allowed in areas of wolf occupancy because of the high risk. Trapping is relatively low risk if small traps are used and traps are checked frequently. Aerial shooting by qualified individuals is also relatively low risk but the public controversy often associated with aerial shooting by government employees may limit its use in some areas. Use of toxicants is not now authorized on public land in the primary analysis area, and future proposed use would likely not be allowed in areas occupied by wolves.

Use of M-44s by both ADC and private applicators would be limited in areas occupied by wolves. Because of the increased possibility of wolves occupying lower elevation areas the effects on the use of M-44s, though limited, would likely be greater. Wolves may show up in several other areas prior to establishment in Yellowstone and use of M-44s would be precluded in these areas. For example, in northwestern Montana where a population of wolves exists, use of M-44s is not limited where single wolves may range. Rather, where a pack of wolves is known to live, M-44 use is restricted in the area at the time wolves are in the vicinity.

Conclusions.--The areas affected by natural recovery would be uncertain and recovery would take a long time. Closures of up to 1 mile (1.6 km) around den sites from March 15 to July 1 would limit recreational use on up to 21-35 mi^2 (54-91 km^2). Livestock grazing on up to 10 allotments totalling about 150 mi^2 (390 km^2), involving about 15 permits, may be delayed until after July 1. Grazing may be delayed or suspended on allotments with active dens or a history of high depredation rates. Activity on several individual timber sales may be delayed until after July 1 but no effect on overall timber harvest is expected. Use of toxicants lethal to wolves and some ADC methods would be limited in areas occupied by wolves.

Impacts on Visitor Use

Under natural recovery, visitors to Yellowstone National Park and the Yellowstone area will know wolves live there, and will have the opportunity to see or hear wolves, or see their sign but these benefits would be delayed until populations were established, compared to Alternative 1. In Denali National Park, Alaska, an estimated 15% of park visitors see wolves (Mech et al. 1991), and the concentrations of wildlife in open areas in Yellowstone National Park are expected to attract wolves to those places (Koth et al. 1990), where they will be observable.

A small percentage of potential backcountry users could be inconvenienced by temporary travel restrictions in the vicinity of wolf den sites from March 15 to July 1. April-June visitation to Yellowstone makes up 26% of annual park use; April-June backcountry use made up 19.2% of the April-October backcountry use nights, and involved 1.4% of stock use nights in 1992. Day use by a few hikers in Yellowstone National Park could be directed to alternative trails if wolf den restrictions limited use of popular trails - roughly 240 hikers could be so affected.

Of 6,151 commercially outfitted backcountry visitor use nights recorded in Yellowstone National Park April-October 1992, none were recorded in April or May, and just 215 in June, representing 3.5% of the April-October total. Stock use nights for April-May were zero, and June stock use nights amounted to 1.5% (90 of the April-October total of 6,194). Consequently, little adverse effect is expected on outfitter operations in Yellowstone National Park.

Assuming monthly distribution of general recreational use on the 6 national forests would be similar to those of the national parks, comparatively few recreationists would be using the backcountry April-June. Monthly summaries of outfitter use on the national forests were not available, but snowy or muddy trails and high stream levels in higher elevations would normally prevent much use April-June, when travel might be restricted within a mile (1.6 km) of wolf dens.

Conclusions.--Recreational users to Yellowstone would eventually have opportunity to see or hear wolves or see their sign but this would take several decades. A slight increase of visitor use may occur specifically for this purpose once populations have established. A small number of visitors may be limited in using areas near wolf dens from March 15 to July 1 but this represents a small percentage of overall visitation. No change in visitor use patterns or use by commercial outfitters is projected.

Impacts on Economics

Impacts on the Economic Value Associated with Hunter Harvest.--The economic impact of natural recovery on hunter harvest in the Yellowstone area is likely to be the same as under Alternative 1, after the population has fully recovered. This impact is estimated at $59,300 to $147,200 annually (Table 4-21). However, this impact will occur several decades later than under Alternative 1, due to the long period anticipated before a fully recovered population has stabilized.

Economic Impacts on Domestic Livestock.--It is estimated that livestock depredation under the Natural Recovery Alternative could be slightly higher than under Alternative 1 after recovering populations begin inhabiting the Yellowstone area. This level of depredation would likely be reached only after a number of years, or even decades, and during the preceding years depredation levels would likely be lower than under Alternative 1. This loss is estimated to average $600 to $9,700 annually over the period of recovery (Table 4-21).

Impacts on Visitor Use and Expenditures.--Once wolves reach the recovered population level, and their presence in the Yellowstone area becomes widely known, visitation to the Yellowstone area may increase to some degree. The timing of this increase is unknown, though the direction and degree of the change in visits or expenditures may be similar to that for Alternative 1.

Economic Effects on the Value Potential Visitors Place on Wolves.--In the case of natural recovery, the benefits to existence values are the same as under Alternative 1 but this value is not realized until the wolf population is recovered, or at least is beginning to recover. In this analysis, it is assumed that the full existence value is realized when there is a viable breeding pair of wolves in living in the Yellowstone area. It is anticipated that under natural recovery a breeding pair of wolves will be present in the Yellowstone area by the year 2010. In calculating the benefits to existence value under this alternative the aggregate net existence value per year is discounted back to 1993 from the year 2010 at a 7% real discount rate. Under these assumptions natural recovery of wolves in the Yellowstone area has an net economic value of between $1.73 and $2.56 million per year (Table 4-21).

Conclusion.--It is estimated that natural recovery in the Yellowstone area under Alternative 2 will lead to total benefits of $1.73 million-$2.56 million per year and total costs of $310,000-$407,000 per year. The largest component of total costs would be the wolf

Table 4-21. Annual net social benefits associated with wolf recovery in the Yellowstone area under natural recovery.

	Annual impact (thousands of 1992 dollars)	
	Low estimate[c]	High estimate[c]
(A) Benefits associated with wolf recovery		
Annual net economic value of wolf recovery	1,733.8	2,560.9
(B) Costs associated with wolf recovery		
Foregone value to hunters[a]	59.3	147.2
Value of livestock losses	0.6	9.7
Annual wolf management cost until recovery[b]	250.0	250.0
Total costs	309.9	406.9
Net benefits of natural recovery in the Yellowstone area[c,d]	1,423.9	2,154.0

[a] Lost value to hunters could possibly be overstated as this figure is based on hypothetical willingness to pay and has not been calibrated in any way as have the net economic benefits estimates.
[b] Note that one half of the total management costs of wolf recovery to both the Yellowstone area and central Idaho are included in the costs associated with this alternative. This cost will only be incurred until wolf recovery is achieved, which varies between alternatives. Other costs and all benefits will continue into perpetuity making annual net benefits significantly higher in many cases once recovery is achieved.
[c] For the benefits estimates, the low and high estimates represent a 95% confidence interval on the estimates of net willingness pay for the alternative. For the individual costs, the low and high estimates represent the best estimates of minimum and maximum costs associated with an alternative. The final net benefits figures do not represent a confidence interval but rather a plausible range of benefits associated with the alternative.
[d] Except for management costs the benefits and costs for this alternative is identical to Alternative 1. The only difference is that the benefits and other costs do not start until there is some natural recovery, assumed to be in the year 2010. The capitalized value of a perpetual stream of the annual costs and benefits beginning in the year 2010 is discounted to the present (1993) then amortized in perpetuity.

management costs of $250,000 per year. Considering the estimated costs and benefits associated with this alternative it is estimated that under Alternative 2 natural recovery in the Yellowstone area will result in net benefits of between $1.42 million and $2.15 million per year.

CENTRAL IDAHO

Impacts on Ungulate Populations

Impacts of 100 wolves are expected to be about the same under this alternative as described under Alternative 1--Reintroduction of Experimental Populations, except that wolves would not be relocated even if the added predation was negatively impacting ungulate populations in localized areas. Recovery would take longer under this alternative than in Alternative 1, so predation would increase gradually over a longer period of time as the wolf population increased to recovery level. Impacts on native ungulate species are expected to be minimal. However, smaller sub-populations of bighorn sheep may be reduced if predation by wolves is heavy when bighorns are vulnerable on winter range. With a recovered wolf population, fewer ungulates may die from malnutrition associated with winter stress. Surviving ungulates may benefit slightly form reduced competition for food and space.

Conclusions.--Recovery would take longer to achieve under this alternative than under Alternative 1, and the level of predation caused by wolves would increase more gradually over a longer period of time as the wolf population slowly increased and expanded at a natural rate. A recovery-level wolf population is expected to have the same impact on elk, deer, moose, and mountain goat populations under this alternative as under Alternative 1. Consequences of wolf predation on bighorn sheep may be more severe under this alternative. Predation of 100 wolves is more likely to result in serious declines of some bighorn sheep populations with inadequate escape terrain on winter range because wolves could not be captured and relocated even if they were impacting big game populations.

Impacts Hunter Harvest

No modifications in harvest of deer, moose, or mountain goats are expected to be required to accommodate for predation by 100 wolves. Harvest of cow elk may have to be reduced 10%-15% (same as in Alternative 1) to maintain current bull harvest and population level.

Harvest of bighorn sheep rams may have to be reduced or eliminated in some herds if those herds are vulnerable on winter range and are being impacted significantly by wolf predation.

Conclusions.--Cow elk harvest may have to be reduced 10%-15% to accommodate predation of 100 wolves, and harvest of bighorn sheep rams may have to be reduced or eliminated in some areas where sheep populations are particularly vulnerable to predation by wolves while on winter ranges with inadequate escape terrain.

Impacts on Livestock

Elements of this alternative that will likely influence impacts on domestic livestock include: (1) retention of "endangered" status for wolves throughout Idaho with no reintroduction, (2) intensive monitoring of wolves dispersing from northwestern Montana or Canada that will be relied upon to establish populations in central Idaho, (3) wolves depredating on livestock will be relocated or lethally controlled by public agency personnel, and (4) livestock operators or other members of the public would not be allowed to legally kill wolves that are attacking or killing domestic livestock. Wolves would be expected to recolonize the central Idaho area, but would also recolonize other areas throughout Idaho, and would be allowed to remain if conflicts were few. Wolves would not be expected to recover in central Idaho for at least 20 years.

Most livestock allotments are located in the southern half of the central Idaho primary analysis area. Because dispersing wolves from Canada and northwestern Montana are expected to recolonize the northern half of the central Idaho area first, livestock depredations during the initial 5-10 years of Alternative 2 implementation are expected to be minimal.

As wolves move into the southern portion of the central Idaho primary analysis area and outlying private land, livestock depredations will likely increase. As wolves approach recovery (estimated to be in about 20 years), annual livestock depredations will probably approach about 12 cattle (range 1-17) and 60 sheep (range 32-92), see related analysis in Alternative 1.

Depredation rates are expected to be higher than those under Alternatives 1, 3, and 4, because private livestock operators would not be allowed to shoot or harass wolves depredating on or harassing domestic livestock. Wolves would be more likely to disperse onto private land and come in contact with additional livestock during natural recovery.

Because of the potential for wolves to disperse onto private land during the recovery period, the potential interaction with domestic dogs is higher under this alternative than Alternatives 1, 3, and 4.

Conclusion.--Recovery of wolves is expected to take about 20 years in central Idaho under the natural recolonization alternative. As wolves move toward recovery in the second decade of this alternative and begin to recolonize the southern part of the central Idaho area, annual livestock depredations are expected to approach about 12 cattle (range 1-17) and 60 sheep (range 32-92).

Impacts on Land Use

This is the "No Action" Alternative. Because wolves would be fully protected under the ESA, Section 7 would apply and would require consultation on all federal activities that may affect wolves. Current direction of the FWS on gray wolf Section 7 consultations is that if implemented "management actions prescribed by the USDA Forest Service, such as timber harvest and road restrictions to protect ungulates and their habitat, adequately protect wolves" (USFWS 1992).

Current restrictions include limiting activities within 1 mile (1.6 km) of active wolf dens or rendezvous sites from March 15 to July 1, and placing some restrictions on non-selective control methods of animal damage control within occupied wolf range (USFWS 1992).

M-44s are currently used on 30 private premises and 1 Bureau of Land Management site in the 10 county central Idaho area. Label restrictions preclude the use of M-44s on national forest lands or in areas that may affect threatened or endangered species. Because wolves dispersing from Canada or northwestern Montana may settle into areas of private land, use of M-44s may be suspended in those areas.

Other terms and conditions of ADC activities in "occupied wolf range" include (1) no neck snares can be used, (2) leghold traps must be checked at least once a day, and (3) number 3N or smaller traps should not be used in proximity to occupied dens and rendezvous sites, unless coordinated with the FWS. The requirement to check leghold traps at least once a day may reduce the use of this technique to control coyotes in some areas newly recolonized by wolves. Although neck snares are not used extensively in central Idaho, they are used in special situations to control coyotes. Expansion of "occupied wolf range" in the future will likely affect the use of neck snares.

Den site restrictions may affect timing of livestock grazing and timber harvest activities on national forest lands in central Idaho. Impacts to recreational activities are expected to be minimal although the establishment of den sites in unexpected areas could restrict access to larger areas or preclude the use of popular river access sites and public campgrounds during the March 15 to July 1 period.

Wolves are not expected to recover under this alternative for at least 20 years in central Idaho. If recovery goals are not being achieved, land use restrictions could become more severe. Future federal activities cannot jeopardize survival and recovery of wolves by contributing to excessive wolf mortality or contributing to major declines in ungulate populations (Wolf Management Committee 1991). In Minnesota, Michigan, Wisconsin, all but 1 national forest, the Chippewa, had open road density guidelines to minimize the risk of human-caused wolf mortality. Open road density restrictions varied from 0.9 mile open road/mi^2 to 1.2 miles open road/mi^2 (0.56 km/km^2 to 0.75 km/km^2).

The Northern Rocky Mountain Wolf Recovery Plan (USFWS 1987) promotes identification and maintenance of dispersal (movement) corridors between Canada and Idaho and the northwestern Montana recovery areas. Management emphasis is directed at preventing human-caused wolf mortality and adhering to existing big game management guidelines. Under Alternative 2, more emphasis may be placed on wolf management in the northern Idaho panhandle.

Conclusions.--The natural recolonization of wolves into central Idaho is expected to have some minor effects on the timing of livestock grazing and timber harvest activities in the 1 mile (1.6 km) closure area around active den sites during the period March 15 to July 1. The expansion of "occupied wolf range," as wolves begin to recolonize more areas in central Idaho, is expected to have some impact on ADCs use of M-44s and leghold traps to control coyotes. Access related restrictions could become more severe in the future if recovery does not proceed as quickly as expected.

Impacts on Visitor Use

Implementation of Alternative 2 will delay the opportunity for people to hear or observe wolves or their sign in central Idaho for 20 years. Because this alternative will not be as controversial as other alternatives including reintroductions, media coverage will not be as intense and not as many people will realize that wolves occur in Idaho. As wolves become more common during the second decade of this alternative, impacts on visitor use will begin to approach those in Alternative 1. Some people who fear wolves will be more likely to visit the central Idaho area during the early years of this alternative, versus later years as wolves become more numerous. As wolves recover under this alternative, other impacts to visitor use will be similar to Alternative 1. If recovery does not precede as quickly as expected, possible access restrictions in the future could impose visitor use to some portions of central Idaho.

Conclusions.--The natural recolonization of wolves will not impact visitor use in central Idaho as quickly as Alternative 1. Because this alternative will not be as controversial as alternatives including reintroductions, not as many people nationally will be aware of wolves in central Idaho. As wolves begin to recover in the second decade of this alternative, impacts on visitor use will be similar as under Alternative 1.

Impacts on Economics

Impact on the Economic Value Associated with Hunter Harvest.--The economic impact of natural recovery on hunter harvest in central Idaho is likely to be the same as under Alternative 1, after the population has fully recovered. This impact is estimated at $504,300 to $756,400 annually (Table 4-22). This impact, however, will occur several decades later than under Alternative 1, due to the long period anticipated before a fully recovered population has stabilized.

Economic Impact on Domestic Livestock.--It is estimated that livestock depredation under the Natural Recovery Alternative could be slightly higher than under Alternative 1 after recovering populations have begun inhabit central Idaho. This level of depredation would likely be reached only after a number of years, or even decades, and during the preceding years depredation levels would likely be lower than under Alternative 1. This loss is estimated to average $1,900 to $12,300 annually over the period of recovery (Table 4-22).

Impact on Visitor Use and Expenditures.--After wolves reach the recovered population level, and their presence in central Idaho becomes widely known, visitation to central Idaho may increase to some degree. The timing of this increase is unknown, though the direction and degree of the change in visits or expenditures may be similar to that for Alternative 1.

Impact on the Existence Value of Wolves.--For Alternative 2, the benefits to existence values are the same as under Alternative 1 but this value is not realized until the wolf population is recovered, or at least is beginning to recover. In this analysis, it is assumed that the full

Table 4-22. Annual net social benefits associated with wolf recovery in central Idaho under natural recovery.

	Annual impact (thousands of 1992 dollars)	
	Low estimate[c]	High estimate[c]
(A) Benefits associated with wolf recovery		
Annual net economic value of wolf recovery	4,258.2	6,220.1
(B) Costs associated with wolf recovery		
Foregone value to hunters[a]	504.3	756.4
Value of livestock losses	1.9	12.3
Annual wolf management cost until recovery[b]	250.0	250.0
Total costs	756.2	1,018.7
Net benefits of natural recovery in central Idaho [c,d]	3,502.0	5,201.4

[a] Lost value to hunters could possibly be overstated as this figure is based on hypothetical willingness to pay and has not been calibrated in any way as have the net economic benefits estimates.
[b] Note that one half of the total management costs of wolf recovery to both the GYA and central Idaho are included in the costs associated with this alternative. This cost will only be incurred until wolf recovery is achieved, which varies between alternatives. Other costs and all benefits will continue into perpetuity making annual net benefits significantly higher in many cases once recovery is achieved.
[c] For the benefits estimates, the low and high estimates represent a 95% confidence interval on the estimates of net willingness pay for the alternative. For the individual costs, the low and high estimates represent the best estimates of minimum and maximum costs associated with an alternative. The final net benefits figures do not represent a confidence interval but rather a plausible range of benefits associated with the alternative.
[d] Except for management costs the benefits and costs for this alternative is identical to Alternative 1. The only difference is that the benefits and other costs do not start until there is some natural recovery-assumed to be in the year 1999. The capitalized value of a perpetual stream of the annual costs and benefits beginning in the year 1999 is discounted to the present (1993) then amortized in perpetuity.

existence value is realized when there is a viable breeding pair of wolves in living in central Idaho. It is anticipated that under natural recovery a breeding pair of wolves will be present in central Idaho by the year 1999. In calculating the benefits to existence value under this alternative, the aggregate net existence value per year is discounted back to 1993 from the year 1999 at a 7% real discount rate. Under these assumptions, natural recovery of wolves in central Idaho has a net economic value of between $4.26 million and $6.22 million per year.

Conclusion.--Natural recovery in central Idaho under Alternative 2 is estimated to lead to total benefits of $4.26 million-$6.22 million per year and total costs of $756,200-$1,018,700 per year. Considering the estimated costs and benefits associated with this alternative it is

estimated that Alternative 2 in central Idaho will result in net benefits of $3.5 million-$5.2 million per year.

YELLOWSTONE

Impacts on Ungulate Populations

Under this alternative, wolves would not be expected to establish populations in the Yellowstone recovery area and state and federal government agencies would not implement or promote programs to enhance their recovery. Unrestricted killing of wolves has precluded establishment of wolf populations in southeastern Alberta where wolves were not a management objective (Alberta Forestry Lands and Wildlife 1991) and was a major factor in the reduction of wolves in Minnesota until federal protection was provided (Fuller et al. 1992). Mortality rates of wolf populations greater than about 28% often result in population declines (Fuller 1989).

Wolves have been observed and single wolves were sporadically killed in northern Montana for the last 3 decades (Flath 1979, Day 1981). However, no populations established until the early 1980s. Populations established near Glacier National Park because of protection of wolf populations in western Alberta and southeastern British Columbia and federal protection of wolves in the United States which allowed survival of dispersing animals. Even with protection it has required over 20 years for a small population to establish in northwestern Montana.

Examination of the population dynamics of wolves in Yellowstone National Park through computer models indicate that a small population could persist in Yellowstone National Park. However, under a management program which involved control of all wolves involved in conflict situations and unrestricted hunting of wolves outside of the park, simulations indicated the wolf population would decline and likely become extinct within a few years (Boyce 1990).

Conclusions.--Under the management framework of this alternative, it is unlikely that wolves would successfully disperse from Canadian populations to Yellowstone. It would be unlikely wolves could survive in sufficient numbers and establish a population in Yellowstone in the foreseeable future. Consequently, wolves would not affect wild ungulate populations in the Yellowstone area. State wildlife management agencies would continue to manage ungulate populations according to their wildlife management objectives, without the need to consider the potential impact from predation by wolves.

Impacts on Hunter Harvests

For the reasons outlined above, wolf recovery would not proceed and wolves would not be expected to establish populations in Yellowstone National Park or in the Yellowstone area. Consequently, wolves would not affect wild ungulate populations so hunter harvests adjacent to the park would not be affected. State wildlife management agencies would continue to manage ungulate populations and hunter harvests according to their wildlife management objectives, without the need to consider the potential impact from predation by wolves. Hunters would not be able to hunt in an area with a complete compliment of native carnivores nor would they have the opportunity to harvest wolves after wolves are recovered and managed by the states.

Conclusions.--Because wolves would not establish populations in the Yellowstone area, ungulate populations and the associated hunter harvests would not be affected. State wildlife management agencies would continue to manage ungulate populations and hunter harvests without considering the potential impacts of wolf predation on hunter harvest.

Impacts on Domestic Livestock

The situation would likely be similar to that in eastern Montana and North and South Dakota during the 1970s through the early 1990s. Occasional dispersing single wolves were reported being observed or killed. Extremely infrequent reports of livestock being killed by wolves were reported. No predictable level of depredations on livestock or domestic dogs are expected to occur in the Yellowstone area. Livestock operators would not need to be concerned about wolves killing livestock.

Impacts on Land Use

Under this alternative, no additional land use restrictions or changes in land use would occur because of wolves.

Conclusions.--No predictable level of wolf depredation on livestock or domestic dogs is expected to occur in the Yellowstone area under this alternative.

Impacts on Visitor Use

Visitors who favor a return of wolves to Yellowstone (a ratio of 6 for to 1 against), and who indicated that a presence of wolves would improve the Yellowstone experience (McNaught 1985), would be denied that experience. Backcountry use would change little, except that those visitors who might visit the backcountry specifically to see or hear wolves or see their sign, would possibly be discouraged from that visit. Commercial outfitters would be unable to offer their clients the experience of traveling in wolf country, or in areas where every member of the native large mammal fauna was present.

Conclusions.--Visitors who favor a return of the wolf to Yellowstone would be denied the experience of having wolves in Yellowstone. Backcountry use would change little. Some visitors who might visit the backcountry to see or hear wolves might be discouraged from that visit.

Impacts on Economics

Impact on the Economic Value Associated with Hunter Harvest.--Under a policy of no wolves present in the Yellowstone area, there would be no reduction in ungulate herds or hunter harvest due to wolves. Consequently, there would be no economic loss to hunters associated with wolves in the area.

Economic Impact on Domestic Livestock.--In the absence of wolves in the Yellowstone area there would be no economic loss associated with wolf predation on livestock in the area.

Impact on Visitor Use and Expenditures.--In the absence of wolves in the Yellowstone area there would be no expected change in visitation to the area due to wolves. Consequently, there would be no expected change in visitor expenditures due to wolves.

Impact on the Existence Value of Wolves.--In the absence of wolves in the Yellowstone area, there is a continuation of current population levels. Accordingly, there is no change in existence values.

Conclusions.--The only estimated costs of this alternative are management costs of $50,000. This amount amortized at 7% implies an annual cost of $3,500. No measurable economic benefits have been associated with this alternative.

CENTRAL IDAHO

Impacts on Ungulate Populations

Wolves would be killed whenever possible. Wolves would not be allowed to recover and would have no positive or negative impacts on ungulate populations. Lone wolves may occasionally disperse or travel through central Idaho, but that would be rare, and predation by these few animals would be inconsequential.

Conclusions.--Wolves would have no positive or negative impacts on ungulate populations in central Idaho.

Impacts on Hunter Harvest

Wolves would be killed whenever possible. Wolves would not be allowed to recover and would have no positive or negative impacts on hunter harvests in central Idaho. Lone wolves may occasionally disperse or travel through central Idaho, and effects on hunter harvests by these few animals would be undetectable.

Conclusions.--Wolves would have no impact on hunter harvest or management of big game populations in central Idaho.

Impacts on Livestock
Removal of wolves from endangered species status in both the federal and state government is expected to result in the removal of any existing wolves in central Idaho and the long-term prevention of wolves becoming established in central Idaho. Because wolves are capable of dispersing long distances, an occasional wolf from Canadian populations may show up in central Idaho. With no protection, any wolves which do disperse into Idaho are not expected to last for long periods. No measurable impacts on cattle, sheep, or dogs are expected. Any depredations will be infrequent and isolated.

Impacts on Land Use
Removal of wolves from endangered species status will result in the eventual removal of any existing wolves in central Idaho and the long-term prevention of wolves becoming established in central Idaho. Section 7 terms and conditions covering ADC activities in "occupied wolf range" in central Idaho will not be applicable now or in the future. In particular, use of M-44s, 1080 toxic collars, and above ground strychnine will no longer be restricted in use because of the presence of wolves in central Idaho. In addition, leghold traps will no longer need to be checked once a day in "occupied wolf range," neck snares will no longer be restricted in "occupied wolf range," and the use of leghold traps larger than 3N around occupied den sites or rendezvous sites will no longer be required to be coordinated with the FWS.

Impacts on Visitor Use
Implementation of Alternative 3 could have varied but subtle impacts on visitor use in central Idaho. Because 19.7% of surveyed Yellowstone Park visitors agreed with the statement "I would be afraid to hike in the park if wolves were present" (McNaught 1985), some people may venture into the central Idaho backcountry in the future who wouldn't if wolves were present.

Because of the national interest in wolf recovery, implementation of Alternative 3 could cause some nonresidents to not visit central Idaho, because of disillusionment with the cessation of protection for the gray wolf.

Impacts on Economics
Impact on the Economic Value Associated with Hunter Harvest.--Under a policy of no wolves present in central Idaho, there would be no reduction in ungulate herds or hunter harvest due to wolves. Consequently, there would be no economic loss to hunters associated with wolves in the area.

Economic Impact on Domestic Livestock.--In the absence of wolves in central Idaho there would be no predictable economic loss associated with wolf predation on livestock in the area.

Central Idaho--Alternative 3

Impact on Visitor Use and Expenditures.--In the absence of wolves in central Idaho there would be no expected change in visitation to the area due to wolves. Consequently, there would be no expected change in visitor expenditures due to wolves.

Impact on the Existence Value of Wolves.--In the absence of wolves in central Idaho, there is a continuation of current population levels. Accordingly, there is no change in existence values.

Conclusions.--The only estimated costs of this alternative are management costs of $50,000. This amount amortized at 7% implies an annual cost of $3,500. No measurable economic benefits have been associated with this alternative.

ENVIRONMENTAL CONSEQUENCES ALTERNATIVE 4. WOLF MANAGEMENT COMMITTEE ALTERNATIVE

YELLOWSTONE

Impacts on Ungulate Populations

Wolves could recover under this alternative but may not recover until 2010, 10 years later than for Alternative 1, Reintroduction of Experimental Populations. Under this alternative, wolves could have similar effects on ungulate populations described for Alternative 1.

As in Alternative 1, a recovered wolf population (10 packs, about 100 wolves) might reduce the elk population on Yellowstone's northern range 5%-30% (Boyce 1990, Boyce and Gaillard 1992, Mack and Singer 1992b) from a 1990 estimate of 17,300 (Mack and Singer 1992a) to about 12,100-16,400 animals. Elk of the Jackson herd south of Yellowstone National Park may decline 4%-8% (from about 15,187 to between 13,972 and 14,580) while elk on the North Fork Shoshone herd may only decline 2%-3% (5,343 to between 5,182 and 5,236 elk). Deer, moose, and bison populations would likely decline as described in Alterative 1.

Some wolves may colonize areas where their presence would be undesirable and state big game management objectives could not be met. This alternative provides for habitat and wild ungulate population enhancement and removal of wolves if wolves prevent states from meeting big game management objectives. These provisions may reduce the negative effects wolves may have on certain ungulate populations and associated hunter harvests. However, given the complex nature of predator-prey dynamics and the enormous number of conditions and tools that might enhance ungulate populations, quantifying reduced effects on ungulates would be speculative and could only be evaluated on a case by case basis with wolves present in the system.

Under this alternative, wolves would have less protection outside national park and wildlife refuge boundaries. Consequently, wolves and their effects on ungulates might be concentrated in parks (Yellowstone) and refuges (National Elk Refuge) and not dispersed throughout suitable habitats in the Yellowstone area. Under these conditions, wolf predation effects on ungulates might be quite similar to those predicted in models that examined wolf predation on ungulates in Yellowstone National Park and the National Elk Refuge area (Boyce 1990, Garton et al. 1990, Boyce and Gaillard 1992, Mack and Singer 1992b).

Conclusions.--With this alternative, wolves would recover in the Yellowstone area around 2010, 10 years later than for Alternative 1. For Alternative 4, a recovered wolf population may reduce ungulate populations as described in Alternative 1. Alternative 4 provides for habitat and wild ungulate population enhancement and removal of wolves if wolves prevent the states from meeting their big game population objectives.

Impacts on Hunter Harvest

During the early stages of wolf recovery (prior to 2010), wolf effects on hunter harvest would be undetectable. At wolf recovery levels (10 packs, about 100 wolves), hunter harvests of primarily antlerless animals may be reduced for some herds, similar to the levels described in Alternative 1. Boyce (1990) and Boyce and Gaillard (1992) predicted wolf recovery would not affect hunting opportunities in Montana. For the Jackson herd, Boyce and Gaillard (1992) estimated hunter harvests may decline 5%-10% (from about 3,330 elk/year to between 2,970 and 3,135 elk/year) while hunter harvests for the North Fork Shoshone herd may decline 1%-2% (from about 640 elk/year to between 627 and 634 elk/year) Mack and Singer (1992b) estimated wolf recovery could reduce antlerless elk harvests of the northern range elk herd 27% (from an average of 994 antlerless elk/year to 714 antlerless elk.year). They also predicted antlerless deer harvests could be reduced but male harvests of elk and deer would not be affected. A recovered wolf population living on Yellowstone's northern range may also reduce the availability of northern range moose permits from an average of 31/year to 16/year (Mack and Singer 1992b). This alternative provides for habitat and wild ungulate population enhancement which could reduce the negative effects wolves may have on ungulate populations and the associated hunter harvests.

Conclusions.--During the early stages of wolf recovery (prior to 2010), wolf effects on hunter harvest would be undetectable. At wolf recovery levels (10 packs, about 100 wolves), hunter harvests of primarily antlerless animals (females and young) may be reduced for some big game herds. The effects on hunter harvests would be similar to those described in Alternative 1. Male harvests should not be affected. This alternative provides for habitat and wild ungulate population enhancement. These provisions could reduce the negative effects (described above and in Alternative 1) that wolves may have on hunter harvests.

Impacts on Livestock

Elements of this alternative that will likely influence impacts on domestic livestock include reintroduction of wolves to Yellowstone National Park, immediate control by public agency personnel of any wolves depredating on livestock, and allowing livestock operators to kill wolves that are attacking or harassing domestic livestock or pets on private land and on livestock allotments on public land. During the first 5 years, few animals will be outside of Yellowstone National Park or in areas that contain livestock. There are large areas surrounding the reintroduction area that have no livestock grazing, approximately 7.5 million acres (303,800 km^2). Wolf populations would likely be recovered in Yellowstone National Park but wolf mortality would likely be substantially higher than under Alternative 1 and recovery would take longer, possibly 10 years.

A summary of wolf depredation on domestic livestock in several areas of North America is presented in the environmental consequences for Alternative 1. In addition, estimates of wolf depredation on cattle and sheep, based on the experience in other areas is also presented in the analysis of effects of Alternative 1. Those projections result in estimates of annual livestock depredation by wolves of about 8 cattle (range 1-13) and 68 sheep (range 38-110) on national forests surrounding Yellowstone National Park. In some allotments that are very remote, are within the home range of several wolf packs, and where livestock are not tended or checked for long periods of time, depredation rates may approach those observed in the Simonette River experimental area in Alberta for short periods of time.

The provision to allow livestock operators to kill wolves that are perceived either attacking or harassing livestock on both private land and public land livestock allotments would increase wolf mortality compared to that expected under Alternative 1. Similar management is employed in southern Alberta and few wolves occur or persist on private land or in readily accessible public lands. Similar results would be expected in the Yellowstone area with wolves occurring almost exclusively in Yellowstone National Park and remote areas of surrounding wilderness areas. Consequently, livestock depredations likely would be fewer than those projected above. Other aspects of annual livestock depredation, such as livestock class most effected, level of operators affected, and high variability between years and between areas, would likely be similar. Depredations on domestic dogs would likely be extremely rare.

Conclusions.--During the first 5 years after beginning reintroduction, livestock losses to wolves would likely be very few, if any, because of the intensive wolf monitoring and management. During the next 5 years or so, as packs become established and begin to reproduce, dispersing animals will try to found new packs and territories; some in the park, some in wilderness areas, and others on public or private land. During this period the loss rates may be similar to those in Alternative 1. However, because livestock operators are permitted to kill wolves that are harassing or killing livestock under this alternative, losses are likely to be fewer than under Alternative 1. As recovery levels are approached and achieved, depredation rates would be expected to be toward the lower range of those estimated for alternative 1 and would likely occur mostly on remote national forest allotments. Losses are estimated to average less than 8 cattle and 68 sheep annually. Wolf depredation on domestic dogs is expected to be very infrequent but will be emotionally disturbing to some of those affected.

Impacts on Land Use

Elements of this alternative that may impact land use include reintroduction of wolves to Yellowstone National Park and designation of wolves outside national parks and national wildlife refuges as a special state managed nonessential experimental population; states would each develop wolf management plans. Agencies would control wolves that are involved in livestock, working animal, or pet depredation; livestock operators would be allowed to kill wolves that are perceived attacking or harassing livestock on private land or public land livestock allotments. Seasonal closures of up to 1 mile (1.6 km) around active wolf den sites from April 1 to June 15 would be used to protect dens in the early stages of population establishment. This alternative would preclude the use of toxicants that are lethal to wolves in areas where wolf occupancy is the management objective. During the first 5 years, few animals will be outside of Yellowstone National Park or wilderness areas. Wolf populations would likely be recovered in Yellowstone National Park but wolf mortality might be substantially higher than under Alternative 1 and recovery would take longer, possibly 20 years.

The effects of this alternative on land use in national parks and national wildlife refuges would be very similar to those described under Alternative 1. Those would include the construction and maintenance of up to 3 temporary confinement and release facilities in Yellowstone National Park and restriction of visitor activity near those facilities. In the short term, visitor access to about 3 mi^2 (7.8 km^2) around wolf confinement and release facilities would be restricted.

During the early stages of population establishment, active den sites within the park would be closely monitored. Human activity in the vicinity of the dens, likely to disrupt successful denning, would be precluded within 1 mile (1.6 km) of den sites. This period would extend from April 1 until June 15.

The focus of population establishment would be in Yellowstone National Park. Previous studies indicate that most wolves would live in the northern third of the park. Effects would be more focused there. Estimates are that 7-11 packs could live in this area. Consequently, restrictions may affect a total of 7-11 mi^2 (18-29 km^2). However, this is the lowest season of visitor use; early season use primarily on main roads and developed facilities, with little backcountry use. Some denning areas will likely be located in areas already under visitor limitations for grizzly bear management so the area affected likely would not be totally additive.

Three general types of activities involving large areas of national forest land include livestock grazing, timber harvest, and recreation.

The limits on public use to protect den areas occurs from April 1 to June 15. Most livestock are permitted on national forests after these dates so would likely not affect initiation of grazing on national forest allotments. This alternative also calls for agency control of depredating wolves, and killing of wolves that are attacking or harassing livestock by livestock operators. Consequently, livestock grazing areas would not likely be adjusted to accommodate wolf occupancy if conflicts developed.

Timber harvest varies by year and by national forest but is projected to average about 28,000 acres (113 km^2) annually (about 55% on the Targhee National Forest west and southwest of Yellowstone National Park).

It is difficult to estimate effects restrictions to protect wolf dens will have on timber harvest. However, several factors suggest effects would be very small. Most timber harvest is on the outside perimeter of the central park and wilderness area; mostly on the Targhee National Forest, where wolf numbers are projected to be quite low. In comparison, a small proportion of the primary analysis area is affected by timber harvest (about 3% of the national forest area). Other seasonal restrictions designed to protect important wildlife areas such as ungulate winter range and birthing areas, grizzly bear spring range, and protection of roads and water quality during spring thaw already limit areas of harvest during the wolf denning period. It is unlikely that closures to protect wolf dens would preclude a measurable portion of annual timber harvest. Some sales could occasionally be delayed slightly if they were proposed during the April 1 to June 15 period.

Recreational activities during the April 1 to June 15 period are normally at the lowest level during the year. Other limitations on access, for reasons discussed previously, and snow and trail conditions at higher elevations generally limit activities in higher elevation backcountry areas. Commercial outfitting generally does not begin until after this period. The only hunting is spring hunting for black bear in some areas. It is possible that wolves could den in several areas that would affect access to national forest land. Under 1 situation, only the area within 1 mile (1.6 km) of dens would be affected. In other situations, the closed area could include the road accessing the area and under this situation a much larger area could be limited to vehicle access. With most wolf territories likely occurring within the park or adjacent wilderness or roadless areas, affects on national forest areas with vehicle access during the April 1 to June 15 period would be small.

The effects on animal damage control activities would likely be reduced from those projected for Alternative 1. The use of techniques, other than toxicants, would not be affected. The effect on the use of M-44s is expected to be very limited for 2 reasons. First, they are not currently authorized for use in national parks, national wildlife refuges, or on national forests in the primary analysis area. This comprises about 11 million acres (44,600 km^2) or about 70% of the primary analysis area. Further, they cannot be used in areas where they may kill a threatened or endangered species. Therefore, they are not used in areas occupied by grizzly bears. Consequently, they are used primarily on low elevation private lands on the periphery of the analysis area or in several of the major river valleys.

This alternative calls for agencies to control wolves that depredate on livestock. It would also allow livestock operators to kill wolves that attack or harass livestock. Those factors, and the likelihood that most wolves would avoid low elevation areas with high levels of human activity, make it unlikely that wolves would occupy areas where M-44s are currently used.

Conclusions.--Disturbance and construction of temporary confinement facilities would occur at up to 3 sites within Yellowstone National Park. To provide security for the facilities, public access would be restricted in an area up to 1 mile (1.6 km) around the facilities during the confinement period. The facilities would not be in normal visitor use areas so measurable affects on overall visitor use would not occur. Human activity would be restricted in an area up to 1 mile (1.6 km) around active den sites from April 1 to June 15 and may limit access to 21-35 mi^2 (54-91 km^2). Based on the seasonality of both visitor activity and the phenology of wolf denning activity, no measurable limitation on overall visitor use of park areas is expected. With most wolf territories likely lying within the park or adjacent wilderness or roadless areas, no measurable effects on recreational access to national forest are expected. Livestock grazing areas would not be adjusted to accommodate wolf occupancy. Some timber harvest sales occasionally may be delayed slightly if they were proposed during the April 1 to June 15 period. No impact on animal damage control activities is expected.

Impacts on Visitor Use

Under this alternative visitors to Yellowstone National Park and the Yellowstone area will know wolves live there, and will have the opportunity to see or hear wolves, or see their sign. Most wolves would occur within Yellowstone National Park and in some areas of the adjacent national forest wilderness areas. In Denali National Park, Alaska, an estimated 15% of park visitors see wolves (Mech et al. 1991), and the concentrations of wildlife in open areas in Yellowstone National Park are expected to attract wolves to those places (Koth et al. 1990), where they will be observable.

A small percentage of potential backcountry users could be inconvenienced by temporary travel restrictions in the vicinity of wolf den sites from April 1 to June 15. April-June visitation to Yellowstone makes up 26% of annual park use; April-June backcountry use made up 19.2% of the April-October backcountry use nights, and involved 1.4% of stock use nights in 1992. Day use by a few hikers in Yellowstone National Park could be directed to alternative trails if wolf den restrictions limited use of popular trails - roughly 240 hikers could be so affected.

Of 6,151 commercially outfitted backcountry visitor use nights recorded in Yellowstone National Park April-October 1992, none were recorded in April or May, and just 215 in June, representing 3.5% of the April-October total. Stock use nights for April-May were zero, and June stock use nights amounted to 1.5% (90 of the April-October total of 6,194). Consequently, little adverse effect is expected on outfitter operations in Yellowstone National Park.

Assuming monthly distribution of general recreational use on the 6 national forests would be similar to those of the national parks, comparatively few recreationists would be using the backcountry April-June. Monthly summaries of outfitter use on the national forests were not available, but snowy or muddy trails and high stream levels in higher elevations would normally prevent much use April-June, when travel might be restricted within a mile (1.6 km) of wolf dens.

Conclusions.--Recreational users to Yellowstone would eventually have opportunity to see or hear wolves or see their sign. A slight increase of visitor use may occur specifically for this purpose once populations have established. A small number of visitors may be limited in using areas near wolf dens from April 1 to June 15 but this represents a small percentage of overall visitation. No change in visitor use patterns or use by commercial outfitters is projected.

Impacts on Economics

Impact on the Economic Value Associated with Hunter Harvest.--The economic impact of the Wolf Management Committee Alternative on hunter harvest is likely to be the same as under Alternative 1, once the population has fully recovered. This is estimated to range from $187,300 to $464,900 annually (Table 4-23).

Economic Impact on Domestic Livestock.--It is estimated that livestock depredation under the Wolf Management Committee Alternative could be slightly lower than under Alternative 1 estimated to range from $1,900 to $30,500 and average $18,277 annually.

Impact on Visitor Use and Expenditures.--It is estimated that visitation and expenditures by visitors to the Yellowstone area will change by the same amount as under Alternative 1 with a net economic benefit of $3.35 million-$19.65 million annually.

Impact on the Existence Value of Wolves.--Under the Wolf Management Committee Alternative it is estimated that the net economic value of wolf existence in the Yellowstone area will be equal to that in Alternative 1 at approximately $8.3 million per year.

Conclusion.--Wolf recovery in the Yellowstone area under Alternative 4 will lead to estimated total benefits of $6.67 million-$9.85 million per year and total costs of $3.41 million-$3.72 million per year. By far, the largest component of total costs would be the wolf management costs of $3.22 million per year. Considering the estimated costs and benefits associated with this alternative, it is estimated that under Alternative 4 wolf reintroduction in the Yellowstone area will result in net benefits of $3.26 million-$6.13 million per year.

Table 4-23. Annual net social benefits associated with wolf recovery in the Yellowstone area under Wolf Management Committee Alternative.

	Annual impact (thousands of 1992 dollars)	
	Low estimate[c]	High estimate[c]
(A) Benefits associated with wolf recovery		
Annual net economic value of wolf recovery	6,673.1	9,854.3
(B) Costs associated with wolf recovery		
Foregone value to hunters[a]	187.3	464.9
Value of livestock losses	1.9	30.5
Annual wolf management cost until recovery[b]	3,225.0	3,225.0
Total costs	3,414.2	3,720.4
Net benefits of wolf recovery in the Yellowstone area[c]	3,258.9	6,133.9

[a] Lost value to hunters could possibly be overstated as this figure is based on hypothetical willingness to pay and has not been calibrated in any way as have the net economic benefits estimates.
[b] Note that one half of the total management costs of wolf recovery to both the Yellowstone and central Idaho areas are included in the costs associated with this alternative. This cost will only be incurred until wolf recovery is achieved, which varies between alternatives. Other costs and all benefits will continue into perpetuity making annual net benefits significantly higher in many cases once recovery is achieved.
[c] For the benefits estimates, the low and high estimates represent a 95% confidence interval on the estimates of net willingness pay for the alternative. For the individual costs, the low and high estimates represent the best estimates of minimum and maximum costs associated with an alternative. The final net benefits figures do not represent a confidence interval but rather a plausible range of benefits associated with the alternative.

CENTRAL IDAHO

Impacts on Ungulate Populations

If wolves are not reintroduced into central Idaho, recovery will continue at a slow rate, and impact on ungulates may remain negligible for the foreseeable future. If wolves are reintroduced, recovery will proceed more rapidly, but the impact of wolf predation is still expected to be minimal. Wolves would not be permitted to be a detriment to ungulate populations. Wolves that were preventing the IDFG from meeting its management objectives could be relocated to other areas. Overall impacts on ungulate species would be similar to those described under Alternative 1, except that funding would be provided annually by the FWS to IDFG for enhancement of ungulate populations.

Conclusions.--If wolves are not reintroduced into central Idaho, wolf recovery would occur at the same rate as Alternative 2. Wolves that significantly impact ungulate populations (e.g., bighorn sheep) could be captured and relocated. Therefore, impact on ungulate populations would be the same as described for Alternative 1. The FWS would provide funding to the IDFG for enhancement of ungulate populations to further reduce the possibility of wolf predation resulting in a decline in ungulate populations. Fewer ungulates may die of malnutrition associated with winter stress. Surviving ungulates may benefit slightly from reduced competition for food and space.

Impacts on Hunter Harvest

To maintain the current size of the elk population and continue the current level of bull harvest in central Idaho, harvest of cow elk may have to be reduced 10%-15% (same as Alternative 1). A reduction in cow harvest by 10% will allow for predation of 100 wolves, an acceptable bull:cow ratio, and an elk population that is increasing faster than the current elk population without wolves (Table 4-11).

No modifications in harvest of deer, moose, bighorn sheep, or mountain goats are expected to be required to accommodate for predation by 100 wolves.

Conclusions.--Harvest of cow elk may have to be reduced 10%-15% in central Idaho (396-594 fewer cows killed than in 1991) to accommodate for predation by 100 wolves. No changes in management of harvest for deer, moose, bighorn sheep, or mountain goats are expected to be necessary.

Impacts on Domestic Livestock

Elements of this alternative that will likely influence impacts on domestic livestock include (1) lethal control by public agency personnel of any wolves depredating on livestock, (2) option for livestock operators to kill wolves that are attacking or harassing domestic livestock or pets on private land, and on livestock allotments on public land. During the initial 5 years under natural recovery, wolf populations would likely remain very low and would rarely come in contact with livestock. Most wolves coming in contact with livestock and detected by private livestock operators would likely be killed. Until recovery goals are achieved, any wolves taken on public or private lands by livestock operators because of livestock depredation and those wolves found to be illegally taken, would be replaced in the reintroduction zone. With no reintroduction after 5 years, wolves would probably not recover in central Idaho in the foreseeable future. With reintroduction, wolves are expected to recover after an additional 15 years (year 2015).

The provision to allow livestock operators to kill wolves that are perceived as either attacking or harassing livestock on both private land and public livestock allotments is expected to increase mortality of wolves in livestock areas and decrease livestock depredations under this alternative. Based on applicable studies from Minnesota, Alberta, and Montana, and taking into account provisions of this alterative, a recovered population of 100 wolves is expected to result in the annual loss of about 8 cattle (range 1-17) and 40 sheep (range 32-92). Similar to other alternatives, depredations are expected to be highly variable between areas and between years. In some allotments that are very remote, lightly tended, and located close to more than 1 wolf pack, depredation rates may occasionally approach those observed in the Simonette River experimental area in Alberta. In the Simonette River area, 39-40 wolves killed or injured 27 cattle in 1 year (Table 4-1). Depredations on domestic dogs would be very rare under this alternative, as very few wolves would be expected to exist near private land.

Conclusions.--Implementation of the Wolf Management Committee Alternative is expected to result in the reintroduction of wolves in the year 2000 with recovery by the year 2015. Wolf depredations on livestock are expected to be less under this alternative than Alternatives 1, 2, and 5. As wolves approach recovery (100 animals) late in the second decade of this alternative, average annual losses of livestock are expected to approach about 8 cattle (range 1-17) and 40 sheep (range 32-92).

Impacts on Land Use

With reintroduction of wolves after the initial 5 years of Alternative 4 implementation, recovery would likely occur in central Idaho within 15 years (2015).

Within the experimental area in Idaho, federal agencies would only have to confer with FWS on activities that are likely to jeopardize the wolf (outside of national parks and national wildlife refuges), and such determination would not prohibit the federal agency from proceeding with the activity if a negative effect were determined. Because of this standard, most agencies in Idaho would not need to consult or confer on land use changes and their effects on wolves within the defined area (Wolf Management Committee 1991).

Seasonal closures of up to 1 mile (1.6 km) around active wolf den sites from April 1 to June 15 may be used to protect wolves from human disturbance during the early stages of population establishment. Use of toxicants lethal to wolves would be precluded in areas where wolf occupancy is the management objective.

Seasonal closures around dens would have little impact on livestock grazing or timber harvest on national forest lands in central Idaho. Minor adjustments in timing of these activities may be necessary in areas of known wolf dens.

Seasonal closures around active dens could also impact recreational access to national forest lands between April 1 to June 15. Because recreational activities are normally at a low level during this time of year, impacts would be slight.

Implementation of Alternative 4 would have minor impacts on the use of M-44s in the 10 county central Idaho area. During 1992, M-44s were used on 30 private premises and 1 BLM site in the 10 county central Idaho area. Label restrictions on M-44s restrict their use in national forests and in areas where threatened or endangered species may be adversely affected.

If wolves show up on private land in Idaho where M-44s are currently being used to control coyote depredations, use of M-44s may be suspended. However, because livestock operators can shoot wolves depredating on livestock or harassing them, few wolves would live on low elevation private lands, and impacts to the use of M-44s would not be measurable. Existing Section 7 terms and conditions on the use of leg-hold traps and neck snares in "occupied wolf range" would likely no longer apply under this alternative.

Conclusions.--Implementation of the Wolf Management Committee Alternative is expected to result in few impacts on land use in central Idaho. Seasonal closures of up to 1 mile (1.6 km) around active den sites during the early phases of wolf population establishment may have some minor short-term impacts on the timing of timber sales or livestock grazing and on recreational access to national forest lands. As "occupied wolf range" increases under this alternative, a slight impact on the use of M-44s could occur. However, because few wolves are expected to exist near private land under this alternative, any impact on the use of M-44s would be slight.

Impacts on Visitor Use

Under Alternative 4, wolf recovery in central Idaho would occur by natural recolonization for the first 5 years of implementation, followed by an expected reintroduction of an experimental population of wolves.

With a reintroduction of an experimental population after the first 5 years, recovery in central Idaho would likely be achieved by the year 2015. Visitors to central Idaho would slowly have more opportunity to hear or observe wolves or their sign in the following years.

Because wolf issues are high profile in the United States, and because wolves are rare in the lower 48 states, many people are expected to visit the central Idaho backcountry in the future specifically for the chance to hear or see wolves. Overall impacts on visitor use are expected to be similar to Alternative 1.

Implementation of the Wolf Management Committee Alternative also includes the reintroduction of replacement wolves for wolves killed by livestock operators or other individuals. These reintroductions are expected to be high profile, and will lead to additional public awareness of wolf recovery efforts in central Idaho.

Conclusions.--Implementation of the Wolf Management Committee Alternative is expected to result in a reintroduction of wolves into central Idaho in the year 2000, followed by the recovery of wolves in about the year 2015. The expected reintroduction of wolves in about the year 2000 is expected to receive national attention. Because of the high profile of wolves and their rarity in the lower 48 states, many people are expected to visit the central Idaho backcountry specifically for the opportunity to hear or see wolves. Overall impacts on visitor use are expected to be similar to Alternative 1.

Impacts on Economics

Impact on the Economic Value Associated with Hunter Harvest.--The economic impact of the Wolf Management Committee Alternative on hunter harvest in central Idaho is likely to be the same as under Alternative 1, after the population has fully recovered. This is estimated to range from $756,800 to $1,135,200 annually (Table 4-24).

Table 4-24. Annual net social benefits associated with wolf recovery in central Idaho under the wolf management committee alternative.

	Annual impact (thousands of 1992 dollars)	
	Low estimate[c]	High estimate[c]
(A) Benefits associated with wolf recovery		
Annual net economic value of wolf recovery	6,847.8	10,012.2
(B) Costs associated with wolf recovery		
Foregone value to hunters[a]	756.8	1,135.2
Value of livestock losses	2.9	18.5
Annual wolf management cost until recovery[b]	3,225.0	3,225.0
Total costs	3,984.7	4,378.7
Net benefits of wolf recovery in central Idaho[c]	2,863.1	5,633.5

[a] Lost value to hunters could possibly be overstated as this figure is based on hypothetical willingness to pay and has not been calibrated in any way as have the net economic benefits estimates.
[b] Note that one half of the total management costs of wolf recovery to both the Yellowstone and central Idaho areas are included in the costs associated with this alternative. This cost will only be incurred until wolf recovery is achieved, which varies between alternatives. Other costs and all benefits will continue into perpetuity making annual net benefits significantly higher in many cases once recovery is achieved.
[c] For the benefits estimates, the low and high estimates represent a 95% confidence interval on the estimates of net willingness pay for the alternative. For the individual costs, the low and high estimates represent the best estimates of minimum and maximum costs associated with an alternative. The final net benefits figures do not represent a confidence interval but rather a plausible range of benefits associated with the alternative.

Economic Impact on Domestic Livestock.--It is estimated that livestock depredation under the Wolf Management Committee Alternative could be slightly lower than under Alternative 1, estimated to range from $2,900 to $18,500 annually after a recovered population is established.

Impact on Visitor Use and Expenditures.--It is estimated that visitation and expenditures by visitors to central Idaho will change by the same amount as under Alternative 1.

Impact on the Existence Value of Wolves.--Under the Wolf Management Committee Alternative, it is estimated that the net economic value of wolf existence in central Idaho will be equal to that in Alternative 1 at approximately $6.85 million-$10.01 million annually.

Conclusion.--Wolf recovery in central Idaho under Alternative 4 is estimated to lead to total benefits of $6.85 million-$10.01 million per year and total costs of $3.98 million-$4.38 million per year. By far, the largest component of total costs would be the wolf management costs of $3.22 million per year. Considering the estimated costs and benefits associated with this alternative, it is estimated that under Alternative 4, wolf reintroduction in central Idaho will result in net benefits of $2.86 million-$5.63 million per year.

YELLOWSTONE

Impacts on Ungulate Populations

Under this alternative wolves would be reintroduced into several suitable areas in the Yellowstone recovery area and wolves would be fully protected under the ESA. Federal agencies and cooperating state agencies and tribes would implement programs to enhance wolf recovery (see Chapter 2 for specific details). Wolf recovery would likely be attained by 2000 (7 years), 2 years sooner than in Alternative 1. Under this alternative, wolf impacts on ungulate populations would be similar to those in Alternative 1 and take place in a shorter time frame. This alternative does not provide for wolf relocation if wildlife management agencies are unable to meet big game management objectives. Therefore, a rare case might exist where wolves may impact some ungulate populations to a greater degree than predicted for Alternative 1.

Conclusions.--In this alternative, wolves would be reintroduced into several places throughout the Yellowstone recovery area and wolf recovery would be attained in about the year 2000 (7 years). Wolf predation effects on ungulate populations would be similar to those described in Alternative 1, except the effects would occur sooner. Alternative 5 does not provide for wolf relocation if wolves prevent the states from meeting their big game population objectives. Therefore, a rare case could exist where wolves may reduce an ungulate population more than predicted in Alternative 1.

Impacts on Hunter Harvest

As stated above in Impact on Ungulate Populations, wolves would be reintroduced in several places throughout the Yellowstone recovery area and recovery would be attained in the year 2000. Wolf impacts on hunter harvest would be similar to those described in Alternative 1, except they would occur sooner because of the accelerated pace of wolf reintroduction in Alternative 5.

Hunter harvests of primarily antlerless ungulates (females and young) might be reduced for some ungulate herds. Antlered (males) harvests in most herds should not be affected. This alternative does not provide for wolf relocation if wolves prevent the states from meeting their big game management objectives (hunter harvest). Consequently, a rare case might exist where wolves could affect an ungulate population and associated hunter harvest more than predicted in Alternative 1.

Conclusions.--Under this alternative, wolf impacts would likely involve a reduction in hunter harvests of primarily antlerless animals for some herds. Hunter harvests of antlered animals should not be affected. Wolf impacts on hunter harvest would be similar to those described in Alternative 1, except the impacts may occur sooner. Alternative 5 does not provide for wolf relocation and a rare case could exist where wolves affect hunter harvests more than predicted in Alternative 1.

Impacts on Domestic Livestock

Elements of this alternative that will likely influence impacts on domestic livestock include rapid reintroduction of wolves, under the most protective measures of the ESA, wolves will be intensively monitored, dispersing animals will be allowed to establish territories where suitable habitat exists, no control by public agency personnel of any wolves depredating on livestock; on public land where conflicts develop, livestock would be removed, and the public would not be allowed to legally kill wolves that are attacking or killing domestic livestock.

During the first several years, few wolves would be outside of Yellowstone National Park or in areas that contain livestock. Wolves would recolonize the recovery areas, but would also recolonize other areas throughout the northern Rocky Mountains and would be allowed to remain. However, wolves would recover rapidly, likely within 3-10 years.

During the first several years after beginning reintroduction, livestock losses to wolves would likely be very few, if any, because of the intensive wolf monitoring and management. As packs become established and begin to reproduce, dispersing animals will try to form new packs and territories; some in the park, some in wilderness areas, and others on public or private land. During this period the loss rates may be similar to those in northwestern Montana.

Because this alternative calls for no control of wolves that depredate on livestock and removal of livestock from public land where conflicts occur, depredations initially would likely be comparable to those described under Alternative 1. However, in the absence of control of depredating wolves, rates on remote areas may be more comparable to those described for the Simonette River, Alberta, experiment; 5-7 times higher for a short period until the conflict was resolved.

Livestock depredation on private land could be a serious problem locally because of less wolf control. This alternative calls for relocation of depredating wolves on private land where chronic problems exist and other methods to resolve problems where unsuccessful. Livestock depredation rates would not be expected to be substantially higher than those experienced in other areas of North America. However, local tolerance would likely be very low and illegal killing of wolves would likely be high.

Recovery under this alternative is projected to proceed rapidly and may occur in 5-7 years. As recovery levels are approached and achieved, depredation rates would be expected to be somewhat higher than the range of those seen in other areas of North America because depredation rates in other areas are lower with control of depredating wolves. Wolf depredation on domestic dogs is expected to be very infrequent, but will be emotionally disturbing to some of those affected.

Conclusions.--During the first several years after beginning reintroduction, livestock losses to wolves would likely be very few, if any, because of the intensive wolf monitoring and management. Later, as packs become established and begin to reproduce, dispersing animals will try to establish new packs and territories; some in the park, some in wilderness areas, and others on public or private land. During this period the loss rates may be similar to those in northwestern Montana averaging several cattle and sheep per year. However, because livestock operators are not permitted to kill wolves that are killing livestock and agency control would be conducted only on private land that has chronic problems, losses are likely to be higher than under Alternative 1. As recovery levels are approached and achieved, depredation rates would be expected to be toward the upper range of those estimated for Alternative 1 and would occur on national forest allotments and lower elevation private lands. Losses are estimated to average more than 19 cattle and 68 sheep annually. Wolf depredation on domestic dogs is expected to be very infrequent but will be emotionally disturbing to some of those affected.

Impacts on Land Use

Elements of this alternative that may influence impacts on land use include rapid reintroduction of wolves under the most protective measures of the ESA. Wolves will be intensively monitored and dispersing animals will be allowed to establish territories where suitable habitat exists. Agencies would control wolves depredating on livestock only on private land with chronic depredations and where other methods of conflict resolution have been unsuccessful. On public land where conflicts develop, livestock would be removed. The public could not legally harass or kill wolves. During the first several years, few animals would be outside of Yellowstone National Park or wilderness areas. Wolves would recolonize the recovery areas, but would also recolonize other areas throughout the northern Rocky Mountains and would be allowed to remain. However, wolves would likely recover within 5-10 years.

Section 7 of the ESA requires agencies to examine their actions and to avoid those that would jeopardize a listed species. If they determine that a proposed action would adversely affect a listed species, they are required to consult with the FWS, who in turn must determine if the proposed action is likely to jeopardize the continued existence of the species. These procedures would apply to the reintroduced population within national parks and national wildlife refuges and to all other federal land and federal actions.

Allocation of land for implementing this alternative in national parks and national wildlife refuges would be greater than those described under Alternative 1. Those would include the construction and maintenance of up to 5 temporary confinement and release facilities in Yellowstone National Park and the restriction of visitor activity in the vicinity of those facilities. In the short term, visitor access to about 5 mi^2 (13 km^2) around wolf confinement and release facilities would be restricted.

Impacts on activities in national parks and national wildlife refuges would be somewhat greater than those described under Alternative 1. During population establishment, active den sites would be closely monitored. Because of the likely requirement to aggressively protect the first wolves denning in Yellowstone National Park, intrusive activities would be precluded within 1 mile (1.6 km) of the den sites. This would extend from March 15 to July 1. If most of the territories of the recovering wolf population occurred within the park, restrictions could affect a total of 21-35 mi^2 (54-91 km^2).

On national forests and other public land impacts on the activities that involve large areas of public land--livestock grazing, timber harvest, and recreation--would be greater than described for any of the other alternatives.

Public land use limits to protect den areas from March 15 to July 1 would likely not affect initiation of grazing on livestock allotments where the likelihood of conflict was low or there was no history of depredation. However, it is possible that grazing on areas with active den areas or where there has been a history of depredation may be delayed or suspended. This alternative calls for agency control of depredating wolves only on private land and only after other methods have failed and chronic depredations continue. Wolf control guidelines under this alternative preclude capture and relocation or killing wolves prior to August 1. Consequently, on public land allotments where wolves depredate on livestock, the livestock will likely be moved to alternative allotments or out of the area.

Although livestock grazing on public land could be substantially more affected, the effects on timber harvest would probably be very similar to those described for Alternative 1. In other areas where wolves have recolonized, and standards and guidelines to provide for other resources such as ungulate winter ranges and birthing areas have been adequately applied in sale design, there has been little effect on levels and timing of timber harvest. However, if wolf mortality impaired population establishment and recovery because of den site disturbance or illegal killing facilitated by roaded access on public land, road density standards established to limit mortality could limit the area available for timber harvest.

Wolves would be reintroduced to Yellowstone National Park and would be allowed to establish territories in suitable habitat. There is considerable uncertainty about where wolves may establish territories and attempt to den, but under this alternative they would be allowed to remain. This would probably affect recreational use and public access to public land more than Alternative 1.

In northwestern Montana during early stages of population establishment road closures have been extended for short periods of time (2-4 weeks) to provide security to wolf dens close to roads that otherwise would have been opened. No areas have been closed for long periods of time. Effects would increase if disturbance by humans caused wolves to abandon dens resulting in wolf pup mortality, or if illegal killing of wolves, facilitated by public access, resulted in wolf mortality that precluded wolf population recovery. In the absence of these factors, effects on recreational use and public access would likely not be measurable.

Effects on ADC activities would be greater than projected for other alternatives. Techniques such as aerial shooting, trapping, and snaring are used only on a limited basis on public land. Use of these techniques would be limited further or curtailed in areas that are occupied by wolves, particularly during spring and early summer, especially in the area of wolf dens or rendezvous areas. Snaring would likely not be allowed in areas of wolf occupancy because of the risk to non target animals. Trapping is relatively low risk if small traps are used and if traps are checked frequently. Aerial shooting by qualified individuals is relatively low risk but the public controversy often associated with aerial shooting by government employees may limit use in some areas. The use of toxicants is not now authorized on public land in the analysis area. However, future proposed use would likely not be allowed in areas occupied by wolves because label restrictions preclude their use in such areas.

M-44s are primarily used by ADC to control coyotes on private land in response to landowner requests. They may also be used by private landowners on private land after the operator receives certification. Use of these devices by both ADC and private applicators would be precluded in areas occupied by wolves. Because of the increased possibility of wolves occupying and remaining in lower elevation areas, including private land, the effects on M-44 use would likely be increased over present use. For example, in northwestern Montana where a population of wolves lives, use of M-44s is not limited where single wolves may range. Rather, where a pack of wolves lives, M-44 use is restricted in the area when wolves are there. Under this alternative, M-44 use would likely be further restricted in areas that contain wolf breeding pairs, persistent use by dispersing animals, or in areas where wolf survival would greatly facilitate recovery.

Conclusions.--This alternative would have the most impact on land use. Public use of a total of 5 mi^2 (13 km^2) around release sites would be precluded. Public use and access restrictions around den and rendezvous sites would affect an additional 21-35 mi^2 (54-91 km^2). Livestock grazing on public land livestock allotments could be seasonally delayed or precluded on allotments with active wolf dens or persistent depredation problems. Seasonal access for recreation or resource development activities could be delayed from March 15 to July 1 to protect wolf dens. ADC activities in areas occupied by wolves would be limited to those posing no lethal risk to wolves.

Impacts on Visitor Use

With reintroduction of wolves as an endangered species visitors to Yellowstone National Park and the Yellowstone area will know wolves live there, and will have the opportunity to see or hear wolves, or see their sign and these benefits would accrue slightly faster than Alternative 1. In Denali National Park, Alaska, an estimated 15% of park visitors see wolves (Mech et al. 1991), and the concentrations of wildlife in open areas in Yellowstone National Park are expected to attract wolves to those places (Koth et al. 1990), where they will be observable.

A small percentage of potential backcountry users could be inconvenienced or access precluded by seasonal restrictions in the vicinity of wolf den sites from March 15 to July 1. April-June visitation to Yellowstone makes up 26% of annual park use; April-June backcountry use made up 19.2% of the April-October backcountry use nights, and involved 1.4% of stock use nights in 1992. Day use by hikers in Yellowstone National Park could be directed to alternative trails if wolf den restrictions limited use of popular trails - roughly 240 hikers could be so affected.

Of 6,151 commercially outfitted backcountry visitor use nights recorded in Yellowstone National Park April-October 1992, none were recorded in April or May, and just 215 in June, representing 3.5% of the April-October total. Stock use nights for April-May were zero, and June stock use nights amounted to 1.5% (90 of the April-October total of 6,194). Consequently, little adverse effect is expected on outfitter operations in Yellowstone National Park.

Assuming monthly distribution of general recreational use on the 6 national forests would be similar to those of the national parks, comparatively few recreationists would be using the backcountry April-June. Monthly summaries of outfitter use on the national forests were not available, but snowy or muddy trails and high stream levels in higher elevations would normally prevent much use March-June, when travel might be restricted within a mile (1.6 km) of wolf dens.

Conclusions.--Recreational users to Yellowstone would have opportunity to see or hear wolves or see their sign within a decade. A slight increase of visitor use is expected specifically for this purpose once populations have established. A small number of visitors may be limited in using areas near wolf dens from March 15 to July 1 but this represents a small percentage of overall visitation. No change in visitor use patterns or use by commercial outfitters is projected.

Impacts on Economics

Impact on the Economic Value Associated with Hunter Harvest.--The economic impact of Alternative 5 on hunter harvest in the Yellowstone area is likely to be slightly greater than under Alternative 1, after the population has fully recovered. This economic impact is estimated to be $187,300 to $464,900 annually (Table 4-25).

Table 4-25. Annual net social benefits associated with wolf recovery in the Yellowstone area under Alternative 5.

	Annual impact (thousands of 1992 dollars)	
	Low estimate[c]	High estimate[c]
(A) Benefits associated with wolf recovery		
Annual net economic value of wolf recovery	6,673.1	9,854.3
(B) Costs associated with wolf recovery		
Foregone value to hunters[a]	187.3	464.9
Value of livestock losses	1.9	30.5
Annual wolf management cost until recovery[b]	2,700.0	2,700.0
Total costs	2,889.2	3,195.4
Net benefits of wolf recovery in the Yellowstone area[c]	3,783.9	6,658.9

[a] Lost value to hunters could possibly be overstated as this figure is based on hypothetical willingness to pay and has not been calibrated in any way as have the net economic benefits estimates.
[b] Note that one half of the total management costs of wolf recovery to both the Yellowstone and central Idaho areas are included in the costs associated with this alternative. This cost will only be incurred until wolf recovery is achieved, which varies between alternatives. Other costs and all benefits will continue into perpetuity making annual net benefits significantly higher in many cases once recovery is achieved.
[c] For the benefits estimates, the low and high estimates represent a 95% confidence interval on the estimates of net willingness pay for the alternative. For the individual costs, the low and high estimates represent the best estimates of minimum and maximum costs associated with an alternative. The final net benefits figures do not represent a confidence interval but rather a plausible range of benefits associated with the alternative.

Economic Impact on Domestic Livestock.--It is estimated that livestock depredation under the Alternative 5 could be slightly higher than under Alternative 1 estimated at $1,888-$30,470 with an average of $18,277 annually.

Impact on Visitor Use and Expenditures.--It is estimated that visitation to the Yellowstone area will change by the same amount as under Alternative 1. This would result in an increase economic benefit of $3.35 million-$19.65 million annually.

Impact on the Existence Value of Wolves.--Under Alternative 5 it is estimated that the net economic value of wolf existence in the Yellowstone area will be equal to that in Alternative 1 estimated at about $8.3 million per year.

Conclusions.--It is estimated that wolf recovery in the Yellowstone area under Alternative 5 will lead to total benefits of \$6.67 million-\$9.85 million per year and total costs of \$2.89 million-\$3.20 million per year (Table 4-25). By far, the largest component of total costs would be the wolf management costs of \$2.70 million per year. Considering the estimated costs and benefits associated with this alternative, it is estimated that under Alternative 5, wolf reintroduction in the Yellowstone area will result in net benefits of between \$3.78 million-\$6.66 million per year.

CENTRAL IDAHO

Impacts on Ungulate Populations

Impacts of wolves on ungulates under this alternative are expected to be similar to those described under Alternative 1. Reintroduction of Experimental Populations, except that wolves could not be relocated if they were impacting ungulate populations in localized areas, even if this added predation were preventing the IDFG from meeting its management objectives. However, this alternative would provide money annually for enhancement of ungulate populations. Overall, impact on ungulate populations in the primary analysis area is expected to be minimal.

Conclusions.--Impact on ungulates is expected to be similar to the impact on ungulates under Alternative 1, except that wolves could not be captured and relocated, even if they were severely impacting certain ungulate populations. Consequently, impact on vulnerable bighorn sheep populations may be more severe than described for Alternative 1. However, habitat enhancement may lessen the impact of wolf predation.

Impacts on Hunter Harvest

To maintain the current population size and continue the current level of bull elk harvest in central Idaho, harvest of cow elk may have to be reduced 10%-15% (same as Alternative 1). A reduction in cow harvest by 10% will allow for predation of 100 wolves, an acceptable bull:cow ratio, and an elk population that is increasing faster than the current elk population without wolves (Table 4-11). Enhancement of ungulate habitat may lessen impacts of predation on ungulate populations.

No modifications in harvests of deer, moose, or mountain goats are expected to be required to accommodate for predation by 100 wolves.

Harvest of bighorn sheep rams may have to be reduced or eliminated in areas where herds are being impacted significantly by wolf predation because they are vulnerable on winter range with inadequate escape terrain.

Conclusions.--Cow elk harvest may have to be reduced 10%-15% to accommodate predation of 100 wolves, and harvest of bighorn sheep rams may have to be reduced or eliminated for some herds that are particularly vulnerable to predation by wolves while on winter range. No changes in management of harvest for deer, moose, or mountain goats are expected to be necessary.

Impacts on Domestic Livestock

Elements of this alternative that will likely influence impacts on domestic livestock include (1) rapid reintroduction of wolves under the most protective measures of the ESA, (2) allowing dispersing animals to establish territories where suitable habitat exists, and no control by public agency personnel of any wolves depredating on livestock.

If conflicts with livestock on public land occur, livestock would be removed. Wolves attacking or killing livestock could not legally be killed. Reintroduced wolves would likely come in contact with livestock within 1 or 2 years in central Idaho. Wolves would not only become established in central Idaho, but also on other private and public land throughout Idaho. Recovery is expected by the year 2000.

Wolves would likely kill some livestock in central Idaho during the first 1 or 2 years of reintroductions. Because wolves would be intensively monitored during the first few years after reintroduction, some losses of cattle and sheep to wolves could be avoided. Depredation on cattle and sheep would increase as wolf populations expanded after 3-5 years.

As wolves approach recovery under Alternative 5, depredation rates on livestock are expected to be higher than under other alternatives. Based on a comparison with known depredation rates from Minnesota, Alberta, and Montana, and adjusted because of elements of this alternative, about 14 cattle (range 1-17) and 70 sheep (range 32-92) are expected to be lost annually to wolves in central Idaho. In some years, lack of wolf control and other factors could lead to annual depredation rates higher than 17 cattle and 92 sheep. For some allotments that are very remote, lightly tended, located close to more than 1 wolf pack, and where there is no wolf control, depredation rates may occasionally approach those observed in the Simonette River experimental area in Alberta, where 39-40 wolves killed or injured 27 cattle in 1 year (Table 4-1). Removal of livestock from public land where conflicts with wolves occur will partially offset increased depredation rates caused by the absence of legal wolf control under this alternative.

Under this alternative, wolves on private land could be relocated if chronic depredation problems existed and after other methods to resolve problems were unsuccessful. Because management and control options are extremely limited under Alternative 5, local tolerance of wolves would likely be very low and illegal killing of wolves would probably be high.

As in Alternative 2, dispersing wolves would be allowed to stay in areas outside of central Idaho, including both private agricultural lands and public rangelands. Depredations on domestic dogs are expected to be higher under this alternative than any other, although still infrequent. In Minnesota, where about 1,200 wolves lived in an area with 68,000 households, 1 dog was lost per 22,000 households per year.

Conclusions.--The rapid reintroduction of wolves under endangered status in central Idaho will result in the annual loss of about 14 cattle (range 1-17) and 70 sheep (range 32-92). Depredation rates are expected to be higher under this alterative than other alternatives as no wolf control will be implemented. Instead, livestock will be removed from allotments where losses occur.

Impacts on Land Use

Under Alternative 5, wolves would be rapidly reintroduced into Idaho under full protection of the ESA. Wolves would likely recover in central Idaho within 5-10 years.

Wolves would be protected under measures of the ESA. Den site closures from March 15 to July 1 would be in effect. Because wolves would receive all protections of the ESA, Section 7 would apply and would require consultation on all federal activities that may affect wolves. Current direction by the FWS on gray wolf Section 7 consultations is that "management actions prescribed by the USDA Forest Service, such as timber harvest and road restrictions to protect ungulates and their habitat, adequately protect wolves" (USFWS 1992).

Current restrictions include limiting activities within 1 mile (1.6 km) of active wolf dens or rendezvous sites from March 15 to July 1, and placing some restrictions on non-selective control methods of ADC within occupied wolf range (USFWS 1992).

Grazing on national forest land may be impacted by wolf presence prior to recovery. Wolf control guidelines under this alternative preclude capture and relocation or killing of wolves or wolf pups prior to August 1. Consequently, livestock on public land allotments where depredations occur will likely be moved to alternative allotments or out of the area.

Impacts from Section 7 consultations would likely be very similar to Alternative 2. In areas where wolves occur and standards and guidelines to provide for other resources such as ungulate winter ranges and birthing areas have been adequately applied in sale design, there should be little effect on levels and timing of timber harvest. However, if wolf population establishment and recovery is impaired by illegal killing, road density standards could be implemented (1 mile open road/1 mi^2 habitat; $0.62km/km^2$); these could limit the area available for timber harvest and recreational activities.

Impacts on the use of M-44s would initially be greater under this alternative than any other, because rapidly reintroduced wolves would likely move into some areas of private land, and precluded or suspended the use of M-44s would be precluded or suspended in those areas.

Because wolves would be expected to be recovered sooner under this alternative than for the other 4 alternatives, the impact would likely cover a shorter time.

Other terms and conditions of ADC activities in "occupied wolf range" include (1) no neck snares can be used, (2) leghold traps must be checked at least once a day, and (3) number 3N or smaller traps should not be used in proximity to occupied dens and rendezvous sites, unless coordinated with the FWS. The requirement to check leghold traps at least once a day may reduce the use of this technique to control coyotes in some areas newly recolonized by wolves.

Conclusions.--Reintroduction of a nonexperimental population of wolves into central Idaho could impact some land uses in central Idaho. One mile (1.6 km) closures around den sites, from March 15 to July 1, may have minor impacts on the timing of timber sales or livestock grazing. If illegal killing precludes successful wolf recovery under this alternative, more stringent access related restrictions may be instituted, including road density standards (1 mile open road/mi^2 of habitat; 0.62 km/km^2). As "occupied wolf range" expands under this alternative, some ADC activities, including the use of M-44s and leghold traps, will probably be affected.

Impacts on Visitor Use

Implementation of Alternative 5 would lead to the quickest recovery of wolves in central Idaho and would provide the quickest opportunity for visitors to hear and observe wolves or their sign. Overall impacts on visitor use would be similar to Alternative 1.

Impacts on Economics

Impact on the Economic Value Associated with Hunter Harvest.--The economic impact of Alternative 5 on hunter harvest in central Idaho is likely to be slightly higher than under Alternative 1 and is estimated at $756,800 to $1,135,200 (Table 4-26).

Economic Impact on Domestic Livestock.--It is estimated that livestock depredation under the Reintroduction of Nonessential Wolves Alternative (Alternative 5) could be slightly higher than under Alternative 1 after recovering populations begin inhabiting central Idaho. This cost is estimated to range from $2,900 to $18,500 annually.

Impact on Visitor Use and Expenditures.--It is estimated that visitation to central Idaho will change under Alternative 5, the same as under Alternative 1.

Impact on the Existence Value of Wolves.--Under the Alternative 5 it is estimated that the net economic value of wolf existence in central Idaho will be equal to that in Alternative 1,9 estimated at about $8.4 million annually.

Table 4-26. Annual net social benefits associated with wolf recovery in central Idaho under Alternative 5.

	Annual impact (thousands of 1992 dollars)	
	Low estimate[c]	High estimate[c]
(A) Benefits associated with wolf recovery		
Annual net economic value of wolf recovery	6,847.8	10,012.2
(B) Costs associated with wolf recovery		
Foregone value to hunters[a]	756.8	1,135.2
Value of livestock losses	2.9	18.5
Annual wolf management cost until recovery[b]	2,700.0	2,700.0
Total costs	3,459.7	3,853.7
Net benefits of wolf recovery in central Idaho[c]	3,388.1	6,158.5

[a] Lost value to hunters could possibly be overstated as this figure is based on hypothetical willingness to pay and has not been calibrated in any way as have the net economic benefits estimates.
[b] Note that one half of the total management costs of wolf recovery to both the Yellowstone and central Idaho areas are included in the costs associated with this alternative. This cost will only be incurred until wolf recovery is achieved, which varies between alternatives. Other costs and all benefits will continue into perpetuity making annual net benefits significantly higher in many cases once recovery is achieved.
[c] For the benefits estimates, the low and high estimates represent a 95% confidence interval on the estimates of net willingness pay for the alternative. For the individual costs, the low and high estimates represent the best estimates of minimum and maximum costs associated with an alternative. The final net benefits figures do not represent a confidence interval but rather a plausible range of benefits associated with the alternative.

Conclusion.—It is estimated that wolf recovery in central Idaho under Alternative 5 will lead to total benefits of \$6.85 million-\$10.01 million per year and total costs of \$3.46 million-\$3.85 million per year. Considering the estimated costs and benefits associated with this alternative, it is estimated that under Alternative 5, wolf reintroduction in central Idaho will result in net benefits of \$3.39 million-\$6.16 million per year.

CHAPTER V

CONSULTATION AND COORDINATION

CONSULTATION AND COORDINATION IN DEVELOPMENT OF THE PROPOSAL

Introduction

This section summarizes the interagency coordination that occurred and was used to develop the proposed action of reintroducing wolves as experimental populations into both Yellowstone National Park and central Idaho.

1989-1992 As part of the Montana Wolf Recovery Program, 268 presentations on wolves were attended by 11,725 people giving biologists an opportunity to hear first-hand the concerns of local residents about wolves and wolf recovery.

May 1991 Several thousand people attended public meetings and hearings about the Wolf Management Committee process and expressed their opinions about wolves and wolf recovery. Several biologists who later became EIS team members were involved in that process.

1991-Weeks of:

12/02 Ed Bangs (FWS and Project Leader), Wayne Brewster (NPS), Kirk Horn (FS) designated agency representatives. Discuss roles with Northern Rocky Mountain Wolf Recovery Coordinator (FWS) Dr. Steven Fritts. Discuss with Montana Dept. Fish, Wildlife & Parks. Weekly and monthly progress reports were prepared for the FWS Regional Director and Director. Quarterly reports were prepared for Congress.

12/09 Meeting with FWS Regional Staff and Christine Turk (NPS) and John Farrell (DOI) to discuss NEPA and legal compliance.

12/16 Meet FWS and NPS in Denver to discuss EIS task directive (plan to develop and schedule draft EIS). Discuss with (FWS) former Project Leader of S. Sea Otter EIS. Initial contact with state resource agencies.

12/23 Draft letter to cooperating federal, state and tribal agencies, and initiate contacts with others with special knowledge or interest in wolf recovery (see list of preparers/formal reviewers, this chapter). These individuals received monthly EIS progress reports, and all EIS scoping documents and reports.

1992-Weeks of:

01/06 Contact states of Montana, Idaho and Wyoming, private members Wolf Management Committee (4), FWS Grizzly Bear Coordinator, FWS Region 1, Washington D.C. Public affairs.

01/13 Contact Mexican Wolf Coordinator and Mr. Demarchi (B.C.). 02/03 FS appoints representative (Laird Robinson) for EIS team.

02/17 FWS, NPS, and FS meet to plan issue scoping open houses.

02/24 Yellowstone Park Superintendent briefed.

03/09	EIS team (FWS, NPS, FS, Animal Damage Control, state representatives) meet in Denver.
03/16	Forest Service briefed. Congressional briefing in D.C. Contact made with Montana, Idaho, and Wyoming Congress and Senate state staffs.
03/23	Contact with Montana on state role. FWS offices in affected regions help set up national 7 open houses. Open house news release sent to Montana, Wyoming, Idaho livestock and conservation groups, Congressional offices, followed by phone call. Mailed news release to 212 people per request.
03/30	Idaho legislature passes bill to allow Fish and Game participation. Congressman Marlenee requests hearings.
04/06	Open houses held. Federal and state agencies participate.
04/13	Issue scoping open houses held, 27 in Montana, Wyoming, and Idaho.
04/20	National issue scoping open houses (7) held.
04/27	Meet with FWS regional and Washington D.C. staffs.
05/11	EIS team meets in Helena to review open houses. Set schedule for alterative scoping hearings. Wyoming and Idaho Cooperative Wildlife Research Units contacted for economic analysis.
05/18	Issue content analysis team begins in Helena.
05/25	Content analysis team finishes analysis prepares report.
06/01	FWS and Idaho F&G meet with Idaho state legislative Oversight Committee in Boise, Idaho. Montana Coop Unit contacted about economic analysis.
06/08	FWS representatives attend "media" tour in Yellowstone. University of Montana awarded economic contract.
06/22	FWS meets with Univ. of Montana economics team. EIS team, including Wind River Tribes and state representatives meet in Denver to finalize issue scoping report and hearings.
07/13	NPS and FS comments indicate economic analysis on track. FWS meets several private groups in Cody & Meeteetse, Wyoming.
07/27	Alternative scoping brochure mailed and published in Montana, Wyoming, Idaho Sunday papers (circulation 230,000).
08/03	Alternative scoping open houses begin.
08/10	Alternative scoping open houses (27) completed.
08/17	Six alternative scoping hearings held.
08/24	EIS team members (FWS, NPS, ADC, and Montana, Wyoming, Idaho) attend 2nd N. American Wolf Symposium and meet with other biologists and managers from throughout the world that are working on wolf issues and research.
09/28	Alternative scoping content analysis team begins in Missoula. John Farrell (DOI) provides EIS writing training to EIS Team in Yellowstone Park.
10/05	FWS, Idaho F&G, and Univ. of Montana economist meet with Idaho Oversight Committee in Dubois, Idaho.
10/13	Alternative scoping completed.

10/19 EIS team meets in Helena to discuss significant issues, alternative scoping report, and alternatives.

11/02 FWS regional office briefed. Idaho F&G meets with Oversight Committee.

11/09 Greater Yellowstone Coordinating Committee (NPS & FS Supervisors) briefed in Idaho Falls.

11/16 Idaho F&G meets with Oversight Committee. FWS briefs FWS Region 6 project leaders.

11/23 Idaho F&G and ADC give presentation to Idaho stockgrowers. Idaho F&G internal meeting on EIS.

12/07 FWS and Wyoming G&F on TV panel discussing wolves. Idaho F&G meets with Oversight Committee. FWS follows up on complaints that the wolf monitoring program not working in Wyoming or Idaho. Contact state and federal biologists to check with cooperators about monitoring.

12/14 EIS team meets in Denver to discuss alternatives, brief FWS, NPS, ADC Regional Directors.

12/21 FWS briefing to Regional Forest staff in Missoula.

1993-Weeks of:

01/04 FWS brief FS Supervisor Management Team in Missoula.

01/11 Idaho F&G brief Idaho Senate Natural Resources Committee. FWS EIS Team Scientist completes analysis of definition: When does a group of wolves become a "wolf population"?, during which 23 biologists familiar with wolves and genetics were contacted for their input. Definition of a wolf population is "2 pair successfully raising at least 2 young for at least 2 consecutive years in a recovery area."

01/18 Idaho F&G brief Idaho House Natural Resources Committee. FWS discuss state wolf resolution with Montana Senate Committee.

01/25 EIS writing team meets in Boise, Idaho to standardize alternatives and impact analysis chapters. Team meets with Idaho Oversight Committee.

02/08 More complaints about wolf monitoring system in Idaho. Contact FWS state office, FS, NPS, states, and FWS Region 1 to ensure monitoring program working.

02/15 Comments received on draft document that requested legal review of draft experimental population rule by DOI Regional Solicitor. Idaho F&G meets internally to discuss impacts to ungulates in Idaho and with Oversight Committee.

02/22 FWS discusses EIS at Montana Wildlife Society meeting in Great Falls.

03/08 Yellowstone Superintendent (NPS) briefed. FWS briefs several Idaho state senators and FWS Region 1 Regional Director in Boise, Idaho.

03/15 FWS and NPS Regional Directors and Regional Solicitors briefed in Denver.

03/22 Dr. Fritts completed analysis of "Whether the 1987 northern Rocky Mountain Wolf Recovery Plan goal of: 10 breeding pairs of wolves, in each of three separate areas (but with some level of interchange), for three consecutive years is a viable wolf population" (Yes). He contacted all wolf recovery teams in the U.S. and 43 (25 of 43 provided input) biologists familiar with wolves and population viability for their advice.

04/05 Brief Regional Forester and staff in Missoula, Montana. Idaho F&G and FWS discuss wolf issues at Idaho and NW section meetings of The Wildlife Society.

04/12 Review comments on first draft EIS from EIS team members.

04/19 Review revised draft EIS with NPS, FWS and DOI in Denver.

05/03 Dr. Fritts completed recommendations for wolf reintroduction techniques. Analysis included contacting 53 wolf biologists, captive animal experts, veterinarians, and people with experience with captive wolves or canids.

05/17 Brief FWS Region 1 staff in Portland, Oregon.

05/24 Brief Washington D.C. staff on draft EIS and proposal.

06/15 Draft EIS completed, approved, and sent to printer for public distribution.

06/30 Draft EIS, including proposal, distributed to public.

Public comments on the DEIS will not be available for public review until after the close of the public comment period on October 15, 1993.

CONSULTATION AND COORDINATION IN DEVELOPMENT OF THE EIS

Planning for the Reintroduction of wolves into Yellowstone National Park and central Idaho was initiated in November 1991 when Congress directed the FWS to prepare a DEIS. An interagency team (see list of preparers, this chapter) was established during the spring of 1992. During preparation of the DEIS, federal, state, and local agencies, specialist interest groups, and the public were consulted to obtain descriptive information, identify significant issues and effects, and identify effective mitigating measures and reasonable alternatives to the proposal. The first series of 34 public meetings was held by the Service in April 1992 (see public participation section, this chapter). At these meetings the Service presented information about the DEIS process and requested the public to identify issues they believed were important to wolf recovery (see Chapter 1 for discussion of issues). In August 1992, another series of 27 meetings and 6 hearings was held to identify alternatives for wolf reintroduction (see Chapter 2 for discussion of alternatives). The agencies and organizations listed at the end of this "Consultation and Coordination" section were contacted by the Service during preparation of the DEIS.

Summary of Public Involvement

Introduction

This sections summarizes the public involvement process (scoping) that was conducted in 1992 to identify issues and alternatives regarding wolf reintroduction into Yellowstone National Park and central Idaho. The section is divided into 2 parts. The issue section describes the process used to identify issues and discusses those issues and how they were addressed in the DEIS. See Chapter 1 for specific information. The second part describes the process used to identify alternatives and discusses those alternatives and how they are used in the DEIS. Eleven major alternatives that were identified are listed and discussed. Six alternatives were addressed through discussions in scoping. Five were chosen to displayed for detailed analysis in the DEIS. See Chapter 2 for specific information.

Issue Scoping

Issue Scoping Process.--The FWS formally began the EIS process on April 3, 1992, by publishing a notice of intent to prepare an Environmental Impact Statement (EIS) in the Federal Register (FR Doc. 92-7681, Vol 57-No. 65). A few days earlier, on March 23, 1992, the FWS had also issued a news release announcing beginning of the EIS process and the schedule for issue scoping open houses. In late March, a letter and a poster that announced the start of an EIS on wolf reintroduction into Yellowstone National Park and central Idaho requesting public involvement was mailed to approximately 2,500 groups and individuals that had either previously expressed an interest or may have had an interest in wolf recovery.

Public issue scoping was the first opportunity for public involvement during this process. The FWS initiated this step by developing and distributing a brochure that detailed the EIS process, background information, issues identified to date, and explained how to become involved in the EIS process. People were asked to identify their issues and concerns related to wolf reintroduction into Yellowstone National park and central Idaho. On March 31, 1991, this brochure was sent to about 12,000 people who had requested to be placed on the mailing list.

During April 1992, open houses were held in 27 communities in Wyoming, Montana, and Idaho. Seven other open houses were held in national locations. The open houses were announced in news releases to the print, radio, and television media in late March. At many open house locations, agency personnel contacted local media immediately prior to the open house to remind the public of the EIS process and open house opportunity. The open houses started at 4:00 p.m. and lasted until 8:00 p.m. At open houses, people could watch a 10 minute-issue scoping video about the EIS process, wolf recovery, and how to become involved in the process and could review maps of the Idaho and Yellowstone areas. People could talk with representatives of the FWS, National Park Service, Forest Service, Animal Damage Control, and state wildlife management agencies, and ask questions about wolves, wolf recovery, the ESA, and the EIS process. People who attended the open houses received copies of the issue scoping brochure, posters that requested public involvement in the EIS process, and were encouraged to leave written comments with the agency personnel or mail them later. Verbal comments or questions were heard and responded to by the agency representatives, but verbal testimony was not formally recorded.

More than 1,730 people attended these open houses, as shown:
WYOMING April 6--Jackson Hole (100), Cody (100), Riverton (50); April 7--Rock Springs (20), Dubois (20), Pinedale (10); April 8--Casper (35), Cheyenne (25), Thermopolis (6). MONTANA April 9--Missoula (85), Bozeman (200), Billings (25); April 10--Hamilton (75), Red Lodge (20), and West Yellowstone (20); April 13--Helena (20), Dillon (120), Gardiner (60). IDAHO April 14--Couer d'Alene (25), Challis (40), Salmon (60); April 15--Lewiston (20), Stanley (15), Idaho Falls (75); April 16--Grangeville (50), McCall (20), and Boise (25).

National meetings were held April 20--Seattle, Washington (60), Anchorage, Alaska (12); April 21--Salt Lake City, Utah (110); April 22--Albuquerque, New Mexico (35), St. Paul, Minnesota (60), and Denver, Colorado (110). April 28--Washington D.C. (30). Attendance for the open houses was about 600 in Montana, 350 in Idaho, 360 in Wyoming, and 385 at the national meetings. Most open houses were well covered by the print, radio, and television media, and public exposure to the EIS process was high.

Written public comments on issues were solicited at the open houses and through the media. The 45 day issue-scoping comment period ended May 15, 1992. An interagency content analysis team began compiling the public comments on May 18, 1992. Some 1,800 issue scoping forms and 1,900 letters, including 8 petitions, were received that identified the issues that people felt should be considered in the DEIS. Comments were received from all fifty states and several foreign countries. The issue scoping content analysis team developed 2 documents, "Summary of Public Comments on Reintroduction of the Gray Wolf to Yellowstone National Park and central Idaho, May 29, 1992," and "Report for the Fish and Wildlife Service on Gray Wolf EIS Analysis of Public Comments--Comments in Addition to Summary Report."

A summary of these documents "Summary of Public Comments on Reintroduction of the Gray Wolf to Yellowstone National Park and Central Idaho, June 1992" was prepared and mailed to approximately 16,000 people who participated in issue scoping or requested to be placed on the EIS mailing list. During alternative scoping in August 1992, many people also commented on issues they believed were important and needed to be considered in wolf reintroduction. All of those issues had been previously identified, but it was apparent from public comment during alternative scoping that the 31 previous issue categories needed to be further refined to fully reflect and address public concerns. Thirty-nine separate wolf reintroduction issues/impacts were finally categorized and addressed in the EIS process. Those 39 separate issues/impacts and concerns were summarized into 9 major issue and concern categories that encompassed all significant and relevant issues. Those 9 categories were used to display differences between alternatives.

Alternative Scoping
The notification process for public scoping of alternatives began with a Notice of Public Hearings in the Federal Register on June 29, 1992 (FR Doc. 92-15172, Vol 57, No. 125).

On July 8, 1992, people who participated in the issues scoping process in the spring of 1992, along with others who expressed an interest, (about 16,000 total) were mailed the "Summary of Public Comments on Reintroduction of the Gray Wolf to Yellowstone National Park and Central Idaho" which contained the schedule for alternative scoping open houses and hearings.

On July 15, 1992, the first news release announcing the alternative scoping open houses and hearings was sent to news media throughout the United States. Over 500 media contacts, including newspapers, and radio and television stations, received the release. On July 31, 1992 another news release was sent announcing the exact dates, locations, and times of the hearings.

In August and September of 1992, the FWS asked the public to help identify various ways to address wolf reintroduction. An alternative scoping brochure was developed that provided background information, described 5 alternatives already identified by the public (No Wolf, Wolf Management Committee, 1987 Wolf Recovery Plan, Natural Recovery, and Accelerated Recovery), and requested the public's help with identifying other wolf reintroduction alternatives. This brochure was mailed on July 30, 1992, to over 20,000 people who had previously requested to be involved in the EIS process. The brochure was also inserted in the August 2, 1992, Sunday edition of 6 regional newspapers in Wyoming, Montana, and Idaho that had a combined circulation of about 230,000.

Open houses were held in 27 communities in Montana, Idaho, and Wyoming. Each open house started at 4:00 p.m. and ended at 8:00 p.m. The public was able to watch a 10 minute video and obtain an alternative scoping brochure that provided information about wolves, wolf management, and the EIS process. The public was encouraged to leave or mail in written comments. Verbal comments were not formally recorded. The open house locations and attendance (#) were as follows: WYOMING August 3--Jackson (28), Riverton (28), and Dubois (43), August 4--Rock Springs (22), Cheyenne (6), and Thermopolis (17); August 5--Cody (60), Casper (16), and Pinedale (8). MONTANA August 6--Billings (12), Bozeman (12), and Missoula (20); August 7--Red Lodge (18), Hamilton (not tallied), and West Yellowstone (3); August 10--Gardiner (20), Dillon (27), and Helena (16). IDAHO August 11--Couer d'Alene (7), Stanley (11), and Salmon (17); August 12--Lewiston (10), McCall (4), and Challis (13); August 13--Grangeville (12), Boise (20), and Idaho Falls (20). Attendance at alternative scoping open houses in August totalled 228 in Wyoming, 159 in Montana, and 104 in Idaho (total 491).

In addition, 6 public hearings were held where the public could leave written comments and/or give verbal testimony. Sign up to give testimony began at noon. The hearings began at 2:00 p.m. and ended at 10:00 p.m. Congressional and tribal representatives and the Governors of each State where given first opportunity to speak and up to 5 minutes to present their testimony. State legislators were given the next opportunity to speak for 3 minutes. The general public was given the opportunity to speak for up to 3 minutes by signing up between noon and 9:00 p.m. for a random drawing that was held hourly. Alternative scoping brochures were provided and everyone was encouraged to leave written comments whether they chose to sign up to testify or not. Everyone who wished to speak had the opportunity to give testimony- every hearing had more times allotted than there were speakers. The hearing locations and approximate attendance (#) were as follows: August 18--Cheyenne, Wyoming (325 people attended and 121 testified); Helena, Montana (450 people attended and 142 testified); Boise, Idaho (130 people attended and 92 testified). August 19--Cheyenne, Wyoming (7:00 a.m. until noon because the 18th was primary election day in Wyoming) (9 people attended and 6 testified), Seattle, Washington (45 people attended and 35 testified), Salt Lake City, Utah (400 people attended and 73 testified), Washington, D.C. (75 people attended and 30 testified).

Nearly 5,000 people commented through letters, petitions, or hearing testimony. Responses included 2,450 letters and post cards, 500 statements in hearing transcripts, 17 petitions, and 18 form letters. The petitions included 1,642 signatures and the form letters, 128 signatures.

An interagency team was formed to review and analyze this information. Public comments were read and specific comments on alternatives, new alternatives, and issues were identified. These comments were then entered into a computer program for easier sorting and retrieval. A report "Reintroduction of the Gray Wolf: The Public's Responses to Alternative Scoping" was prepared. The public expressed a wide range of opinions about wolf recovery alternatives. At least 25 different mixes of the 5 basic alternatives were identified by the public. In addition to the 5 draft alternatives the public had previously identified, and numerous modifications or combinations of portions of those alternatives, 4 other alternatives representing new concepts were recommended.

A summary "Alternative Scoping Report" was mailed to nearly 30,000 people on the EIS mailing list on November 18, 1992. The mailing list for the progress planning report in April 1993 included 32,000 addresses representing all 50 states and 40 foreign countries.

List of Preparers

The Environmental Impact Statement was prepared under the supervision of the United States Department of Interior, Fish and Wildlife Service.

Important Notice

The FWS has sole responsibility for the content and direction of the DEIS. Participation or review by technical representatives of other agencies does not imply concurrence, endorsement, or agreement to any recommendations, conclusions, or statements in the EIS. Official agency positions on the DEIS will be provided by those agencies that wish to provide comment during the standard public participation process of a DEIS which will occur during the summer of 1993. All public comments, including those from agencies that participated in the development of the EIS, will be addressed and will be available for public review in fall 1993, after the DEIS comment period is closed.

Persons who contributed to the preparing of the statement or where formally requested to be involved in its review are listed below.

Gray Wolf Interagency EIS Team
This team bears primary responsibility for preparing the plan. The members are:

Ed Bangs.--U.S. Fish and Wildlife Service, Wildlife Biologist. Gray Wolf EIS Project Leader. Responsible for plan development, direction, and content.

Worked at chemical plant, cattle ranch/feed lot, and oil fields 1969-1975. Wildlife Biologist. B.S., Utah State University (1974), and M.S., University of Nevada-Reno, (1979) in Wildlife Management. U.S. Fish and Wildlife Service- 1975-1988 as a wildlife biologist on Kenai National Wildlife Refuge, Alaska. Duties included a wide variety of wildlife research and management programs, including wolves and big game, caribou reintroduction, and EIS land-use planning. 1988-1991 as Project Leader, Gray Wolf Recovery in Montana including wolf monitoring, research, control, and public information.

Carol Tenney.--U.S. Fish and Wildlife Service, Data Automation Clerk. Responsible for coordinating correspondence, mailing lists, and Team administrative support.

Two year business course, Northern Montana College from fall 1960 to summer 1962. Bureau of Indian Affairs June 1962-June 1967 worked for real estate appraisers. Two years in Los Angeles as Medical Clerk, October 1968-February 1970. Great Falls and Helena, Montana Employment Assistance, June 1975-June 1980. U.S. Forest Service, Voucher Examiner, September 1983 to September 1985. U.S. Environmental Protection Agency, administrative support in the Superfund Program, September 1985-March 1992. U.S. Fish and Wildlife Service, March 1992-present.

Steve Fritts.--U.S. Fish and Wildlife Service, Wolf Recovery Coordinator, Northwestern U.S., Responsible for wolf science expertise.

Raised on cattle ranch in Arkansas. B.S. and M.S. zoology University of Arkansas (1970 & 1972), Ph.D. in ecology and behavioral biology (study of recolonizing wolves in Minnesota), University of Minnesota, 1979. U.S. Fish and Wildlife Service 1979-1984- Research on wolf population dynamics and wolf/livestock relationships and carried out wolf depredation control program in Minnesota. 1985-1989- Oversaw 6 endangered species research programs (including Minnesota wolf research) at Patuxent Wildlife Research Center. 1989-present- Coordinating Service wolf recovery efforts in Montana, Wyoming, Idaho, and Washington, conducting/coordinating Congressionally mandated studies regarding wolf recovery to

Yellowstone National Park, oversee wolf recovery efforts in Montana and Wyoming (monitoring, research, control, and public education).

Wayne Brewster.--National Park Service, Research Administrator. National Park Service representative on Gray Wolf EIS planning team.

Raised on ranch in North Dakota. Education--B.S. and M.S., South Dakota State University, Wildlife and Fisheries Science. Experience--wildlife biologist, U.S. Fish and Wildlife Service, evaluation of federal projects, effects on fish and wildlife resources, 1975-1979; supervisory biologist, Montana and Wyoming, evaluation of federal projects, environmental contaminants, and endangered species recovery programs, 1979-1988; wildlife biologist, Glacier National Park, responsible for gray wolf monitoring, management, and research, 1988-1991; and research administrator, Yellowstone National Park, responsible for gray wolf research and management, 1991 to present.

John Mack.--Biological Technician, Yellowstone National Park. Responsible for compiling and analyzing ungulate data for the Yellowstone area portion of the DEIS.

Raised in Montana. Education--B.S. in Biological Sciences, Fish and Wildlife Option at Montana State University, Bozeman (1985), M.S. in Fish and Wildlife Management, Montana State University (1988). Conducted black bear research in south-central Montana. Worked for U.S. Forest Service on grizzly bear habitat mapping. Worked 2 springs on South Fork Grizzly Bear Study in northwest Montana. Collected data on habitat enhancement project for bighorn sheep in northwest Montana. Involved in a variety of projects relating to wildlife resources and gray wolf research in Yellowstone National Park from 1989 to present.

Laird Robinson.--USDA Forest Service Representative. Public Affairs Specialist. Responsible for Public Participation Expertise.

B.A. University of Montana, 1981-1988 Northern Region Forest Service, Public Involvement Specialist. 1988-1990 Regional Fire Recovery Coordinator. 1991 Regional Centennial Coordinator. 1992-present gray wolf EIS public affairs specialist.

Jerome Hansen.--Idaho Department of Fish and Game Representative, responsible for preparation of central Idaho portion of EIS.

B.S. Biology, Emporia State University, Kansas. M.S. Wildlife Management, West Virginia University, 1986-present., wildlife mitigation specialist, Idaho Department Fish and Game, 1985-1986 Wildlife biologist, District biologist Kansas Fish and Game, 1983-1985, Research Assistant, U.S. Fish and Wildlife Service. Conducted wolf status and habitat survey in central Idaho.

Jon Rachael.--Idaho Department of Fish and Game, Wildlife Biologist. Responsible for preparing central Idaho portion of EIS.

B.S., Wildlife Science, Pennsylvania State University, (1988), M.S., Wildlife Biology, University of Montana (1992). Conducted research on mortality of white-tailed deer in an area being recolonized by wolves in northwestern Montana. Temporary employee Idaho Department of Fish and Game and private wildlife ecology consultant.

Disciplinary Specialists

Margot Zallen.--U.S. Department of the Interior, Regional Solicitor Office. Attorney. Provide legal guidance for DEIS.

Christine Turk.--National Park Service, Chief, Branch of Compliance and Legislation, Rocky Mountain Region. Responsible for NEPA and EIS legal and compliance advise.

B.S., biological sciences, University of Delaware. Senior Resource/Compliance Specialist, Denver Service Center, National Park Service, and research marine scientist, University of Delaware College of Marine Studies.

Renee Evanoff.--Illustrator, Yellowstone National Park. Responsible for graphic design and illustration of brochures, reports, and document covers.

Duties with the National Park Service have included editing, illustration, and computer graphics used in the production of "Effects of Grazing by Wild Ungulates in Yellowstone National Park" Volumes I-II and "Wolves for Yellowstone?" Volumes I-IV, is art director for the quarterly publication "Yellowstone Science." Yellowstone National Park, Graphics Specialist.

Paul Schullery.--Yellowstone National Park, Environmental Protection Specialist. Responsible for writing and editing portions of DEIS.

Historian, B.A., Wittenberg University, M.A. Ohio University, Affiliate Professor of History, Montana State University, Adjunct Professor of American Studies, University of Wyoming. Ranger-Naturalist and Park Historian Yellowstone National Park, 1972-1977, intermittently, research consultant Yellowstone and Mt. Rainier National Park 1988-present. Professional writer: author or co-author of 18 books and more than 100 articles on nature, conservation, history, and outdoor sport 1979-present.

Norm Bishop.--Yellowstone National Park, Park Ranger, Resource Interpreter. Compiled visitor use data and analysis for DEIS.

Naturalist. B.S. Botany, University of Denver 1954, Graduate study Colorado State University 1958-1961 in Forest Recreation and Wildlife Management. Research and wolf educator.

Sarah Broadbent.--Writer/Editor, Yellowstone National Park. Responsible for editing and document production.

B.A., 1987, Saint Olaf College, Northfield, Minnesota.

Kristen Churchill.--Biological Technician, Yellowstone National Park. Assisting in document preparation.

B.S., 1990, St. Lawrence University, Canton, New York.

Patricia Terletzky.--Biological Technician, Yellowstone National Park. Assisting in document preparation.

B.S., 1989, University of Wisconsin, Madison.

Mark Johnson.--Wildlife veterinarian, Yellowstone National Park. Responsible for writing and editing portions of the DEIS.

B.S. Zoology, Montana State University (1980), M.S. Veterinarian Science, University of Saskatchewan (1983), D.V.M. Colorado State University (1987). Specializes in wildlife capture, handling, and diseases. Writer/editor for several park service publications.

John Duffield.--University of Montana, Economics Professor. Led University of Montana Team that analyzed social and economic impacts.

Economist. B.A., Northwestern University (1968), Ph.D., Yale University (1974) in resource economics. Professor of Economics, University of Montana 1974-present. Specializes in the economics of fishery, wildlife, water, and recreation resources. Directed projects for the U.S. Environmental Protection Agency, National Park Service, Forest Service, and many state resource management agencies.

Other University of Montana team members include: Dr. Dan Pletscher (wildlife biologist, Professor School of Forestry), Dr. Claire Mongomery (economist, Asst. Professor School of Forestry), Dr. David Patterson (statistician, Assoc. Professor, Department of Mathematical Sciences), Dr. Stewart Allen (social psychologist and recreation specialist, consultant, formerly taught at University of Idaho), and Chris Neher (economics and computer specialist, M.A. economics, Univ. of Montana).

Primary Technical Review and Coordination Team
This group helped gather information and assisted in the development and review of concepts, ideas, and strategies used in the draft Gray Wolf EIS. However, they did not have control over program recommendations or contents which are solely those of the FWS.

Carter Niemeyer.--USDA/APHIS/Animal Damage Control, Wolf Management Specialist. Responsible for livestock depredation investigations and conducting control actions to remove wolves that prey on livestock in the northwestern region of the U.S.

Wildlife Biologist. B.S. and M.S. Iowa State University in Wildlife Biology. U.S. Fish and Wildlife Service (until transfer to USDA), Animal Damage Control 1975-1991 as a Supervisory Wildlife Biologist (District Supervisor) for Animal Damage Control in western Montana. Duties include control of depredating birds and mammals for the protection of crops and livestock and the supervision of ADC field operations in western Montana. 1991-present wolf management specialist ADC.

John Talbott.--B.S. Wildlife Conservation, University of Wyoming 1977. Deputy Director Wyoming Game and Fish Department 1992 to present; Assistant Chief of Wildlife Division, 1990-1992; District Supervisor 1986-1990; District Game Warden 1981-1986. Extensive work with mammalian predators through involvement in Interagency Grizzly Bear Committee, Yellowstone Ecosystem Grizzly Bear Subcommittee, Grizzly Bear Population Task Force, Southeast Bighorn Mountain Lion Ecology, Black-Footed Ferret Reintroduction.

Prior to employment with the Wyoming Game and Fish Department, worked as a wildlife ecologist in private industry.

Arnold Dood.--Montana Department of Fish, Wildlife and Parks Representative, Endangered Species Coordinator. Responsible for coordinating department comments on the DEIS at various times during its preparation.

B.S. Fish and Wildlife Management, Montana State University, 1976; M.S. Fish and Wildlife Management, Montana State University, 1978. From 1978-1979 conducted statewide coyote studies; 1979-1981 nongame studies in eastern Montana; 1981-1984 Game Management Biologist in Glendive; 1984-present Statewide Endangered Species Coordinator.

Dick Baldes.--U.S. Fish and Wildlife Service, Project Leader, Lander, Wyoming Fish and Wildlife Management Assistance Office.

Fish and Wildlife Biologist. B.S. in wildlife management, University of Wyoming and M.S. in Fisheries, Colorado State University. Wyoming Game and Fish Department fisheries biologist 1962-1965, Montana Fish and Game Department fisheries biologist 1968-1971, U.S.

Fish and Wildlife Service 1972-present. Duties include fish and wildlife management and research, primarily on Native American lands.

Gary Lajeunesse.--Supervisor of the Shoshone and Arapaho Fish and Game Department. Responsible for coordinating Wind River Tribes comments on the DEIS at various times during its preparation.

Born and raised on Wind River Tribal lands. Graduated from Saint Stevens High School, Graduated Federal Police Training Academy, Brigham City, Utah 1980. BIA law enforcement training and other federal and local training courses. Game Warden and Supervisor of Tribal Game Wardens 1978-1984. Supervisor BIA Game Enforcement Division 1984-1988. Supervisor Shoshone and Arapaho Fish and Game Department 1988-present. Duties include fish and game management and enforcement programs on Wind River tribal lands.

Issue Scoping Content Analysis Team
Team that analyzed public comment during issue scoping (April-May 1992).

Deanna Riebe.--USDA Forest Service, Clearwater National Forest. Public Affairs Specialist. Team leader and co-chair, issue and alternative content analysis team.

B.A. Interdisciplinary (emphasis communication and business management). Public affairs specialist, Siuslaw National Forest, Northern Region Forest Service, and Clearwater National Forest. Content analysis project included: Siuslaw Forest Plan, FS/BLM land exchange, proposed changes to national fire policy, involvement in litigation cases in Forest Service Region 6, and environmental assessments for timber sales, road management, and electronic communication sites.

Team Members Were:
Joy Perius, Planning and Cultural Resource Specialist, Yellowstone National Park.
Kristen Churchill, Biological Technician, Yellowstone National Park.
David Fulton, Research Assistant, FWS, Fort Collins, Colorado.
Teddi Coutts, Computer Program Specialist, Helena National Forest.
Melanie Scott, Hydrologic Technician, Helena National Forest.
Roseanna Finnley, Data Base Technician, Helena National Forest.
Bernie Patterson, Forestry Technician, Helena National Forest.
Pauline Dodson, Landscape Architect Trainee, Helena National Forest.
Barbara Hart, Procurement Clerk, Helena National Forest.

Alternative Scoping Content Analysis Team
Team that analyzed public comment during alternative scoping (August-September 1992).

Deanna Riebe.--FS, Clearwater National Forest. Public participation specialist. Co-Chair, content analysis team. See above.

Kathy Sweet.--Forest Service, Deerlodge National Forest. Public participation specialist. Co-Chair, content analysis team and responsible for computer support.

Writer-Editor, B.A. German, University of Wisconsin-Oshkosh. USDA Forest Service 1980-1987 computer program analyst on Uinta and Deerlodge Forests. Duties included systems analysis and programming, systems management, and computer application instruction. 1989-present writer-editor and interdisciplinary team member responsible for writing environmental documents.

Team Members Were:
Joy Perius, see above, Yellowstone National Park.
Amanda Hardy, GIS (computer) technician, Yellowstone National Park.
Palmer Bowen, Writer-editor, Deerlodge National Forest.
Heather Berg, Planning Forester, Nez Perce National Forest.
Sherry Munther, Public Affairs Specialist, Northern Region.
Mark Van Every, Public Affairs Specialist, Dixie National Forest.
Mary Hernvall, Carto (mapping)-technician, Kootenai National Forest.
Carlene Orr, Information Receptionist, Kootenai National Forest.
Alice Hayes, Computer Assistant, Kootenai National Forest.
Jackie Duke, Clerical Assistant, Rocky Mountain Region.
Molly Haddow, Support Services Specialist, FS Rocky Mountain Region.
Erma Kaeding, Carto-technician, Kootenai National Forest.
Ray Keibler, Forester, Flathead National Forest.
Kathy Minta, Editorial Assistant, Flathead National Forest.
Maryneil Oechsner, Wildlife Biologist, Targhee National Forest.
Susan Hartman, Forestry Student Trainee, Kootenai National Forest.
Jill Leman, Archeologist, Humboldt National Forest.
Matthew Setty, Wildlife Biologist, Elko District.
Joe Brady, Private citizen volunteer, Kalispell, Montana.

DEIS Technical Review and Coordination Team
This group was formally requested to review and provide oversight on the draft Gray wolf EIS. They were kept informed of DEIS progress but were not requested to provide specific comments before the draft was released for public review. They represent unique wolf management and recovery or EIS expertise or represented agencies that were potentially affected by a decision on wolf reintroduction in Yellowstone National Park or central Idaho.

Jim Claar.--USDA Forest Service, Northern Region, Wildlife and Fisheries, staff specialist. Missoula, Montana.

Dan Christofferson.--Shoshone-Bannock Tribes. Tribal Wildlife Biologist. Fort Hall, Idaho.

John Gunson.--Alberta Wildlife Branch. Edmonton, Alberta. Carnivore Biologist.

Bob Haney.--Canadian Parks Service. Chief Park Warden, Banff National Park.

Gary Henry.--FWS, Red Wolf Coordinator, Asheville, North Carolina.

Kirk Horn.--USDA Forest Service, Northern Region, Staff Director, Wildlife and Fisheries. Missoula, Montana.

Jim Owings.--BLM, Wildlife Biologist representing Montana State Office. Butte, Montana.

Blair Joselyn.--Minnesota Department of Natural Resources, Wolf Specialist. St. Paul, Minnesota.

Dave Kellyhouse.--Alaska Department of Fish and Game, Director Wildlife Conservation. Juneau, Alaska.

Steve Knick.--BLM, Wildlife Biologist representing Idaho State Office. Boise, Idaho.

Dave Mech.--FWS, Wolf Researcher in Minnesota. St. Paul, Minnesota.

Dave Parsons.--FWS, Mexican Wolf Coordinator. Albuquerque, New Mexico.

Allen Pinkham.--Nez Perce Tribal Representative, Clearwater National Forest Tribal Assistant. Lapwai, Idaho.

Roger Wickstrom.--BLM, Wildlife Biologist representing Wyoming BLM. Cheyenne, Wyoming.

Anna Wolterson/Ray Demarchi/Vivian Banci.--British Columbia Ministry of Environment, Wildlife Branch, Wildlife Biologists/Carnivore Specialists. Victoria and Cranbrook, British Columbia.

Adrian Wydeven.--Wisconsin Department of Natural Resources. Non-Game Biologist. Wolf Specialist. Park Falls, Wisconsin.

Brian Anderson.--FWS, Wildlife Biologist, Anchorage, Alaska.

Jeff Haas.--FWS, Wildlife Biologist, Olympia, Washington. Coordinates wolf issues in Washington.

Bruce Zoellick/Ted Koch.--FWS, Wildlife Biologists, Boise, Idaho. Coordinate wolf issues in Idaho.

Jane Roybal.--FWS, Wildlife Biologist, Cheyenne, Wyoming. Coordinates wolf issues in Wyoming.

Ron Naten.--FWS, Colorado. NEPA specialist.

Ron Refsnider/Craig Johnson.--FWS, Twin Cities Minnesota. Coordinate wolf issues in Great Lakes Region.

LIST OF ORGANIZATIONS AND PERSONS SENT THE DEIS FOR REVIEW

Federal Agencies

Copies of this Draft Environmental Impact Statement (EIS) are being provided to federal, state, local agencies, Native American tribes, interest groups, and organizations who may be affected by the final decision and the above list of preparers/reviewers.

Due to the voluminous number of people and organizations on the mailing list, copies of the DEIS have been provided to public libraries in Montana, Wyoming and Idaho, and in national cities where open houses or public hearings were held in 192: Salt Lake City, Utah; Denver, Colorado; Albuquerque, New Mexico; St. Paul, Minnesota; Washington, D.C.; Anchorage, Alaska; Seattle, Washington.

Council on Environmental Quality
Information Office

Environmental Protection Agency
Director, Office of Federal Activities

Regional Director, Region 8
Denver, Colorado

Regional Director, Region 10
Seattle, WA

United States Dept. of Agriculture
Secretary of Agriculture

Animal & Plant Health Inspector Service
Animal Damage Control
  Deputy Administrator
  Regional Director, Western Region

Extension Office/Information Office

Forest Service
  Wildlife and Fish Staff
  Regional Forester, Region 1
  Regional Forester, Region 2
  Regional Forester, Region 4
  Regional Forester, Region 6

United States Dept. of Interior
Secretary of Interior
Office of the Solicitor
Bureau of Indian Affairs
  Office of Director
  Area Director, Billings, Montana

Bureau of Land Management
  Office of Director
  State Director, Idaho
  State Director, Montana
  State Director, Wyoming

National Park Service
Office of Director

Regional Director
Alaska Region

Regional Director
Pacific Northwest Region

Regional Director
Rocky Mountain Region

Superintendent
Grand Teton National Park

Superintendent
Yellowstone National Park

United States Fish & Wildlife Service
Office of Director
Regional Director, Region 1
Regional Director, Region 3
Regional Director, Region 6
Regional Director, Region 7
Ecological Services
State Offices Idaho, Montana, Wyoming
Boise, Helena, Cheyenne

STATE OF IDAHO
Honorable Cecil Andrus
Governor

Director
Dept. of Commerce

Director
Dept. of Fish and Game

Director
Dept. of State Lands

President
Eastern Idaho Technical College

President
Idaho State University

Lemhi County Planning & Zoning Comm.
Lemhi County Courthouse

President
Lewis and Clark State College

President
North Idaho College

President
University of Idaho

STATE OF MONTANA
Honorable Marc Racicot
Governor

Director
Dept. of Commerce

Director
Dept. of Fish Wildlife & Parks

Director
Dept. of Natural Resources and Conservation

Commissioner
Dept. of State Lands

Director
Montana Dept. of Agriculture

Montana State Library
U.S. & Senate Documents Dept.

President
Montana State University

President
University of Montana

Provost
Western Montana College

STATE OF WYOMING
Honorable Mike Sullivan
Governor

Director
Dept. of Commerce

Director
Dept. of State Lands & Farm Loan

Director
Game And Fish Dept.

State Planning Coordinator
State Capitol

President
University of Wyoming

Wyoming State Legislature

Native American Tribes Elected Officials

Chairman
Nez Perce Tribal Executive Council
Lapwai, Idaho

Chairman
Couer d'Alene Tribal Council
Plummer, Idaho

Chairman
Blackfeet Tribal Business Council
Browning, Montana

Chairman
Confederate Salish & Kootenai Tribes
Pablo, Montana

President
Fort Belknap Community Council
Harlem, Montana

Chairman
Fort Peck Executive Board
Poplar, Montana

Chairperson
Little Shell Tribe
Havre, Montana

President
Northern Cheyenne Tribal Council
Lame Deer, Montana

Chairman
Shoshone/Bannock
Fort Hall, Wyo.

Federal Elected Officials

Honorable Larry Craig
U.S. Senate, Idaho

Honorable Dirk Kempthorne
U.S. Senate, Idaho

Honorable Michael Crapo
U.S. House of Representatives, Idaho

Honorable Larry LaRocco
U.S. House of Representatives, Idaho

Honorable Max Baucus
U.S. Senate, Montana

Honorable Conrad Burns
U.S. Senate, Montana

Honorable Pat Williams
U.S. House of Representatives, Montana

Honorable Alan Simpson
U.S. Senate, Wyoming

Honorable Malcolm Wallop
U.S. Senate, Wyoming

Honorable Craig Thomas
U.S. House of Representatives, Wyoming

Local Elected Officials

Board of County Commissioners
Custer County, Idaho

Board of County Commissioners
Park County
Cody, Wyoming

Idaho County Commissioner

Businesses and Organizations

American Farm Bureau Federation
Washington, D.C.

American Sheep Industry

Englewood, Colorado

President
American Sheep Industry Assoc.
Rock Springs, Wyoming

Associated Press
Boise, Idaho

Jack Atcheson & Sons Inc.
Butte, Montana

Backcountry Horseman of Idaho
Salmon, Idaho

Backcountry Horseman of Montana
Helena, Montana

Backcountry Horseman of Wyoming
Lander, Wyoming

Beaverhead County Farm Bureau
Dillon, Montana

Billings Gazette
Cody, Wyoming

Blueribbon Coalition
Idaho Falls, Idaho

Casper Star
Laramie, Wyoming

Chamber of Commerce
Campbell County
Gillette, Wyoming

Chamber of Commerce
Gardiner, Montana

Chamber of Commerce
Ketchum-Sun Valley
Sun Valley, Idaho

Chamber of Commerce
Worland, Wyoming

Colorado Farm Bureau
Denver, Colorado

Chairman
Arapahoe Business Council
Fort Washakie, Wyoming

Common Man Institute
Abundant Wildlife Society
Gillette, Wyoming

Defenders of Wildlife
Washington, D.C.

Defenders of Wildlife
Rocky Mountain Region
Missoula, Montana

Ducks Unlimited
State Marsh Coordinator
Boise, Idaho

Earth First!
Wolf Action Network
Bozeman, Montana

Environmental Defense Fund
Washington, D.C.

Environmental Defense Fund
Rocky Mountain Office
Boulder, Colorado

Fishing & Hunting News - Editor
Seattle, Washington

Foundation for North American Wild Sheep
Cody, Wyoming

Executive Director
Friends of the Earth
Washington, D.C.

Gallatin Valley Snowmobile Assoc.
Bozeman, Montana

Executive Director
Gem State Hunters Assoc.
Homedale, Idaho

Greater Yellowstone Coalition
Bozeman, Montana

Publisher
High Country News
Paonia, Colorado

Humane Society of the U.S.
Washington, D.C.

Idaho Cattle Association
Boise, Idaho

Executive Vice President
Idaho Cattle Association
Boise, Idaho

Idaho Conservation League
Ketchum, Idaho

Idaho Conservation League
Sun Valley, Idaho

President
Idaho Farm Bureau
Boise, Idaho

Idaho Field Archery Association
Orofino, Idaho

Idaho Guides & Outfitters

President
Idaho Hunters Association
Homedale, Idaho

President
Idaho Outfitters & Guides Assoc.
Boise, Idaho

Idaho Outfitters & Guides License Board
Boise, Idaho

Idaho State Rifle & Pistol Assoc.
Meridian, Idaho

Idaho Woolgrowers Assoc.
Boise, Idaho

Institute for Tourism & Rec. Research
University of Montana

International Assoc. of Fish & Wildlife Agencies
Washington, D.C.

International Wolf Center
Ely, Minnesota

Mission Wolf
Littleton, Colorado

Director
Montana Department of Agriculture

Montana Farm Bureau

Montana Farmer Stockman

Montana Farmers Union

Montana Guides & Outfitters

Executive Vice President
Montana Stock Growers Assoc.

President
Montana Wildlife Federation

Montana Wool Growers Association

National Assoc. of State Recreation Planners
Atlanta, Georgia

National Audubon Society
Washington, D.C.

National Audubon Society
Rocky Mountain Regional Office
Boulder, Colorado

Refuge Manager
National Elk Refuge
Jackson, Wyoming

National Fish & Wildlife Foundation
Washington, D.C.

President
National Park Foundation
Washington, D.C.

National Parks & Conservation
Rocky Mountain Regional Director
Salt Lake City, Utah

National Trappers Association, Inc.
Bloomington, Illinois

National Wildlife Federation
Washington, D.C.

Executive Director
National Wildlife Federation
Central Rocky Mountain Region
Boulder, Colorado

National Wildlife Federation
Northern Rocky Mountain Office
Missoula, Montana

National Wildlife Federation
Regional Director, Wyoming

Native American Fish & Wildlife Society
Broomfield, Colorado

Natural Resources Council of America
Washington, D.C.

The Nature Conservancy
Arlington, Virginia

The Nature Conservancy
Big Sky Director, Montana

Nature Conservancy
Silver Creek Preservation
Picabo, Idaho

North American Wild Sheep Foundation
Boise, Idaho

Northern Plains Resource Council
Billings, Montana

Northern Plains Resource Council
Helena, Montana

Northern Rockies Conservation Cooperative
Jackson, Wyoming

No-Wolf Option Committee
Wapiti, Wyoming

Pheasants Forever, Inc.
St. Paul, Minnesota

Post Register
Idaho Falls, Idaho

Powder River Basin Resource Council
Sheridan, Wyoming

Public Land AccAssoc. Inc.
Bozeman, Montana

President
Putting People First
Washington, D.C.

Refuge Manager
Red Rock Lakes NWF
Lima, Montana

Executive Director
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Sierra Club
Wyoming Chapter

Sierra Club Legal Defense Fund, Inc.
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Lander, Wyoming

Voice of the Wolf, Inc.
Endangered Species Foundation

Golden, Colorado

Washington Wolf Project
Seattle, Washington

The Wilderness Society
Washington, D.C.

The Wilderness Society
Northern Rockies Regional Office
Bozeman, Montana

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The Wildlife Society
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The Wildlife Society
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Wind River Multiple Use Advocates
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Wyoming Stockgrowers

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Wyoming Wildlife Federation

Wyoming Woolgrowers Association

President
Wyoming Woolgrowers Assoc.

Yellowstone Association
Yellowstone Park, Wyoming

Because of the voluminous number of people and organizations on the mailing list not all are listed. A complete list of names (addresses may not be released) is available upon request from the FWS.

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APPENDIX 1. CHRONOLOGY OF WOLF RECOVERY

CHRONOLOGY OF WOLF RECOVERY IN THE NORTHERN ROCKY MOUNTAINS

Summary of Wolf Status and Recovery in Northern Rocky Mountains

1700 Wolves were abundant throughout all of North America, north of Mexico City, except extreme desert regions.
1850 Extermination of ungulates and large predators began, including bison and wolves in the West.
1900 Wild ungulate populations and large predators were decimated by unregulated harvest and settlement.
1910 Wolves were virtually eliminated in eastern U.S., greatly reduced in West.
1915 U.S. Biological Survey initiated wolf control in West.
1925 Viable wolf populations were reported eliminated from West.
1944 The last documented wild wolf was killed in the greater Yellowstone area.
1950 Reports of wolves in Wyoming, Montana and Idaho continued. Lone wolves were killed in Montana and Idaho every decade until the present time.
1966 British Columbia began recovery and wolf populations increased southward. Reports of wolves continued in U.S. and increased slowly. Wolf reintroduction into Yellowstone National Park was recommended by several biologists.
1971 The first interagency meeting for management of the northern Rocky Mountain Wolf was held in Yellowstone National Park. Reports indicated there may have been 10-15 wolves in Yellowstone area and 5-10 in Glacier National Park.
1972 Wolf research by Wolf Ecology Project, University of Montana, began by evaluating wolf reports and sightings. They found no evidence of wolf packs in Montana.
1973 The ESA was enacted; wolves became protected in the U.S.
1973 Wolves became protected by Montana State law.
1974 An Interdisciplinary Wolf Recovery Team was appointed and led by a Montana Fish and Game representative. Introduction was considered in selected areas.
1977 Wolves became protected by Idaho State law.
1978 A lone wolf was photographed and another killed in central Idaho.
1978 The Wolves of Yellowstone report indicated no wolf packs in the Yellowstone area; viable populations ended by 1925.
1979 A lone wolf was monitored adjacent to Glacier National Park.
1980 A lone wolf depredated on livestock near Big Sandy, Montana, and was killed by FWS. This was the first documented depredation in over 50 years.
1980 The Northern Rocky Mountain Wolf Recovery Plan was reviewed by the public and approved by the FWS.
1981 The Wolf Recovery Team leader appointed new members, and revision of recovery plan began.
1986 The first wolf den in the western U.S. in over fifty years was documented in Glacier National Park.

1987 The revised Northern Rocky Mountain Wolf Recovery Plan was reviewed by the public and approved by the FWS.

1987 National Park Service director Mott suggested beginning EIS for reintroduction to Yellowstone. Park Service began wolf information program.

1987 A wolf pack near Browning, Montana, depredated on livestock and was removed by the FWS. Representative Owens (Utah) introduced a bill to require the NPS to reintroduce wolves to Yellowstone National Park (H.R. 3378 Sept. 30, 1987).

1988 The Interim Wolf Control Plan was approved by FWS. The Wolf Recovery Program in Montana was staffed and funded.

1988 Congress directed National Park Service and FWS to conduct "Wolves for Yellowstone?" studies and mandated appointment of Wolf Recovery Coordinator.

1989 Depredating wolves from Marion, Montana were relocated, leading to the establishment of the Ninemile wolf pack near Missoula, Montana. Representative Owens (Utah) introduced bill to Congress requiring initiation of EIS for wolf reintroduction to Yellowstone (H.R. 2786 June, 1989). It was not passed.

1990 Senator McClure (Idaho) introduced a bill "to provide for the reestablishment of the gray wolf in Yellowstone National Park and central Idaho Wilderness" (5.2674 May, 1990). It did not pass.

1990 The National Park Service and FWS released the first "Wolves for Yellowstone?" report, Volumes I and II.

1990 Congress established the Wolf Management Committee. No Congressional or agency action was taken on the Committee's May 1991 recommendation.

1991 Congress directed the FWS, in consultation with the Park Service and the Forest Service, to prepare a DEIS on wolf recovery in central Idaho and Yellowstone National Park.

1991 Congress funded the FWS to support the Animal Damage Control Wolf Management Specialist position in the West.

1991 A black wolf was illegally poisoned on a livestock allotment in a central Idaho Wilderness area.

1991 Two separate radio-collared wolves moved into Idaho. One stayed, the other went back to Canada.

1992 The National Park Service and the FWS released a second "Wolves for Yellowstone?" report, Volumes III and IV.

1992 An estimated 40 wolves in 4 packs occupied northwestern Montana. All packs except the Ninemile Pack, which resulted from relocation of a problem wolf in 1989, and Murphy Lake Pack were still in the Glacier National Park area. Lone wolves continued to be reported throughout Montana, Idaho, and Wyoming but no wolf reproduction was documented in Idaho or Wyoming.

1992 A possible wild wolf was photographed in Yellowstone. A wolf was shot just south of Yellowstone. No other wolves located despite increased monitoring.

1992 Congress directed the FWS to complete EIS by January 1994 and that it expected the proposed alternative to conform to existing law.

1993 An estimated 45 wolves in 5 packs occupy northwestern Montana. Monitoring efforts increased in Idaho and Wyoming but no wolf packs have been located.

CHRONOLOGY OF GRAY WOLF EIS

11/13/91	Congress directs FWS to prepare EIS on wolf reintroduction into Yellowstone National Park and central Idaho.
12/3/91	EIS team selections begin, continue through March 1992.
3/92	Idaho Legislature passes bill that allows Idaho Fish and Game to participate in EIS.
3/23/92	News release on issue scoping open houses issued.
3/25/92	Letter and poster requesting participation sent to over 2,500 groups or individuals that may be interested in EIS.
4/3/92	Notice of Intent to prepare EIS published in Federal Register. News release provided.
4/3/92	Issue scoping brochure sent to 10,000 people on mailing list.
4/6/92	Series of 34 issue scoping open houses (9 each in Wyoming, Montana, Idaho and 7 National) began, 1,730 people attended.
5/15/92	Issue Scoping Comment period closed. Nearly 4,000 comments received.
6/29/92	Notice of Hearings published in Federal Register.
7/8/92	Issue scoping report sent to 16,000 people on mailing list, includes alternative scoping open house schedule.
7/10/92	News release on issue scoping report issued.
7/17/92	News release announcing alternative scoping open houses issued.
7/30/92	Alternative scoping brochure mailed to about 20,000 people.
7/31/92	News release on alternative scoping hearings issued.
8/2/92	Brochure inserted in 230,000 Sunday newspapers in Wyoming, Idaho, and Montana.
8/3/92	Series of 27 alternative scoping open houses began, 491 people attended.
8/18/92	Series of 6 alternative scoping hearings begins, about 1,400 people attended and 430 testified.
9/4/92	Comment period for alternative scoping closed, nearly 5,000 comments received. News release issued.
11/18/92	Alternative scoping report sent to about 31,000 people on mailing list, representing all 50 states and 40 foreign countries.
1-4/93	DEIS is prepared.
4/93	EIS progress report was sent to about 32,000 people remaining on mailing list.
6/93	DEIS completed and public review requested during 90 days public comment period.

APPENDIX 2. TECHNICAL SUMMARY: WOLF BIOLOGY AND ECOLOGY

Biology

Taxonomy.--Wolves have existed throughout North America and have occupied nearly all habitats in the Northern Hemisphere except for true deserts. Early taxonomists divided the North American gray wolf into 24 subspecies based on skull characteristics, body size, and color; often utilizing few specimens. The subspecies of wolf that was described for the central Rocky Mountains, *Canis lupus irremotus*, was similar to other subspecies in the western United States and extreme southwestern Canada.

Contemporary researchers using multivariate analysis and molecular genetics, along with larger sample sizes suggest that 24 subspecies are unwarranted and that 5 North American subspecies are more reasonable. These subspecies overlap extensively with each other since they represent averages and trends in morphology that occur within a given geographical area. Genetically, there is very little distinction among gray wolf populations, at least in part due to the mobility of the species. Currently, all populations of wolves in the lower 48 states, irregardless of subspecies classification, are listed as endangered except for the gray wolf in Minnesota which is listed as threatened.

Physical Characteristics.--The wolf is the largest wild member of the dog family Canidae. Coat color ranges from white to shades of gray to black. In Minnesota, most wolves are gray. However in Montana, black wolves are as common as gray wolves. Adult males average 90-110 pounds and range from 43-175 pounds, while adult females average 80-90 pounds and range from 39-125 pounds. Males are usually 5-6.5 feet long from nose to tail tip, and females range from 4.5-6 feet in length. Most wolves stand 26-32 inches tall at the shoulder. The largest wolves are in Alberta, British Columbia, and Montana.

With long legs and a deep, narrow chest, the wolf is well suited for far-ranging travels. Wolves have large feet which aid in wintertime travel over crusted snow and allow them an advantage for preying on various ungulates, which can sink much deeper in the snow. Front feet are slightly larger than rear feet. Wolf tracks average 4 inches wide and 5 inches long with claw marks. Wolf and large domestic dog (great Dane, St. Bernard, and Irish wolfhound) tracks are similar in size, and often impossible to differentiate from each other.

Two important means of communication for wolves are howling and scent-marking. Within a wolf pack, howling serves in the identification, location, and assembly of separated pack members. It may also be particularly useful in facilitating the movements of pups and adults from one rendezvous site to the next. Howling may serve a social function when pack members rally around the alpha individuals and greet each other. It is also a means of advertising the presence of the pack within its territory, and the pack's willingness to defend resources such as pups, a kill, and the territory. This avoids direct conflicts between packs.

Scent-marking is the application of an animal's odor to its environment. It is used by wolves to communicate information regarding territory, location of food, and even the behavioral or physiological condition of the animal. Scent-marking usually involves urinating and defecating. Scent marks are commonly made at route junctions and especially along the edges of pack territories. These scent marks inform lone wolves or packs when they are entering another pack's territory.

Pack organization.--The basic social unit in wolf populations is the pack. A pack consists of 2 to 30 wolves (usually 5-15) which have strong social bonds to each other. Packs are formed when 2 lone wolves of the opposite sex find each other, develop a pair bond, breed, and produce a litter of pups. Central to the pack are the dominant (alpha) male and (alpha) female. The remaining pack members are usually related to the alpha pair and constantly express their subordinate status through postures and expressions when interacting with the dominant pair. Young members approaching sexual maturity may challenge the dominant animals, which can result in dynamic changes in each wolf's social position in the pack.

Breeding within the pack usually occurs only between the top-ranking alpha male and female. Wolves become sexually mature at 2 years of age. Although courtship behavior occurs in varying degrees throughout the year, the actual breeding season occurs from late January through April, depending on the latitude. Wolves in higher latitudes generally breed later. Wolves in Yellowstone National Park (45 degrees latitude) bred any time from late January to late February and possibly early March. During the breeding season in late winter, the pack may move extensively within its territory.

Pregnant alpha wolves complete digging of dens as early as 3 weeks before the birth of the pups. Most wolf dens are burrows in the ground, usually in sandy soil. Wolves may also den in hollow logs, rock caves, or abandoned beaver lodges. Some dens are used traditionally by a wolf pack from year to year. Also, certain specific areas (on the order of 5 mi^2, 13 km^2) may contain several den sites which are used in different years by the pack. Some wolf packs can be sensitive to human disturbance during this season and may abandon the den if disturbed. This poses a particular risk to younger pups that cannot regulate their own body temperature.

Wolf pups, in general, are born in late March to May after a 63-day gestation period. In Yellowstone, wolf pups were born any time from late March though April. Litter sizes of wolves usually range from 4 to 7. In Yellowstone National Park, the average litter size taken from dens in the early 1900s was 7.8 pups and varied from 5 to 13.

With the denning area established in the spring, pack movements center around the den. However, adult pack members may travel long distances from the den for food. The maternal female is usually at the rendezvous site more than other adults, but she may also range several miles away. All pack members may help feed the female and young. Pack members also provide play and protection for the growing pups. The pups are weaned at 5 to 6 weeks of age.

A wolf pack will usually move from the den site (or occasionally from a second den site) to the first rendezvous site when the pups are 6-10 weeks of age which is in late-May through early July. The first rendezvous site is usually within 1-6 miles (2-10 km) of the natal den site and often consists of meadows and adjacent timber with surface water nearby. A succession of rendezvous sites are used by the pack until the pups are mature enough to travel with the adults, usually by September or early October. Each successive rendezvous site is usually 1-4 miles (2-6 km) from the previous site. Occupancy times vary from 10-67 days. As with dens, rendezvous sites may receive traditional use by wolf packs year after year. Wolves appear less sensitive to human disturbance at later rendezvous sites than they do at the first one.

By about October, pups are mature enough to travel with the adults, and pack movements become nomadic throughout the territory. As the pack travels throughout its established territory preying primarily on ungulates, the alpha wolves usually lead the pack and choose the direction and specific routes of travel. Wolves often travel on established routes including game and logging trails, roads, and frozen waterways, occasionally cutting across from one such route to another. Daily travel distances for wolf packs are typically in the range of 1-9 miles (2-15 km), while distances between successive kills vary from 8-34 miles (13-55 km). Wolf packs in Yellowstone National Park apparently followed the ungulates and included both summer and winter ranges of ungulates in their territories.

In most wolf populations, packs occupy exclusive territories. Territories may range in size from 80 mi^2 (210 km^2), as in Minnesota, to over 660 mi^2 (1,700 km^2) as in Alberta. Territories in northwestern Montana average about 300-400 mi^2 (780-1,040 km^2). Lone wolves may range over areas in excess of 1,000 mi^2 (2,590 km^2). As pack members are traveling, they deposit urine and scat markers which identify their territories. Foreign wolves entering established territories may be killed.

Mortality.--Wolves die from a variety of causes: malnutrition, disease, debilitating injuries, interpack strife, and human exploitation and/or control. In areas with little or no human exploitation, the primary causes of mortality are disease and poor nutrition in pups or yearlings and death of adults from other wolves. Mortality rates for yearlings in unexploited populations can average about 45% and 10% for adults. In Minnesota during 1969-1972, September appeared to be a critical month for malnourished wolf pups to survive. Minnesota wolf pups with body weights less than 65% of standard weight had a poor chance of survival, whereas pups of at least 80% of standard weight had a high survival rate. Body weights appeared related to available food supply. Mortality rates of wolf pups in exploited populations (with snaring, poisoning, or hunting) can reach 80%.

Fall and winter may be critical periods for wolf survival. Beginning in the autumn, wolf mortality rates are most influenced by the degree of exploitation and/or control by humans. Overwinter (October-March) mortality rates within packs ranged from 0%-33% for a minimally exploited population to 14%-88% for a heavily exploited population. Established wolf populations apparently can withstand human-caused mortality rates of 28%-35%. Protected wolf populations can increase at rates of 28%-35%.

Dispersal.--The nature and extent of dispersal in wolves appears related to wolf density and prey availability. In low-density populations, these animals may disperse just out of their natal pack's territory into an unoccupied area, find another lone wolf of the opposite sex, and form a new pack. In high-density populations, such animals may stay in the pack, if possible, and wait for changes in the rank order and opportunities to mate. If forced out, these loners may trail a pack or live in the buffer zones between territories to avoid packs. In some situations, young adult wolves may disperse hundreds of miles. However, mortality is often high among dispersing animals and therefore, the chances of finding a mate and successfully establishing a new pack are low. Wolves may disperse at ages ranging from 9-28 months or more. Dispersal in late winter by yearlings is common.

Ecology

Niche.--Prior to arrival of European man, the wolf was the primary predator (excluding Native Americans) of large ungulates in most of North America. All biological and social aspects of the wolf make it adapted for this role. No other carnivore in the western United States replaces the ecological role of the wolf. Although the coyote (*Canis latrans*) occasionally preys upon young, old, and vulnerable ungulates, its main diet primarily consists of rodents and lagomorphs. The coyote does not prey year-round on large ungulates. Other animals (besides man) that regularly prey on large mammals in North America include mountain lions (*Felis concolor*) and black (*Ursus americanus*) and grizzly bears (*Ursus arctos*). Although the mountain lion regularly preys on large ungulates, its methods of hunting (primarily "ambush") and social organization (solitary) contrast sharply with the socially cooperative methods of the wolf. Black and grizzly bears, usually solitary by nature, stalk and kill moose, elk, and deer and take mostly calves but occasionally take vulnerable adult ungulates as well.

Food Habits.--In general, wolves depend upon ungulates for food year round. In northern Montana, elk, moose, and deer (mule and white-tailed deer) are the principal prey species. Smaller mammals can be an important alternative to ungulates in the snowfree months. These small mammals include beaver, marmots, ground squirrels, snowshoe hare, pocket gophers, and voles. In various areas of North America, during years of abundant beaver populations, beaver have comprised 25%-75% of the spring-fall diet of wolves, so in those areas or situations, they may prey less on young ungulates. Nonetheless, when these figures for beaver are converted to a biomass basis, ungulates still constitute the bulk of the summer diet and certainly of the annual diet. In areas where beaver are not so abundant, ungulates usually account for more than 90% of the biomass consumed by wolves.

Prey Consumption Rates.--On an average, wolves eat 9 lbs of meat per wolf per day during winter. Although the wolf is capable of eating large quantities of food in a short time, such quantities are not always available. Thus, wild wolves may have to go for several days at a time without eating. Wolves probably could fast for periods of 2 weeks or more while searching for vulnerable prey. When food is available, wolves can replenish themselves to prepare for another period of fasting. The wolf, with its large stomach capacity, seems well adapted for this cycle of feasting and extended fasting.

The frequency of kills by a wolf pack varies tremendously, depending on many factors including: (1) pack size, (2) diversity, density, and vulnerability of prey, (3) snow conditions, and (4) degree of utilization of the carcasses. Because the wolf's prey varies in size from small mammals to beaver to bison, the kill rate of each species varies according to the amount of food each provides.

In Minnesota, where wolves eat white-tailed deer almost exclusively, estimated kill rates range from 15-19 deer per wolf per year. In areas where elk are the dominant prey, these kill rates are generally lower. In Riding Mountain National Park, 1 wolf averaged 14 ungulates killed per year which included deer, elk, and moose. Based on prey abundance in Yellowstone, the primary prey is expected to be elk and mule deer. It has been estimated that wolves will kill an average of 12 ungulates/wolf/year.

Influence of Wolf Predation on Ungulate Populations.--Wolf predation on larger ungulate populations usually results in smaller fluctuations in ungulate numbers over the years. Smaller die-offs from winter-kill may occur because wolves are preying on weakened animals before they die.

Wolf predation is one component of total annual mortality in many ungulate populations. Wolves usually do not deplete their prey populations, but may keep some prey species at low levels if ungulate populations are already low and other limiting factors exist. Computer models have predicted that wolves in the Yellowstone area may reduce ungulate populations by 5%-30% and decrease fluctuations in the population, but would not have devastating effects on the prey populations.

Influence on other predators.--Wolf impacts on other predators can vary. Coyotes may be less abundant in Yellowstone with wolves present, and red fox (*Vulpes vulpes*) may benefit from wolf presence. Black bears and wolves usurp carcasses from each other, and wolves occasionally prey upon black bears, but no published information suggests either species would be significantly affected. Brown bears and gray wolves coexist throughout much of North America and Eurasia. Sympatric populations of wolves and grizzly bears do not appear to significantly impact survival or reproduction of each other. Some indirect competition for spring carrion, winter-weakened ungulates, and newborn calves may occur between wolves and grizzlies in Yellowstone. However, based on data from other geographic areas, grizzlies appear able to compete with wolves for prey; because grizzlies are omnivorous and not totally dependent upon ungulates, it is likely grizzlies will easily adapt to the presence of wolves.

APPENDIX 3. PUBLIC ATTITUDES ABOUT WOLVES: A REVIEW OF RECENT INVESTIGATIONS

American public attitudes toward wolves, both in general and in relation to Yellowstone National Park, have been surveyed by numerous investigators. This paper presents a chronological summary of surveys, including both Yellowstone-related ones and those involving other areas of the country. All such surveys are included, whether they involve Yellowstone or not, in order to more fully portray American attitudes about wolves, and trends in those attitudes.

Minn (1977) studied attitudes toward wolf recovery in Rocky Mountain National Park, Colorado, and found that 74.2% of respondents favored wolf restoration, and 25.8% did not.

Kellert (1985b) found that in Minnesota, there was "a strong positive perception of the timber wolf among all sample groups except farmers," and that all groups agreed that the timber wolf was "symbolic of nature's wonder and beauty."

In a survey of attitudes among members of the National Cattlemen, American Sheep Producers, National Trappers Association, and members of the public in the Rocky Mountains and Alaska, Kellert (1985a) found that in the Rocky Mountain region, 50% liked wolves and 30% did not.

McNaught (1985), in a survey of Yellowstone National Park visitors, found that they favored reintroduction 3 to 1, and that they believed, 6 to 1, that "a presence of wolves would improve the Yellowstone experience."

Bath (1987a) surveyed various Wyoming interest groups, and found that 91.2% of members of the Wyoming Stock Growers were not in favor wolf reintroduction in Yellowstone National Park; 89.2% of Defenders of Wildlife members were in favor of wolf reintroduction, as were 66.8% of Wyoming Wildlife Federation members.

Bath (1987b) surveyed the public in Wyoming counties around the park, and found that 51% opposed wolf reintroduction in Yellowstone National Park, and 39% favored it. Bath also found that those opposing wolf reintroduction had a poorer knowledge level about wolves than those favoring it.

Bath (1987c) surveyed the Wyoming general public, and found that 48.5% favored wolf reintroduction into Yellowstone National Park, 34.5% opposed it, and 17% had no opinion.

Lenihan (1987) surveyed Montana residents, and found that 65% believed that wolves belong in the state; 78% of people living in the state's most populous counties agreed, while 54% of rural Montanans agree. Of those surveyed, 78% believed that "ranchers should be able to shoot wolves that attack livestock on their own property." A majority (52%) approved of reintroduction of wolves into areas of Montana, Idaho, and Yellowstone Park, but 56% of those from rural counties did not approve. A majority (59%) believed that ranchers should be compensated for livestock lost. Lenihan found that the 2 most important rationale for support of wolf reintroduction were that wolves were an important member of the ecological community (41%), and wolves were historically present (40%). The most important rationale for opposition was that livestock losses would be unacceptably high (57%).

A survey conducted by the Idaho Environmental Science Teachers (1987) through the University of Idaho Wildlife Issues Course found that 78% of Idahoans agreed with the statement that "I would like to see wild populations of wolves exist in Idaho," while 12% disagreed and 10% had no opinion.

Tucker and Pletscher (1989) surveyed hunters and residents of Flathead County (northwestern Montana), and found that 71.5% of the residents of the North Fork area and 58.3% of the hunters in Flathead County hoped that wolves would continue to inhabit the area and "should be allowed to spread beyond this area." They also concluded that "support [for wolves] could dwindle if restrictions on recreational and commercial uses were introduced to promote recovery."

Bath and Buchanan (1989) surveyed attitudes of five different interest groups in Wyoming: members of the Wyoming Stock Growers, of Defenders of Wildlife, of Wyoming Wildlife Federation, of the statewide public, and of counties near the proposed recovery area. They found that "extremes of the issues were defined by the stock growers and members of Defenders of Wildlife. Most members of the Wyoming Wildlife Federation and the statewide public had positive attitudes toward wolf-restoration, although the public in counties surrounding the wolf-recovery site held more negative attitudes."

Bath and Phillips (1990) and Bath (1991) surveyed the Montana and Idaho general public, and found that 43.7% of Montanans, 48.5% of Wyomingites and 56% of Idahoans favored wolf reintroduction into Yellowstone National Park, while 40.3% of Montanans, 34.5% of Wyomingites, and 27% of Idahoans were opposed. No opinion on wolf reintroduction was held by 16% of Montanans, 17% of Wyomingites, and 17% of Idahoans.

Kellert (1990) surveyed Michigan public attitudes. Of Upper Peninsula residents, 64% favored wolf restoration, 15% opposed it, and 21% were uncommitted. Of Lower Peninsula residents, 57% favored restoration, 9% opposed it, and 34% were uncommitted.

Bath and Phillips (1990) noted that the primary reason for opposition among Idaho and Montana residents to wolf reintroduction was the cost of the program, which agreed with Bath's (1987c) survey of Idaho residents. Bath and Phillips asked survey subjects if they would change their minds if a variety of conditions were met (including financial compensation for livestock losses, keeping livestock losses to less than 1%, and keeping wolves in the park and surrounding wilderness areas), and concluded that "most respondents who do not favor reintroducing the wolf would not change their opinion regardless of the options presented to them. On the other hand, if wolves could be monitored effectively and be restricted within the park and surrounding wilderness areas, an additional 27% (Montana) and 25% (Idaho) would be in favor of wolf reintroduction."

The Wyoming Game and Fish Department (Thompson 1991) surveyed Wyoming residents on wolf reintroduction, and found that 44% were in favor of Yellowstone Park wolf reintroduction, while 34.5% were opposed and the remaining 21.5% were undecided or had no opinion. This was very similar to Bath's (1987c) findings, but in other respects the 2 studies differed. For example, Thompson found that more than 30% (compared to 16.2% of Bath's respondents) of respondents would change their opposition to wolf restoration if wolves could be kept in the park and adjacent wilderness areas. Thompson also found that 14% of those opposed to wolf restoration (compared to 6.3% of Bath's respondents) would change their opinion if there was a compensation program for wolf restoration. On the other hand, Bath and Thompson's respondents agreed quite closely, 58.5% and 56.8% respectively, that wolves that killed livestock should be killed.

Freemuth (1992) asked Idahoans, "Do you favor or oppose having wolves in the wilderness and roadless areas of central Idaho?" He found that 72.4% favored wolves, 22.1% opposed them, and 5.4% did not know or had no opinion.

Eisenstein (1992) conducted an attitudinal survey analysis of 52 representative individuals regarding wolf restoration in Yellowstone National Park. He was seeking detailed responses on concerns and issues, rather than quantifiable yes-or-no expressions of positions. Thus his work does not statistically analyze public opinion, but summarizes and presents great amounts of personal position and opinion. His conclusions included the following general statement about wolves: "The interviews revealed not only polarization, but gross misunderstandings and misconceptions concerning the wolf and the program. It was clear that people still do believe in the horror stories of the wolf and 'Little Red Riding Hood.' Many respondents stated as fact that they know wolves kill people."

Duffield et al. (1992) surveyed American citizens nationally and found that "while GYA [Greater Yellowstone Area] respondents are nearly evenly divided in their opinion on wolf reintroduction, the US respondents are heavily in favor of reintroduction... Almost everyone in the GYA has an opinion on this issue with only 7 percent saying they 'don't know.' The national sample shows a strong majority favoring wolf recovery--by about a 2:1 margin." When asked to respond to the statement, "I dislike even the idea of wolves being present in Yellowstone Park," 25% of the Yellowstone area respondents strongly agreed, while 4-6% of US-wide respondents agreed.

Public approval of wolf reintroduction in Yellowstone National Park is high. Nationally, the public is very strongly in favor of reintroduction, while regionally there is at least a slight majority in favor of reintroduction. There is still some public concern over safety risks, that is over the possibility that wolves might attack people. McNaught (1985) found that 19.7% of his respondents would be afraid to hike in Yellowstone Park if wolves were present.

There is a great concern among potentially affected stockgrowers that wolves will kill their stock, and any losses are unacceptable to them. There is strong public support for a compensation program to protect livestock owners from financial losses due to wolf depredation. There was likewise strong public concern over the need to control wolf distribution, in whatever management scenario is ultimately adopted. The public does not want wolves to have unlimited freedom to range on public and private lands, and wants wolf control measures to be stringent and promptly enacted.

The surveys do not agree on whether the public considers wolves a serious threat to wildlife populations, but among the surveys there is a consistent level of public concern over possible impacts on wildlife, especially as those might affect hunter harvest. There is significant public concern over the monetary costs of implementing a reintroduction program.

APPENDIX 4. SCIENTIFIC TECHNIQUES FOR THE REINTRODUCTION OF WILD WOLVES

A wide variety of potential strategies exist for reintroducing wolves. Development of the following plan was based on (1) results of the previous relocations of wolves, (2) responses to questionnaires sent to 56 biologists who were familiar with behavior of wolves in the wild and in captivity, (3) practical limitations such as climate and human access to release sites, and (4) the best judgement of biologists familiar with the Northern Rocky Mountains and recovery of those wolves as to which procedures were most likely to succeed. Some of the specific factors and variables considered were: cost, humaneness, number and genetics of wolves to be used, effect of wolf removals on the donor population, capture method, transport method, type of release ("hard" or "soft"), age and breeding status of wolves, whether to use wolves that were already pairbonded or to artificially pair adult wolves after capture, likelihood of breeding in captivity, time of year of capture and release and length of holding period, type holding facility, care needed in captivity, what to feed captive wolves, structure and size of pens at release site, whether to use radiocollars and dart collars, climate conditions and physiographic characteristics of capture and release sites, whether to conduct reintroductions into Yellowstone and central Idaho concurrently, the number of years over which releases would be necessary to establish a population in each area, and the strong need to acquire better information to use in planning future reintroductions.

Different approaches to reintroduction will be the used in Yellowstone and central Idaho, and each approach will be continually evaluated and modified as necessary. For Yellowstone National Park, the approach will be to capture, transport, hold, and soft-release small to moderate sized packs of wild wolves (4-7 individuals) that will include the breeding (alpha) pair and their pups. Strong emphasis will be placed on including the alpha pair, as they already are pairbonded and presumably proven breeders. The approach in central Idaho will be to hard release wild wolves that are of prime dispersal age (1-2 year-old) and thus duplicate as nearly as possible the processes by which pack formation naturally occurs. At this age wolves often leave their packs and search of mate and a vacant area where they can begin their own pack.

Wolves selected for reintroduction would be from areas of British Columbia (B.C.) or Alberta that are similar to Yellowstone and central Idaho (mountainous terrain with elk and deer as the main prey). Use of Canadian wolves would be pending approval of Canadian authorities and approval of all necessary permits. Wolves from B.C. and Alberta are probably genetically similar and of the same genetic stock that is now colonizing northwestern Montana. Exact sites for selection of wolves would be primarily made by Canadian authorities. Ideally these areas would have enough treeless landscape to make helicopter darting of wolves possible, and would be accessible by air or road to allow capture and transport of the wolves. Removal of wolves from Canada would cause a temporary local reduction in wolf numbers, but numbers would recover to original levels soon after the experiment was concluded.

In June-August 1994, 1-2 wolves from 8 different packs would be trapped, radio-collared, released, and radio-tracked. Traps would be modified to prevent or reduce foot damage, and the entire trapping process would stress safety of the wolves. The assistance of local game management officials and the local public (including registered trappers) would be necessary. Special effort would be made to capture the alpha (breeding) pair from the packs, especially the alpha female which would be identified by evidence she had recently nursed pups. The packs selected would not all have adjoining territories in order to reduce the chances of them being closely related. Wolves believed to be breeders would be fitted with remote controlled capture-collars and released. Others would be fitted with standard radio-collars and released. Collars would be color coded so radio-collared wolves were recognizable by observation from radio-tracking aircraft. Tissue samples would be collected from each wolf captured and would be examined for physical condition, evidence of disease, and parasite infections. This initial period of familiarization with the area and capture of wolves would probably take several weeks per pack. Radio-collared wolves would be located and observed from aircraft to help gather important background information such as which wolves were the alphas, relationships of radioed wolves to other pack members, pack size, and areas used by packs. The ability to know to which pack a captured wolf belongs would be an important advantage of this approach.

In October the entire packs, or as many pack members as could be obtained (estimated at 3-7 wolves per pack), would be captured by darting from a helicopter and by firing of remote controlled dart-collars. Trapping in fall by program personnel or contracted local trappers may be necessary to supplement helicopter darting. If captures require several days the wolves captured first would be transported to a veterinary facility and held until remaining pack members were captured. Effort would be made to capture and transport 3-7 wolves from 6 of the 8 packs in this manner. The remaining 2 packs would be left behind to serve as a starting point for capturing and radio-marking efforts the following summer. We anticipate that up to 30 wolves would be captured and released in the first year, but only 20 would contribute to establishment of a population in the recovery areas because some will leave, disappear, or die.

After capture, breeders and pups would be separated from non-breeding pack members (mostly 1-2-year-old wolves). As soon as possible the adults and their pups would be flown to holding pens already prepared in Yellowstone Park. At this time they would receive further disease screening and vaccinations. Non-breeding adults would be taken to Idaho and released, as would any other wolves of uncertain pack affiliation.

In summer 1994, an intense public information campaign would be started in the Yellowstone and central Idaho areas to inform people that wolves will soon be present.

This effort would include information on how to identify wolves and distinguish them from coyotes and other animals, and would inform hunters of the possibility of encounters with wolves and that they should not be killed.

Only the Yellowstone wolves would be held in pens (1 acre, 0.4 ha) at the release sites. Pens would be built with chain link fence, fence overhand, underground digging barrier, electric hot wire, shade, water, and other features of existing captive wolf facilities. Pens would be double hot wired on the outside to prevent grizzly bears and bison from trying to enter them. Adult wolves would be fitted with capture collars and pups with regular collars in case of premature escape. There would be 3 individual pens and release sites in Yellowstone and 1-2 release sites in central Idaho. Sites would be areas with year round populations of prey (elk and/or deer) nearby, would not be within sight of permanent human facilities and would be separated by a minimum of 5 miles (8 km) in Yellowstone. All release sites would be closed to the public and human activity would be restricted within a 1 mile (1.6 km) radius of pens. Every effort would be made to avoid disturbance by humans and any habituation to humans while the wolves were in captivity. Site selection and pen design would be such that wolves could be fed and observed with minimal disturbance. Wolves would be fed road-killed ungulates that were handled by project personnel in such a way as to minimize the amount of human scent left on them. Keepers would stay in wall tents or trailers in view of, but at least 1/4 mile (0.4 km) from the sites.

On or about December 1, the penned wolves wearing capture collars would be captured and those collars replaced (drug life is about 2 $^1/_2$ months). After 1 week of calming, the door to the pen would be left open and the wolves allowed to leave on about December 5. Actual dates of release at the 3 sites would be staggered by a few days in order to monitor movements and behavior during the early post-release period and follow any individuals that quickly left the site. If deep snow is not yet causing site access or other problems for keepers, release dates would be delayed further until weather conditions did become prohibitive, but not later than January 1. Carrion would be left at or near the site until the wolves did not need it. Carrion would consist of road-killed ungulates collected and frozen during fall 1994. About 6,000 lbs of carrion (equivalent to about 40 deer) would be fed to the wolves while in captivity and another 2,400 lbs. made available after release. Locations of released wolves in Yellowstone and central Idaho would be determined by radio-telemetry at least 3 times a week, depending on weather conditions. Radio-tracking would be both from the ground and from aircraft. Wolves that leave the release areas in Yellowstone and central Idaho will be returned as needed.

The procedures described above would be repeated yearly for 3-5 years or until breeding populations (at least 2 wild pairs successfully raising 2 young each for 2 consecutive years) had become established in Yellowstone and central Idaho. Wolves from the same general areas in Canada, but not the same packs, would be captured for use in reintroductions in years 2, 3, 4, and 5. The same pens at the Yellowstone release sites would be reused in subsequent years unless a pack became established in the immediate area. In that case the pens/releases would be moved (estimated 3-10 miles, 5-16 km) outside areas packs were using. After a population becomes established, the release pens would be disassembled and the site left in as natural a state as possible.

There have been very few previous introductions of gray wolves. Prior experiences with artificially moving wolves from one location to another have revealed a strong tendency for the animals to travel widely and try to return to their home territory (Fritts 1992). This experiment attempts to alleviate that problem in Yellowstone by a lengthy holding period at the release site ("soft" release), as has been successful with the Red wolf reintroduction program (mostly captive-raised wolves) in the southeastern U.S. However, conducting a soft release in central Idaho involves more logistical problems due mainly to access and may not be required. The terrain and widely dispersed ungulate populations in central Idaho may naturally restrict wolf movements to the desired areas. The most feasible and least expensive approach for Idaho is to hard release wolves of dispersal age, with the expectation that many will travel extensively, but some will pair bond and form new packs in much the same manner as occurs naturally. Separation from their packs and release in another area simulates natural dispersal and the creation of lone wolves as potential progenitors of new packs. Studies of hard released wolves have shown that after a period of orientation their behavior appears to be the same as naturally dispersing lone wolves.

Because of the dearth of previous experience and lack of proven reintroduction techniques for wild wolves, it is clear that a reintroduction program will not proceed predictably or smoothly, at least at first. Because of differences in temperament and behavior between wolves, we doubt that any single technique is best for every wolf or every wolf pack. Planning and preparation for each stage of the reintroduction must be as meticulous as reasonably possible, and numerous factors must be considered. Even so, anticipation of every problem is almost impossible, and unexpected turns of events must be anticipated and adaptations quickly made.

This reintroduction effort will provide much new knowledge about how to conduct a reintroduction of wild wolves and will be successful because it involves repeated releases of wolves and adaptation of procedures until populations are established. However, any observers who are unprepared for temporary setbacks and mortality of some of the wolves will be disappointed. Various aspects of the above procedure will be modified as experience dictates. Modifications would generally add complexity and expense to the relatively simple procedures described above.

Conclusion.--Wolves from Canada would be reintroduced into Yellowstone and central Idaho. Breeding adults and their pups would be released into Yellowstone in December after being held there in pens for several weeks and fed deer and elk carrion. Non-breeding adult wolves, mostly from the same packs would be released into central Idaho in autumn without previously being held there. Reintroductions would be repeated in following years until populations became established in both areas.

APPENDIX 5. COST ESTIMATES FOR WOLF REINTRODUCTION ALTERNATIVES

Alternative 1. Reintroduction of Experimental Populations

Summary.—A non-essential experimental population rule would be established by regulation. One or 2 wolves from 8 packs in Canada would be radio-collared in June-July and released on site. In October, 30 wolves from these packs would be captured. Breeding adults and their pups from 3 packs would be confined at 3 release sites in Yellowstone National Park. Yearlings and other adults (about 15) would be immediately released in central Idaho. In December, wolves in Yellowstone (about 15) would be released. The wolves would be monitored and returned to release sites as necessary. Fifteen wolves/year or a total of 45-75 wolves would be reintroduced to each area. This process would continue for 3-5 years. If hard release techniques proved as successful as soft release, or if establishment of wolf populations took less than 5 years, then overall program costs would be lower. After wolf reintroduction and establishment of a wolf population, wolves would be monitored in each area until recovery (10 breeding pair in each of 3 recovery areas for three successive years) is achieved (about 2002). After recovery wolf populations are managed by the states.

Annual estimated costs of implementing Alternative 1.

	1994-1998 Reintroduction/Year		1999-2002 Monitoring/Year Each Area
	Yellowstone	Idaho	
Staff/support	$200,000	$200,000	$150,000
Monitor Donor Population	$ 30,000	$ 30,000	0
Facility Preparation/Care	$100,000	0	0
Capture/transport	$ 20,000	$ 20,000	0
Confine/release	$ 20,000	$ 5,000	0
Monitor wolves	$ 50,000	$ 50,000	$ 50,000
Law Enforcement	$ 25,000	$ 25,000	$ 25,000
Wolf Control	$ 25,000	$ 25,000	$ 50,000
Administration/Support	$ 70,500	$ 53,250	$ 41,250
Total Annual Cost	$540,500	$408,250	$316,250
Total Project Cost	$2,702,500	$2,041,250	$1,265,000
Grand Total All Costs Until Recovery		$ 6,008,750 (1992 dollars)	

Alternative 2. Natural Recovery of Wolf Populations

Summary.--An enhanced wolf recovery program similar to the one that has been implemented in Montana since 1988 would begin in the central Idaho and the Yellowstone areas. This program would emphasize public information and education. The program would also control wolves that attacked livestock, fund research on wolves and their prey, and enhance the current wolf monitoring program to better document the location and distribution of any wolves that disperse into these areas. The Montana program currently utilizes 2 full time and 1-2 seasonal biologists and annually costs about $200,000/year. This program also has employs a full time Animal Damage Control Wolf Management Specialist that annually costs about $50,000/year. Establishing enhanced wolf recovery programs in the central Idaho and Yellowstone areas, that would be similar to the Montana wolf recovery program, would cost about $250,000/area/year.

Annual estimated costs of implementing Alternative 2.

Staff/Support (Estimated 65% staff time I & E)	$ 95,000
Research (Wolf and Ungulates)	$ 40,000
Monitoring (Equipment, Aircraft, contracts)	$ 20,000
Control (ADC support, including I & E efforts)	$ 50,000
Education/Information (I & E)(Printing, etc.)	$ 20,000
Administration/Office Support	$ 25,000
Annual Grand Total	$250,000/area/year (1992 dollars)

If wolf recovery took 30 years and more active recovery programs were established in both the Yellowstone and central Idaho areas, total costs ($500,000 x 30) would be <u>$15,000,000</u>.

If wolf recovery programs were only established in the central Idaho and Yellowstone areas after a wolf pair was documented and the programs were discontinued in each area as soon as 10 breeding pairs were documented for three consecutive years, total costs would be about <u>$10,000,000</u> (recovery still estimated in 2025).

Alternative 3. No Wolf Recovery

Summary.--Special legislation would be prepared for action by Congress and the states of Montana and Idaho. Wolves would be removed from the list of threatened and endangered species in the northern Rocky Mountains of the United States. Without legal protection from persecution by people wolf recovery in these areas would not occur. A few wolf packs would continue to exist in extreme northwestern Montana in Glacier National Park and lone wolves would occasionally occur in other areas but would not persist. No additional costs would be involved with control of wolves that attack livestock.

The only costs associated with implementing this alternative are associated with staff time and travel required to draft legislation to change current federal and state law. It is estimated that changing legislation and regulations would require 2 people working for 1 year and support (travel, per diem, equipment, etc.). We estimate that implementing this alternative would cost about $100,000. Wolf recovery and additional yearly costs would not occur.

Annual estimated costs of implementing Alternative 3.
1994--$100,000, no subsequent costs.

Alternative 4. Wolf Management Committee

Summary.--Congress would pass special legislation designating wolves throughout most of Montana and all of Idaho and Wyoming as a special state-managed nonessential experimental population. For 2 years the states would develop their wolf management plans, during which time the FWS would manage wolves as an experimental population. Liberal take of wolves by the public and agencies would be allowed for any wolves harassing or attacking livestock. In 1996 wolves would be reintroduced (same techniques as the Experimental population alternative) into Yellowstone National Park and, if in 5 years, breeding activity had not documented, possibly central Idaho. Any wolves documented killed in control actions or illegally would be replaced. If wolf mortality from control associated with livestock protection was 30%, recovery would occur in Yellowstone about 2010 and in central Idaho about 2015. A total of 45-75 wolves would be reintroduced initially and 125 reintroduced as replacements in each reintroduction area. If wolf mortality from control was 20%, recovery would occur in Yellowstone about 2007 and central Idaho about 2012. A total of 45-75 wolves would be reintroduced initially and 75 reintroduced as replacements in each reintroduction area.

Annual cost estimates of implementing Alternative 4[a].

Plan Task	Agency	2 Planning years	5 Implementation years
State Plan	states	$ 442,000	$ 110,000
EIS/Rule	federal	$ 900,000	0
Information	all	$ 860,000	$ 2,006,000
Reintroduction	NPS/FWS	$ 650,000	$ 3,685,000
Wolf Management	all	$ 110,000	$ 2,907,000
Law Enforcement	all	0	$ 1,810,000
Land Management	FS	$ 700,000	$ 2,250,000
Wolf Monitoring	all	$ 690,000	$ 2,523,000
Ungulate Monitoring	all	$ 210,000	$ 3,515,000
Wolf Research	all	$ 580,000	$ 3,012,000
Ungulate Research	all	0	$ 1,394,000
Ungulate enhancement	states	0	$ 10,690,000
Grand Total		$ 5,142,000	$ 33,902,000

[a] Annual Cost Estimates for the first 7 years of this plan are those provided to Congress by the Wolf Management Committee in the May 1991 report.

Total--first 7 years of plan implementation--$39,044,000
Estimated Plan implementation per year after first seven years--$6,000,000/year.

Grand Total Costs Recovery in 2012--(7 + 12 years) $111,004,000
Grand Total Costs Recovery in 2015--(7 + 15 years) $129,044,000

Alternative 5. Reintroduction of Nonexperimental Wolves

Summary.--Wolves would be reintroduced to the Yellowstone and central Idaho areas, and managed as fully endangered species. No experimental population rule would be established. Habitat conditions for wolves would be improved through $3,000,000/year of improvements/purchases/easements of vital ungulate habitats. Similar techniques to the Reintroduction of Experimental Populations alternative (Alternative 1) would be used but for a longer period of time (until 10 breeding pairs were established in each area, but at least 5 years). If hard release of wolves was as successful as soft release, overall program costs would be slightly lower. There would be an enhanced law enforcement program. After 10 breeding pair were established they would be monitored until delisting. Recovery would probably occur about 2000.

Annual cost estimates for implementation of Alternative 5.

	1994-1998 Reintroduction/Year		1999-2000 Monitoring/Year Each Year
	Yellowstone	Idaho	
Staff/support	$200,000	$ 200,000	$ 150,000
Monitor Donor Population	$ 30,000	$ 30,000	0
Facility Preparation/Care	$100,000	0	0
Capture/transport	$ 20,000	$ 20,000	0
Confine/release	$ 20,000	$ 5,000	0
Monitor wolves	$ 50,000	$ 50,000	$ 50,000
Law Enforcement	$ 100,000	$ 100,000	$ 100,000
Wolf Control	$ 10,000	$ 10,000	$ 10,000
Ungulate Habitat	$ 1,500,000	$1,500,000	$ 1,500,000
Administration/support	$ 104,500	$ 87,250	$ 71,500
Total Annual Cost	$ 2,134,500	$ 2,002,250	$ 1,881,500
Total Project Cost	$ 10,672,500	$ 10,011,250	$ 7,526,000
Grand Total All Costs Until Recovery		$ 28,209,750 (1992 dollars)	

APPENDIX 6. WOLF REINTRODUCTION INTO YELLOWSTONE NATIONAL PARK AND CENTRAL IDAHO AND EXECUTIVE ORDER 12630 (GOVERNMENT ACTIONS AND INTERFERENCE WITH CONSTITUTIONALLY PROTECTED PROPERTY RIGHTS)

Under Executive Order 12630, executive departments and agencies should review their actions carefully to prevent unnecessary takings of private property. Governmental actions, including Federal regulations or proposed Federal regulations, that may have an impact on private property should be scrutinized to avoid undue or unplanned burdens.

The proposed action to reintroduce gray wolves into Yellowstone National Park and central Idaho has been designed to avoid taking of private property. If gray wolves are released in Yellowstone National Park, Wyoming and central Idaho, they will be released and managed so the recovery actions are compatible with existing private land uses (principally ranching) so that the lifestyle and income are not negatively effected. Other wild predators, such as coyotes, mountain lions, black bears, grizzly bears, foxes, and golden eagles presently utilize lands in public and private ownership and are an accepted part of the natural environment. Private landowners are concerned that wolves will depredate on livestock and that wolf recovery will place restraints on their land management practices or reduce their incomes. Wolves, just like other large predators will occasionally attack livestock. However, currently there is a private compensation program to pay for livestock killed by wolves. In addition, wolves that kill livestock are controlled by the U.S. Fish and Wildlife Service, Animal Damage Control, and/or cooperating agencies just as are other large predators. Designation of the released population as experimental nonessential means the released wolves will be treated as though they are a proposed species except inside National Parks and National Wildlife Refuges where they will be treated as threatened for the ESA Section 7 requirements. Private property will not be affected by land-use restrictions because of wolf recovery.

We anticipate that gray wolves will initially be viewed as a novelty by the local community and attract considerable attention. Eventually, however, we believe gray wolves will be viewed as a normal part of the local resident's natural environment and the wolves will receive diminishing attention from the local populace.

The U.S. Fish and Wildlife Service foresees no need to purchase lands as part of this gray wolf recovery effort. If such a need arose, acquisition would be only from willing sellers. Land values in northwestern Montana have not been noticeably affected by wolves recently recolonizing that area and there is no reason to suspect that wolf presence will negatively affect land values in other parts of Montana, Idaho, or Wyoming.

The reintroduction will undoubtedly attract the interest of wildlife viewers throughout the United States as well as other areas. Tourism is a major industry in the Yellowstone and central Idaho areas and some tourists will include visits to these areas because wolves are present. Federal public land managers on National Forests, Wildlife Refuges, Bureau of Land Management lands, and National Parks will provide opportunities to visit areas with wolves. Therefore, visitors are unlikely to be a trespass nuisance on private lands.

Therefore, the Service does not anticipate that the action proposed in this rulemaking will negatively affect the value of private property.

APPENDIX 7. INTRA-SERVICE SECTION 7 EVALUATION THE REINTRODUCTION OF GRAY WOLVES TO YELLOWSTONE NATIONAL PARK AND CENTRAL IDAHO

DESCRIPTION OF PROPOSED ACTION

In 1991 Congress directed the U.S. Fish and Wildlife Service to prepare an environmental impact statement (DEIS) on wolf reintroduction in Yellowstone National Park and central Idaho. In the DEIS, the U.S. Fish and Wildlife Service's proposed action is to capture gray wolves from 8 or more separate wolf packs in Canada and release them in Yellowstone National Park and central Idaho. Starting in October 1994, 3 breeding adults and their pups (15 wolves) would be captured in southern British Columbia and Alberta, held in three pens in Yellowstone National Park 6-8 weeks, fed ungulate carcasses (collect from road kills etc.), and released in December. In addition, 15 yearlings and non-breeding adults would be immediately released in central Idaho in October. All wolves would be radio-collared and monitored 3 times a week. Wolves would be moved as necessary to facilitate recovery in central Idaho and the area surrounding Yellowstone National Park. The reintroduction would occur under authorities of section 10j of the Endangered Species Act which allow a high level of management flexibility within the experimental population areas, for listed species designated as nonessential experimental populations. In addition to other provisions, the special rule would allow moving any wolves that impact or have potential to impact other listed species. The reintroduction would continue until a wild wolf population was established (defined as 2 wild breeding pair, successfully raising at least 2 young for 2 consecutive years in an area). It is expected reintroductions would occur for 3-5 years. As a result of this action wolf populations should reach viability [defined as 10 breeding pair, in 3 areas (northwest Montana, central Idaho and the area in and around Yellowstone National Park), for 3 consecutive years] by 2002. At that point wolf populations could be delisted and managed solely by the respective states and tribes. Wolves have naturally recolonized and are expanding in northwestern Montana so the proposed action only involves central Idaho and the Yellowstone area. This Intra-Service Section 7 evaluation involves the proposed action (preferred alternative) in the DEIS on the Reintroduction of Gray Wolves in Yellowstone National Park and central Idaho, July 1993.

LOCATION

The proposed project involves the northern Rocky Mountains of the United States, and specifically refers to the states of Montana, Idaho, and Wyoming. The experimental population area for Yellowstone include all of Wyoming, and that portion of Montana and Idaho east of Interstate 15 and south of Highway 12. The experimental area for central Idaho includes that portion of Montana and Idaho west of Interstate 15 and south of

Interstate 90. Wolf populations resulting from this reintroduction are expected to occur primarily in the Greater Yellowstone and central Idaho areas (see Figure 1) but individual wolves may occasionally occur throughout the three states. Wolves outside the proposed experimental rule area (ie. northwestern Montana and northern Idaho) are listed as endangered and are not affected by the conditions of the proposed experimental rule.

LISTED SPECIES OR CRITICAL HABITAT CONSIDERED

Threatened and Endangered Species--Montana, Idaho, Wyoming

Gray Wolf (*Canis lupus*)
Grizzly Bear (*Ursus arctos horribilis*)
Woodland Caribou (*Rangifer tarandus caribou*)
Black-footed ferret (*Mustela nigripes*)
Bald Eagle (*Haliaeetus leucocephalus*)
Peregrine falcon (*Falco peregrinus*)
Whooping crane (*Grus americana*)
Piping plover (*Charadrius melodus*)
Least tern (*Sterna antillarum*)
Pallid sturgeon (*Scaphirhynchus albus*)
Sockeye Salmon (*Oncorhynchus nerka*)
Chinook Salmon (*Oncorhynchus tschawytscha*)
Kendall Warm Springs dace (*Rhinichthys osculus thermalis*)
Wyoming Toad (*Bufo hemiophrys baxteri*)
Bruneau Hot Springsnail (*Pyrgulopsis bruneauensis*)
Five Species of Snake River mollusks including:
-Desert valvata snail (*Valvata utahensis*)
-Bliss rapids snail (undescribed *Hydrobiid*)
-Idaho springsnail (*Pyrgulopsis idahoensis*)
-Snake River physa snail (*Physa natricina*)
-Banbury Springs limpet (undescribed *Lanx* sp.)
MacFarlane's four-o'clock (*Mirabilis macfarlanei*)

OBJECTIVES OF THE ACTION

Successful implementation of the proposed action will foster the recovery of gray wolf populations in the northern Rocky Mountains of the United States. Beginning establishment of a wolf population that will grow to 10 breeding pairs of wolves, in both the central Idaho and Yellowstone National Park recovery areas, which comprise two of three wolf recovery areas (northwestern Montana, central Idaho and the Greater Yellowstone area) necessary for the recovery of gray wolves in the northern Rocky Mountains of the U.S., will contribute to recovery of the species. Natural wolf recovery has established a growing population of about 45 wolves in northwestern Montana. Successful reintroduction of wolves designated as an nonessential experimental population in central Idaho and Yellowstone National Park beginning in 1994 will establish viable wolf populations in those areas by about 2002. About 30 wolves will be captured in Canada in October for 3-5 consecutive years. Fifteen wolves (yearlings and non-breeding adults) per year will be taken directly to Idaho and released. Fifteen wolves (adults and their pups) per year will be transported to Yellowstone National Park and held in three separate 1-acre pens for 6-8 weeks before being released. These wolves will be radio collared and monitored 1-3 times per week. Wolves will be moved as required to enhance wolf recovery. Several wolves from each wolf pack will be captured and radio collared until a recovered population is established so that wolf population growth can be closely monitored. Recovered wolf populations will be managed by the respective state wildlife resource agencies, in much the same manner as mountain lion and black bears currently are managed.

EXPLANATION OF IMPACT OF ACTION ON LISTED SPECIES OR CRITICAL HABITAT

Gray Wolf.--Beneficial effect. Wolves currently recolonizing northwestern Montana and potentially northern Idaho will not be impacted by the proposed action because those wolves are outside the proposed experimental population rule area. Some wolves that are offspring of reintroduced wolves will eventually leave experimental area and travel into northwestern Montana. These wolves will contribute to increased genetic diversity but are unlikely to significantly impact the rates of wolf population growth in Montana. The capture and release of wolves from Canada into the reintroduction areas is not likely to impact the natural dispersal rate of wolves from Canada into northwestern Montana, because most wolves captured for reintroduction will not be adjacent to the U.S./Canada border.

This action will lead to the recovery of wolf populations in the Yellowstone and central Idaho areas by about 2002, enhancing recovery of the species. The genetic diversity of wolves in the Yellowstone and central Idaho areas will be increased as a result of reintroduction rather than eventual natural immigration of closely related wolves from northwestern Montana. The proposed experimental rule will result in some wolves being killed, moved, or removed from the reintroduction areas because of conflicts with livestock, ungulate populations, or possibly other listed species. Such losses of individual wolves are incorporated as part of the wolf recovery/reintroduction program and are not expected to significantly affect wolf population growth to recovery. There have been occasional lone wolves in the central Idaho and Yellowstone areas for decades. Such individuals might become more exposed to mortality under an experimental population rule than they currently are. However, any increased vulnerability would be mitigated by reintroduction because any rare mortalities would be more than offset by reintroduction of 15 wolves/year and the chances of finding mates and producing young by such individuals are greatly enhanced by reintroduction. See reintroduction of Gray Wolves in Yellowstone National

Park and central Idaho draft Environmental Impact Statement for details of wolf management and recovery.

Grizzly Bear.--Not likely to adversely effect. Grizzly bears and wolves co-exist throughout the northern Hemisphere and would be expected to co-exist in the recovery areas. Wolf and grizzly bear research in and near Glacier National Park has indicated only minor interaction between bears and wolves, other than that they both kill ungulates. Bears will occasionally usurp wolf-killed ungulates by driving the wolves away. Wolves and grizzly bears have been documented to kill each other in a few other areas of North America but such instances are uncommon and unlikely even in areas with high densities of both grizzly bears and wolves. Wolves and bears usually avoid direct contact with one another. Wolves may both provide and compete for ungulate carcasses with grizzly bears, but such competition should be insignificant. Ungulate populations are expected to decrease less than 15% from their current high levels because of recovered wolf populations. Grizzly bear densities are not strongly linked to ungulate density. Recent investigations indicate that it is unlikely that wolves will have a detrimental effect on grizzly bear numbers or survival. If any unforeseen effects did occur or were likely, the proposed experimental population rule allows for wolves in the experimental population areas to be moved to other areas to resolve local conflicts with other listed species. In addition to the regular monitoring of reintroduced radio collared wolves, there is an active grizzly bear research and management program in and around Yellowstone National Park, including monitoring of radio collared bears, that would likely detect significant potential impacts or competition. For references see Servheen and Knight 1990, Koth et al. 1990, Mattson and Knight 1992.

The confinement of wolves at three temporary one-acre pens in Yellowstone National Park will occur from late October until late December for 3-5 years. While during this time most grizzly bears will be going into hibernation, some may be attracted to these facilities because of odors. The pens will be designed (chain link fence, digging barrier, and double hot wired on the outside) so that it will be very difficult for grizzly bears to enter them. Therefore, bears will not receive any positive reinforcement by approaching the pens. Food (ungulate carrion primarily obtained from road killed ungulates) for the wolves will be stored off site and in locations where bears are not attracted to it (freezers at already developed areas). Pens will not be located in areas that are vital fall grizzly bear habitat. Secure facilities will also be provided for the people caring for the wolves. All individuals involved in the program will receive specific training in bear safety and proper methods of sanitation and behavior in grizzly bear country. Since the Park receives millions of visitors each year and backcountry users, hunters, and outfitters/guides often camp and recreate in grizzly bear country with minimal conflicts, no bears should become "nuisance bears" and be required to be removed from the wild as a result of this proposal. No bear mortalities or threats to human safety are expected to occur as a result of the facilities, confinement, or feeding of wolves.

Woodland Caribou.--Not likely to adversely affect. Wolves feed on ungulates including woodland caribou. Wolves, in combination with other factors, have been at least partly responsible for declines or suppression of woodland caribou populations in parts of Canada (Gunson 1992). The habitat of woodland caribou in northern Idaho (about 40-50 caribou) is outside the proposed experimental population rule area in central Idaho. If wolf recolonization were to occur in this area of northern Idaho, it would most likely result from individual wolves naturally dispersing from expanding populations in Canada and northwestern Montana, and not from wolves resulting from wolf reintroduction into the experimental population area in central Idaho. By reintroducing wolves and accelerating wolf population recovery in central Idaho, the states will gain more management flexibility sooner than if natural recovery was to slowly progress, therefore maximizing the ability of resource managers to mitigate or prevent any potential impact of wolf predation on woodland caribou. Natural recovery increases the chances that wolves would naturally recolonize the area in northern Idaho where these caribou live, before wolf populations can be delisted and managed entirely by the states. While predation may be an important factor in the Selkirk Woodland Caribou population, the caribou recovery team did not recommend removal of predators as a step in reducing caribou mortality. They also did not believe that wolf predation was likely to limit caribou population growth in the foreseeable future (Wayne Wakkinen, Idaho Fish and Game, pers. comm.). This caribou population is intensively monitored by radio telemetry and any radio collared wolves could be located during caribou monitoring. Therefore, potential impacts or predation from wolves would likley be quickly detected. It is unlikely that wolves from central Idaho would colonize the specific areas where these caribou live and if they did, focus on caribou as prey to an extent that would impact caribou recovery. To date, wolves in Montana have appeared to focus hunting behavior in lower elevations and on white-tailed deer. In the area where woodland caribou now live in Idaho, white-tailed deer are usually at lower elevations and are much more abundant than are woodland caribou, so wolves are unlikely to find and heavily prey upon woodland caribou prior to wolf population recovery (2002). If known (marked) reintroduced wolves travelled outside the experimental population area, they would likely be captured and moved back. Furthermore the experimental rule permits any experimental wolves that are affecting the recovery of other endangered or threatened species to be moved. In addition, Section 10 of the Endangered Species Act provides authority to the Secretary of the Interior to enhance the survival of listed species, which could include protecting endangered caribou from excessive predation by another listed species, such as naturally dispersing wolves from northwestern Montana or Canada.

Black-footed Ferret.--No effect. Wolf recovery is unlikely to have effects on black-footed ferrets. Wolves do not regularly prey on mammals smaller than beaver. Wolves resulting from the proposed action are expected to be uncommon in the habitats (prairie dog towns) or areas (Meeteetse and Shirley Basin, Wyoming or Charles M. Russell National Wildlife Refuge, Montana) that are currently proposed for ferret recovery. Wolves can contract and transmit diseases, such as canine distemper, rabies, and plague, which can seriously impact ferrets. However, wolves, which will be uncommon, are not expected to significantly affect the transmission of diseases because these types of diseases are already common among coyotes, foxes, and badgers which are already abundant throughout Montana, Wyoming and Idaho.

Bald Eagle.--No effect. Wolves are not known to prey on bald eagles or their nests, which are primarily in trees or on steep cliffs in the potentially affected areas. Bald eagles occasionally utilize carcasses of ungulates killed by wolves. Bald eagles and wolves occur throughout most of Canada and Alaska and despite extensive research on both species, no negative impacts to eagle populations because of wolves have been documented. The facilities would not be active during the period that bald eagles nest. Any facilities required to confine wolves as part of the reintroduction program would not be constructed near active eagle nests or eagle concentration areas, such as fall fish spawning areas.

Peregrine Falcon.--No effect. Wolves are not known to prey on peregrine falcons or their nests which are typically on cliffs. Wolves do not usually prey on small birds, waterfowl, or small mammals and therefore will not compete for food with peregrine falcons. Peregrine and other falcons and wolves co-exist in parts of Canada and Alaska without apparently affecting one another. Any facilities required to confine wolves would not be constructed near active peregrine falcon hack sites or aeries. Facilities would not be active during the time that falcons nest.

Whooping Crane.--No effect. Wolves, other than rare dispersing individuals resulting from the proposed reintroduction, are unlikely to move to the Gray's Lake National Wildlife Refuge in Idaho or Red Rock Lakes National Wildlife Refuge in Montana, where the only known concentrations of Whooping Cranes currently exist in the northern Rocky Mountains. There is no known breeding population of Whooping Cranes in potentially affected areas. Wolves in Wood Buffalo National Park, Canada have been documented to occasionally depredate on Whooping Crane nests and may occasionally kill adult cranes that are disabled or unable to fly. However, such instances are unlikely and rare in Idaho due to the timing of Whooping Crane presence in Idaho (summer), cranes do not nest in this area, and because wolves are most likely to be denning at that time and their movements would be most likely restricted to more remote areas close to Yellowstone National Park and central Idaho. If such unexpected conflicts were to occur or appeared likely, the experimental population rule allows wolves to be moved from areas within the experimental population area to resolve conflicts with the recovery of other listed species.

Piping Plover.--No effect. Wolves, other than rare dispersing individuals resulting from the proposed action, are unlikely to move into areas with plovers (primarily lower elevation, prairie or sagebrush areas in eastern Montana). Wolves are not expected to use sandy beaches along lakes, reservoirs, and alkaline lakes where plovers nest. Wolves rarely feed on small birds or their nests.

Least Tern.--No effect. Wolves, other than rare dispersing individuals resulting from the proposed action, are unlikely to move into areas with terns (primarily lower elevation, prairie or sagebrush areas in eastern Montana). Wolves are not expected to use sandy beaches along lakes and reservoirs where terns nest. Wolves rarely feed on small birds or their nests.

Pallid Sturgeon.--No effect. Wolves do not usually prey on fish and are unlikely to occur in fish habitat.

Sockeye Salmon.--No effect. Wolves have been documented to feed on spawning salmon when they are abundant and accessible. It is likely that most of the salmon eaten by wolves would have already spawned, since they would be easier to catch or would be washed up near shore as carrion. Wolves would have trouble catching salmon prior to spawning in the large water bodies of the Snake River system. The low numbers of salmon and wolves make it highly unlikely that wolves would ever catch or feed on salmon in the northern Rocky Mountains.

Chinook Salmon.--No effect. Wolves have been documented to feed on spawning salmon when they are abundant and accessible. It is likely that most of the salmon eaten by wolves would have already spawned, since they would be easier to catch or would be washed up near shore as carrion. Wolves would have trouble catching salmon prior to spawning in the large water bodies of the Snake River system. The low numbers of salmon and wolves make it highly unlikely that wolves would ever catch or feed on salmon in the northern Rocky Mountains.

Kendall Warm Springs Dace.--No effect. Wolves are not documented to frequent hot springs or feed on small fish. Wolves, other than occasional dispersing individuals, are unlikely to occur in this area. Wolves also are not documented to utilize specific habitat occupied by the dace (one warm spring).

Wyoming Toad.--No effect. Toads are not a normal prey item of wolves. Wolves are unlikely to occur in the area occupied by the Wyoming Toad (SE Wyoming).

Bruneau Hot Springsnail.--No effect. Mollusks are not a normal wolf prey. Wolves are not known to effect mollusk populations or frequent mollusk habitat. Wolves, other than rare occasional dispersing individuals, are not expected to occur in this area.

Five Species of Snake River Mollusks.--No effect. Mollusks are not a normal wolf prey. Wolves are not known to effect mollusk populations or frequent mollusk habitat. Wolves, other than rare occasional dispersing individuals, are not expected to occur in this area.

MacFarlene's Four-o'clock.--No effect. Wolves are not normally plant eaters and are not documented to effect populations of plants. Approximately 100 wolves in central Idaho is unlikely to have any effect on plant distribution or abundance. Wolves will not effect ungulate distribution and numbers to the extent that could impact ungulate grazing patterns and consequently plant distribution.

Critical Habitat

No critical habitat has been designated by the proposal, nor is the proposal likely to impact critical habitat of any other listed species. Therefore, no designated critical habitat will be affected by the proposed action.

Impacts to Category 1, 2 and 3 Candidate Species

The list of category 1, 2, and 3 candidate species for Wyoming, Montana and Idaho was reviewed and wolf recovery will not affect any of these species. See Appendix I for list.

RECOMMENDATIONS TO AVOID IMPACTS OR ENHANCE SPECIES CONSERVATION

The proposed action is anticipated to have a beneficial effect on the gray wolf so there are no recommendations for avoiding impacts to that species.

The proposed action is not likely to adversely impact grizzly bears or woodland caribou. There will not be a significant impact on grizzly bears or woodland caribou. Any potential adverse impacts on grizzly and woodland caribou that could result from wolf competition or predation can be minimized by close monitoring of reintroduced wolves (many of whom will be radio collared and monitored as part of the reintroduction strategy) and continued monitoring of woodland caribou and grizzly bears, encouraging wolf population growth on Forest Service lands in central Idaho where woodland caribou do not live, and by implementing provisions in the experimental population rules that allow experimental wolves to be moved if negative impacts to populations of other listed species occur or are likely to occur. In the unlikely event that wolves of unknown origin, focus their hunting efforts on woodland caribou populations in northern Idaho, the Secretary of the Interior could issue a permit under Section 10 of the Endangered Species Act, to move wolves from the immediate area to reduce predation pressure on caribou and still achieve wolf recovery. Conflicts with grizzly bears around facilities in Yellowstone National Park will be minimized by locating the facilities in areas without high fall bear use, secure construction of the temporary pens and employee facilities, following established guidelines for sanitation in grizzly habitat, providing bear safety training for all project employees, and properly storing wolf food off-site.

The proposed action is not anticipated to have any impacts or affect on the black-footed ferret, bald eagle, peregrine falcon, whooping crane, piping plover, least tern, pallid sturgeon, sockeye salmon, chinook salmon, Kendall warm springs dace, Wyoming toad, Bruneau Hot Springsnail, any of the five species of Snake River mollusks, or MacFarlane's four-o'clock. Therefore, there are no recommendations for avoiding impacts to these species.

CONCLUSION

It has been determined that the proposed reintroduction of nonessential experimental populations of gray wolves into central Idaho and Yellowstone National Park will have a beneficial affect on gray wolves. It has been determined that the proposed action will not be likely to adversely impact grizzly bears or woodland caribou. It has been determined that the proposed action will have no affect on the black-footed ferret, bald eagle, peregrine falcon, whooping crane, piping plover, least tern, pallid sturgeon, sockeye salmon, chinook salmon, Kendall warm springs dace, Wyoming toad, Bruneau Hot Springsnail, any of the five species of Snake River mollusks, or MacFarlane's four-o'clock. Candidate species in Montana, Wyoming or Idaho will not be affected by the proposed action.

PROJECT LEADER:________________________ **DATE:**______________

MAY AFFECT:_________ **WILL NOT AFFECT_XXX**___________

COMMENTS:

LITERATURE CITED

Gunson, J.R. 1992. Historical and Present Management of Wolves in Alberta. Wildl. Soc. Bull. 20:330-339.

Koth, B. D.W. Lime, and J. Vlaming. 1990. Effects of restoring wolves on Yellowstone area big game and grizzly bears: opinions of fifteen North American experts. Pages 4-52 to 4-81 in Wolves for Yellowstone? A report to the United States Congress, Volume 2, Research and Analysis. National Park Service, Yellowstone National Park, Wyoming.

Mattson, D.J., and R.R. Knight. 1992. Spring bear use of ungulates in the Firehole drainage of Yellowstone National Park. In: Varley, J.D. and W.G. Brewster, eds. Wolves for Yellowstone? A report to the United States Congress, Volume IV Research and Analysis. National Park Service, Yellowstone National Park, Wyoming. 750pp.

May 7, 1993. Phone conversation with U.S. Fish and Wildlife Service Boise Idaho field office (Secretary). Request threatened and endangered species list for Idaho.

May 7, 1993. Phone conversation with U.S. Fish and Wildlife Service Cheyenne Wyoming state office (Jane Roybal). Request threatened and endangered species list for Wyoming.

May 7, 1993. Conversation with U.S. Fish and Wildlife Service Helena Montana State office (Scott Jackson). Request threatened and endangered species list for Montana.

May 21, 1993. Conversation with Scott Jackson (USFWS, Helena MT) review draft biological evaluation (BE). Copies sent to Boise, ID and Cheyenne, WY state offices for review.

May 27, 1993. Phone conversation with Ted Koch (USFWS, Boise, ID) to check species list and discuss (BE). A few minor revisions suggested.

May 27, 1993. Conversation with Scott Jackson (USFWS, Helena, MT). Discuss BE, review comments on draft. A few minor revisions suggested and incorporated.

May 27, 1993. Phone conversation with Steve Brockmann (USFWS, Cheyenne, WY). Review comments on draft BE. A few minor suggestions made and incorporated.

May 27 and June 1, 1993. Phone conversation with Wayne Wakkinen (Idaho Fish and Game, Woodland Caribou Project Leader, Boner's Ferry, ID). Discuss woodland caribou and conclusions in BE. Some suggestions made for BE and incorporated.

Threatened and Endangered Species--Idaho

Bald Eagle (*Haliaeetus leucocephalus*)
Peregrine Falcon (*Falco peregrinus*)
Whooping Crane (*Grus americana*)
Gray Wolf (*Canis lupus*)
Grizzly Bear (*Ursus arctos horribilis*)
Woodland Caribou (*Rangifer tarandus caribou*)
MacFarlanes four o'clock (*Mirabilis macfarlanei*)
Sockeye Salmon (*Oncorhynchus nerka*)
Chinook Salmon (*Oncorhynchus tschawytscha*)

Candidate Species:
White Sturgeon (*Acipenser transmontanus*) (Kootenai River population only)
Bull Trout (*Salvelinus confluentus*)
Bonneville Cutthroat Trout (*Oncorhynchus clarki utah*)
Snake River Fine-spotted Cutthroat Trout (*Oncorhynchus clarki* ssp.)
Redband Trout (*Oncorhynchus mykiss gibbsi*)
Leatherside Chub (*gila copei*)
Wood River Sculpin (*Cottus leiopomus*)
Spotted Frog (*Rana pretiosa*)

White-faced Ibis (*Plegadis chihi*)
Trumpeter Swan (*cygnus buccinator*)
Harlequin Duck (*histrionicus buccinator*)
Northern Goshawk (*Accipiter gentilis*)
Ferruginous Hawk (*Buteo regalis*)
Columbian Sharp-tailed Grouse (*Tympanuchus phsianellus columbianus*)
Mountain Quail (*Oreortyx pictus*)
Black Tern (*Childonias niger*)
Long-billed Curlew (*Numenius americanus*)
Loggerhead Shrike (*lanius ludovicianus*)

Preble's Shrew (*Sorex Preblei*)
Pygmy Rabbit (*Brachylagus idahoensis*)
Townsend's Big-eared Bat (*Plecotus townsendii townsendii*)
Northern Idaho Ground Squirrel (*Spermophilus brunneus brunneus*)
Southern Idaho Ground Squirrel (*Spermophilus brunneus endemicus*)
North American Wolverine (*Gulo gulo luscus*)

Threatened and Endangered Species--Montana

Preble's Shrew (*Sorex preblei*)
Spotted Bat (*Euderma maculatum*)

Swift Fox (*Vulpes velox*)
North American Wolverine (*Gulo gulo luscus*)
North American Lynx (*Felis lynx*)
Pygmy Rabbit (*Brachylagus idahoensis*)
Woodland Caribou (*Rangifer tarandus caribou*)
Ferruginous Hawk (*Buteo regalis*)
Northern Goshawk (*Accipiter gentilis*)
Baird's Sparrow (*Ammodramus bairdii*)
Black Tern (*Chlidonias niger*)
Trumpeter Swan (*Cygnus buccinator*)
Harlequin Duck (*Histrionicus histrionicus*)
Loggerhead Shrike (*Lanius ludovicianus*)
Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*)
Mountain Plover (*Charadrius montanus*)
White-faced Ibis (*Plegadis chihi*)
Long-billed Curlew (*Numenius americanus*)

White Sturgeon, Kootenai River pop. (*Acipenser transmontanus*)
Interior Red Band Trout (*Onchorhynchus mykiss gibbsi*)
Paddlefish (*Polyodon spathula*)
Bull Trout (*Salvelinus confluentus*)
Montana Arctic Grayling (*Thymallus arcticus*)
Sturgeon chub (*Macrhybopsis (Hybopsis) gelida*)
Sicklefin chub (*Macrhybopsis (Hybopsis) meeki*)
Blue Sucker (*Cycleptus elongatus*)
Spotted Frog (*Rana pretiosa*)

Rocky Mountain Capshell (snail) (*Acroloxus coloradensis*)
Meltwater Lednian Stonefly (*Lednia tumana*)
Brown's Microcylloepus Riffle Beetle (*Microcylloepus browni*)
Warm Spring Zaitzevan Riffle Beetle (*Zaitzeva thermae*)
Regal Fritillary Butterfly (*Speyeria idalia*)
Alexander's Rhycophilan Caddisfly (*Rhyacophila alexanderi*)

Plants
Sapphire Rockcress (*Arabis fecunda*)
Barr's Milkvetch (*Astragalus barrii*)
Bitterroot Milkvetch (*Astragalus scaphoides*)
None (*Botrychium crenulatum*)
Peculiar Moonwort (*Botrychium paradoxum*)
Cascade Reedgrass (*Calamagrostis tweedyi*)
None (*Carex lenticularis var. dolia*)

Alpine Rabbitbrush (*Chrysothamnus parryi ssp. montanus*)
Long-styled thistle (*Cirsium longistylum*)
Yellow springbeauty (*Claytonia lanceolata* var. *flava*)
None (*Erigeron lackschewitzii*)
Rabbit Wild Buckwheat (*Eriogonum agopus*)
Howell's Gumweed (*Grindellia howellii*)
Water Howellia (*Howellia aquatilis*)
Few-seeded bladderpod (*Lesquerella humilis*)
Lemhi beardtongue (*Penstemon lemhiensis*)
Primrose (*Primula alcalina*)
Persistent Sepal Yellowcress (*Rorippa calycina*)
Shoshonea (*Shoshonea pulvinata*)
Spalding's Catchfly (*Silene spaldingii*)
Bitterroot Trisetum (*Trisetum orthochaetum*)

Threatened and Endangered Species-Wyoming
Black-footed ferret (*Mustela nigripes*)
Bald eagle (*Haliaeetus leucocephalus*)
Peregrine falcon (*Falco peregrinus*)
Whooping crane (*Grus americana*)
Kendall Warm Springs dace (*Rhinichthys osculus thermalis*)
Wyoming toad (*Bufo hemiophrys baxteri*)
Gray wolf (*Canis lupus*)
Grizzly bear (*Ursus arctos horribilis*)

Mammals
Preble's shrew (*Sorex preblei*)
Spotted bat (*Euderma maculatum*)
Allen's 13-lined ground squirrel (*Spermophilus tridecemlineatus alleni*)
Preble's meadow jumping mouse (*Zapus hudsonicus preblei*)
Pygmy rabbit (*Brachylagus idahoensis*)
Fringed-tailed myotis (*Myotis thysanodes pahasapensis*)
Swift fox (*Vulpes velox*)
North Amer. wolverine (*Gulo gulo luscus*)
Plains (Eastern) spotted skunk (*Spilogale putorius interrupta*)
North Amer. lynx (*Felis lynx canadensis*)

Birds
Trumpeter swan (*Cygnus buccinator*)
White-faced ibis (*Plegadis chihi*)
Harlequin duck (*Histrionicus histrionicus*)
Ferruginous hawk (*Buteo regalis*)

Northern Goshawk (*Accipiter gentilis*)
Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*)
Mountain plover (*Charadrius montanus*)
Long-billed curlew (*Numenius americanus*)
Black tern (*Chlidonias niger*)
Loggerhead shrike (*Lanius ludovicianus*)

Amphibians
Western boreal toad (*Bufo boreas boreas*)
Spotted frog (*Rana pretiosa*)

Reptiles
Black Hills redbelly snake (*Storeria occipitomeoculata ahasapae*)

Fish
Colorado cutthroat trout (*Salmo clarki pleuriticus*)
Bonneville cutthroattrout (*Salmo clarki utah*)
Flannelmouth sucker (*Catostomus latipinnis*)
Sturgeon chub (*Hybopsis gelida*)
Plains topminnow (*Fundulus sciadicus*)
Roundtail chub (*Gila robusta*)
Leatherside chub (*Gila copei*)

Invertebrates
Narrow-foot hygrotus diving beetle (*Hygrotus diversipes*)
Jackson Lake Springsnail (*Pyrgulopsis* aka *Fontelicella*)
(=Elk Island snail) or *Amnicola robusta*)
Jackson Lake Snail (*Helisoma Carinifex jacksonense*)
Cave Physa (= Wyoming cave snail) (*Physella Physa spelunca*)

Plants
Sapphire Rockcress (*Arabis fecunda*)
Barr's Milkvetch (*Astragalus barrii*)
Bitterroot Milkvetch (*Astragalus scaphoides*)
None (*Botrychium crenulatum*)
Peculiar Moonwort (*Botrychium paradoxum*)
Cascade Reedgrass (*Calamagrostis tweedyi*)
None (*Carex lenticularis var. dolia*)
Alpine Rabbitbrush (*Chrysothamnus parryi* ssp. *montanus*)
Long-styled thistle (*Cirsium longistylum*)
Yellow springbeauty (*Claytonia lanceolata* var. *flava*)
None (*Erigeron lackschewitzii*)

Rabbit Wild Buckwheat (*Eriogonum agopus*)
Howell's Gumweed (*Grindellia howellii*)
Water Howellia (*Howellia aquatilis*)
Few-seeded bladderpod (*Lesquerella humilis*)
Lemhi beardtongue (*Penstemon lemhiensis*)
Primrose (*Primula alcalina*)
Persistent Sepal Yellowcress (*Rorippa calycina*)
Shoshonea (*Shoshonea pulvinata*)
Spalding's Catchfly (*Silene spaldingii*)
Bitterroot Trisetum (*Trisetum orthochaetum*)

APPENDIX 8. MEMORANDUM REGARDING DEFINITION OF A WOLF POPULATION

1378 January 14, 1993

MEMORANDUM

To: Project Leader, Yellowstone and Central Idaho Gray Wolf EIS, FWE, 301 South Park, Helena, MT 59626

From: EIS Team Wolf Scientist and Northern Rocky Mountain Wolf Recovery Coordinator

Subject: Definition of "Wolf Population"

Per your request I have attempted to define a "population" of wolves, since a biological definition may be called for in the development of the Yellowstone and central Idaho Wolf EIS.

I could find no previous definition of wolf population in the scientific literature.

The process I used was a follows:

1. Review definitions of "population" in textbooks on population ecology.
2. Survey the opinions of 23 biologists familiar with wolves.
3. Incorporate my own views. These were formulated in university coursework, personally researching wolves, and through familiarity with the published information on the species.

There is no hard and fast definition for a population. Most textbook definitions convey the concept of a group of individuals of a certain species occupying an arbitrarily defined area at an arbitrarily defined time. The idea that reproduction is occurring is either specifically stated or implied in practically all definitions encountered. Moreover, some definitions include the idea that a population will have a birth rate, death rate, sex ratio, age structure, etc., implying a substantial number of individuals is involved over enough time to establish more than an instantaneous rate.

The majority of respondents to my survey indicated that reproduction must be occurring in order for a group of wolves to be considered a population. The entire range of responses varied from 1-2 wolves to 10 breeding pairs of wolves. The ability of the "population" to sustain itself long-term and even demonstrate some measure of "viability" was important to several respondents.

In view of all the input, I propose the following definition of a wolf population:

> "*A wolf population is at least 2 breeding pairs in a specified area, each of which have within the previous 2-year period produced at least 2 offspring surviving until January 1 of the year following reproduction.*"

The group of wolves would cease to be a population if one or both pairs do not survive, do not maintain their pair-bond, do not breed, do not produce offspring, or if both pups do not survive for the specified period.

It is extremely important to recognize that the definition above represents the minimum standards for a wolf population. The definition does not describe a recovered wolf population or a viable wolf population. In fact it falls far short of describing either.

According to this definition, I do not believe it is appropriate to speak of a current greater Yellowstone (GYA) wolf population. The level of reported and confirmed wolf activity there is far short of that which would meet the definition. Similarly, I doubt that it would be appropriate to speak of a central Idaho wolf population. The information we have for Idaho is more indicative of occasional immigration of single wolves from a breeding population(s) elsewhere, possibly with intermittent reproduction in some years, but with very low survival of any wolves that travel there or are born there.

Another consideration with Idaho is as follows. If wolves were in Idaho and met the population definition there, then it would be appropriate to speak of an Idaho population. (One can arbitrarily define the area of consideration for this purpose, and a state border is satisfactory). However, in a biological sense it would be just as legitimate to argue that naturally-occurring breeding pairs in Idaho comprise the southern extremity of the Montana population, which in turn is part of a population extending north to Banff and Jasper National Parks in Canada. No physiographic barrier exists to impede movement back and forth between the two states, and dispersing wolves entering Idaho would most likely be from Montana. The relatively discontinuous habitat between Montana and the GYA and between Idaho and the GYA would cause me to view any GYA population as more of a distinct entity.

I see no reason to believe that we are even close to having a separate population in the GYA or in Idaho, although the proximity of Idaho to the Montana wolves will likely result in population development there before in the GYA.

APPENDIX 9. MEMORANDUM REGARDING A VIABLE WOLF POPULATION IN THE NORTHERN ROCKY MOUNTAINS

FEDERAL BUILDING, U. S. COURTHOUSE
301 S. PARK
P. O. BOX 10023
HELENA, MT 59626

1378 March 24, 1993

MEMORANDUM

To: Project Leader, Yellowstone and Central Idaho Gray Wolf EIS, FWE, 301 South Park, Helena, MT 59626

From: EIS Team Wolf Scientist and Northern Rocky Mountain Wolf Recovery Coordinator, FWE, 301 South Park, Helena, MT 59626

Subject: Assessment of whether population goal established for delisting in the 1987 Northern Rocky Mountain Wolf Recovery Plan constitutes a viable wolf population

The Northern Rocky Mountain Wolf Recovery Plan established a population goal for delisting of 10 breeding pairs of wolves in 3 separate recovery areas for 3 consecutive years. Subsequent discussions of reintroduction and recovery in the greater Yellowstone area and central Idaho have assumed that a more or less self sustaining or "viable" population would be in place in the Northern Rockies once this goal was attained. The question of whether the recovery goals in the Recovery Plan are still valid and should be included in the EIS is a matter deserving careful consideration. The assessment of viability of populations has evolved rapidly since the plan was finalized. Therefore, I have attempted to re-examine the issue with inclusion of recent advances in the field of conservation biology and the contemporary concept of population viability.

I attempted to consider only biological criteria in reassessing the population goal in the recovery plan. The process I followed in conducting this analysis was to:

1. Survey recent published literature on population viability analysis (PVA) and minimum viable populations (MVP) and assess the implication to wolves in the Northern Rocky Mountain area of the U.S.

2. Review recovery goals in other recovery plans for wolves (Mexican wolf, Eastern Timber wolf, Red wolf), most of which were completed after the last revision of the Northern Rocky Mountain Wolf Recovery Plan and after the field of conservation biology was more fully developed.

3. Survey the opinions of biologists who have studied wolves.

4. Incorporate my own thoughts.

Note that my approach did not include an effort to determine the number of wolves required for population viability through modeling. The rationale for that decision will be apparent from the discussion below.

RESULTS

Literature survey

In recent years it has been widely recognized that larger populations are much more likely to persist for longer periods. Small populations are susceptible to several types of problems (eg. genetic, demographic, environmental) that can lead to extinction. A minimum viable population (MVP) is a population large enough to overcome those problems and allow "long-term" persistence. Discussions of MVPs are predicated on the availability of a minimum secure area, sometimes referred to as minimum area requirement (MAR) where a population has a selected probability of survival for an arbitrarily chosen period (Soule and Simberloff 1986, USFWS 1989). Population viability analysis (PVA) is the process of estimating MVPs within a range of genetic and demographic conditions. Time periods selected for population survival are often 50, 100, 200 or more years and the probability of survival is often set at 95%.

The estimation of MVP is difficult and imprecise. MVP theory is an apparently sound but untested concept (Peek et al. 1991). A complex of considerations are involved, including genetic diversity, demographic stochasticity, environmental stochasticity, natural catastrophes, social dysfunction, and spatial distribution of the population. Genetic viability ensures heterozygosity and the associated reproductive vigor needed for population growth and adaptation to changing environments. Demographic factors affect population size and persistence and include such parameters as sex ratio, litter size, mortality rates, age at first reproduction, and number of breeders. Variance in individual reproductive performance has been shown to be a major component of both demographic and genetic stochasticity and thus is a major component of the analysis of population viability. Changes in climate and other unpredictable aspects of the environment are important, as they affect the availability of key resources--especially vulnerable prey in the case of wolves. Small populations have been shown to lose genetic variability much faster than larger populations, and this "genetic drift" is the overriding factor controlling the loss of genetic variation, although it can be countered with only 1 or a few migrants per generation.

PVA has been applied to the red wolf (Canis rufus), the Mexican wolf (Canis lupus baileyi) and the Italian wolf (see below). Each of these taxa represent far more challenging conservation problems than the restoration and survival of wolves in the Northern Rockies of the U.S. because of the scarcity of individuals and initial absence of a wild population (Mexican wolf and red wolf) and habitat problems.

Calculations that consider genetic factors such as inbreeding generally involve an estimation of the ratio of the effective population size[1] (N_e) to the total population (N). A 1% level of inbreeding per generation, which is often assumed to be the maximum acceptable for short-term viability, requires an N_e of at least 50 (Soule 1980:160). We can safely conclude that the minimal size of a wolf population must be well in excess of 50 just to meet the "1% rule". Bath et al. (1988) using the Reed et al. (1986) formula calculated that an N_e=50 required 46-150 wolves (about the number expected to exist in the Yellowstone ecosystem) (Yellowstone National Park et al. 1990). For long-term viability of an animal population, N_e= 500 has been suggested (cf. Franklin 1980, Lande and Barrowclough 1987). These rough figures for short-term and long-term survival have led to the so-called 50/500 rule for genetic fitness which is often used, despite a slim empirical basis (Shafer 1990:73). Many writers have stressed this number may only be the right order of magnitude, and that we do not have the ability to predict hard numbers (cf. Grumbine 1990). Clearly, finding an area to support N_e=500 of wolves in the lower 48 states is very unlikely, as this would equate to a total population in the low thousands.

Soule (1980:162-163), using the 1% rule, and assuming: (1) one-third of adults actually breed, (2) a certain amount of population fluctuation occurs, (3) overlapping generations, and (4) other assumptions, roughly calculated an N_e of 200 would be needed for wolves and that a total population of 600 or more would be needed to overcome loss of genetic variability. Theberge (1983:88-89) also recognized the probable loss of genetic variability in small or isolated populations of wolves and the loss of vigor and fecundity that could result. Based on the minimum N_e of 50 wolves, he (1983:88-89) calculated that a minimum of 13,000 km^2 (5,019 mi^2) would be necessary to support a population in Canada, owing to the low densities of wolves there. He warned against actions that would create an

[1]Effective population size (N_e) is defined as the number of animals that would have the same reduction in genetic variability over time as an ideal population in which, for example, population numbers are constant, sex ratios equal, and all members contributed equally to each subsequent generation. The N_e of a population of mammals is usually smaller than the total number of animals because, for example, not all animals are breeders, differing sex ratios, variances in family size, and variances in population size from one generation to the next (Mysterud and Falck 1989).

increasingly patchy distribution, including regional prey depletion and long-term wolf control. Shields (1983), on the other hand, argued that wolves are organized into small, semi-isolated demes and a degree of inbreeding naturally characteristic of a fragmented population structure would allow maintenance of local adaptations which would enhance the species-wide genetic variability, allowing greater ability to respond to environmental change. Shields probably under-estimated the amount of gene flow in wolf populations. Allendorf (1983) recommended a management strategy of 1 migrant (successfully reproducing) per generation among isolated nature reserves. The same conclusion was reached by Lande and Barrowclough (1987) and Lacy (1987).

As mentioned above, determining MVP via models is difficult for a variety of reasons, a major one being unpredictable changes in the environment (Boyce 1992). Soule and Simberloff (1986:19) observed that thoughtful estimates of MVP for many animal species are rarely lower than an N_e of a few hundred, and this lower limit would often correspond to an actual population of about 1,000. Soule (1987) guessed that MVPs would often be in the low thousands.

In reviewing MVP studies, Boyce (1992:500) pointed out that five different studies synthesizing data on extinction for different vertebrate taxa have revealed that populations below N=50 consistently show a high probability of extinction, whereas populations above 200 are often reasonably secure, given protected habitat. PVA's done to date indicate that for isolated populations, preservation of most of the gene pool for several centuries will require maintenance of total populations of hundreds or thousands. Thomas (1990) used empirical data to estimate population sizes necessary for medium to long-term persistence and concluded that 10 is too few, 100 is usually inadequate, 1,000 is adequate for species of normal variability, and 10,000 should permit persistence of most birds and mammals. Nonetheless, populations that occupy habitat fragments that are far too small to hold thousands of individuals sometimes have strong conservation potential. If isolation is not complete, population variability is low, and the environment is stable, geometric mean values of 500 may allow long term persistence.

One wild wolf population has been especially instructive about population viability of the species and 3 others lend insight. The Isle Royale wolf population was probably founded about 1949 from a single gray wolf pair. The population has numbered as high as 50, but since 1988 has declined to around a dozen animals. Wayne et al. (1991) estimated that about 50% of the heterozygosity has been lost, compared to mainland wolves. Both the founder effect and genetic drift were instrumental in reducing genetic variability which may have been responsible for the decline of the population. Despite development of these problems, it is important to note that the Isle Royale population thrived for 30 years and is extant, although of debatable viability today, some 44 years after colonization. Remnant wolf populations in Italy, Spain, and Portugal, numbering about 100, $\leq$200, and $\leq$200 respectively for several decades or more, have repopulated those countries rather than becoming extinct.

Boyce (1990) used a simple extinction model to demonstrate the strong relationship between the area (size) of the recovery zone for a hypothetical Yellowstone wolf population and expected time to extinction. For example at N=40, the time to extinction was 20.8 years and at N=60 it was 357.8 years. Boyce used these results to emphasize that the security of a Yellowstone National Park wolf population could be greatly increased by expanding the recovery zone outside the Park, which was assumed to increase population size. The area necessary to support a viable population of wolves was estimated in the 4000-5000 mi^2 range by Mech (in Henshaw 1979:430) and Soule (1980:163). Yellowstone National Park is about 3,472 mi^2 and the greater Yellowstone area has 18,281 mi^2 of federal land; the central Idaho recovery area is about 12,355 mi^2.

Spatial distribution of a population has a major influence on its viability (Gilpin 1987). In nature many populations exist as partially isolated sets of sub-populations, termed "metapopulations." Genetic variability lost within each sub-population can be offset by new variants being reintroduced by interchange between sub-populations. Moreover, a metapopulation is less vulnerable to demographic and environmental stochasticity. Extinction of 1 sub-population is likely to be followed by re-colonization from another--contrasted with, for example, a scenario in which <u>all</u> individuals living within a single area are poisoned out and that area is too isolated for new colonizers to reach it. In a true metapopulation, dispersers from 1 sub-population are likely to be reach and rekindle the sub-population in another area.

Related to the metapopulation concept, the size and spatial distribution and configuration of reserves has received much theoretical treatment. Goodman (1987) believed that a series of reserves, equal in total area to 1 large reserve, would have fewer extinctions from environmental perturbation than a large one so long as there was migration between them. The extent to which environmental perturbations act in concert between different patches of a metapopulation is a critical factor in determining the advantage of that arrangement (Gilpin 1987).

There is general consensus in the conservation biology literature that most (possibly all) U.S. reserves are too small for long-term support of large vertebrate species (Schonewald-Cox 1983, Newmark 1985, Salwasser et al. 1987, Soule 1987, Grumbine 1990). Newmark (1985) examined eight parks and park assemblages and concluded that only 1 could support populations (MVP = 50) of wolves and other wide-ranging mammals. At a MVP of 500, even the largest preserve was six times too small. Similar conclusions were reached by Schonewald-Cox (1983), Salwasser et al. (1987), Grumbine (1990), and others.

<u>**Recovery goals and PVA's for other wolf populations**</u>

Recovery Teams in the U.S. were among the first to grapple with the question of what constitutes a viable population of wolves as they set recovery goals for wolves in different regions of the country. Except for the Mexican Wolf Recovery Plan, which is under revision, the plans specifically call for the re-establishment of more than 1 population as a part of ensuring viability. The current Mexican Wolf Plan recommends the establishment of a captive population of unspecified size and the re-establishment of a wild population of at least 100 wolves in a 5,000 mi^2 area. The Northern Rocky Mountain Wolf Recovery Plan has the objective of 10 breeding pairs of wolves in each of 3 recovery areas for 3 consecutive years (USFWS 1987). This approach considers numbers, subdivision of the population into essentially a metapopulation by way of distribution of available habitat, and some demonstration of persistence.

The revised Eastern Timber Wolf Recovery Plan specifies the need for 2 "viable" populations (Minnesota's plus 1 other) (USFWS 1992). For a population outside of Minnesota to be considered viable, it must: (1) if isolated, average at least 1 wolf/50 mi^2 (self-sustaining, $\geq$200 wolves) distributed within a minimum of 10,000 mi^2 over five consecutive years, or (2) if located within 100 miles of a self-sustaining wolf population, must average at least 1 wolf/50 mi^2 or consist of 100 wolves in an area of at least 5,000 mi^2 over five consecutive years. The team believed that a population of at least 200 located more than 200 mi from the Minnesota population (e.g. northern New York or northern Maine) was large enough to be viable, as well as to have sufficient genetic diversity to exist indefinitely in isolation, and that a smaller population (>100) in Wisconsin/Michigan will remain viable and retain necessary genetic diversity via immigration from Minnesota (USFWS 1992:25-26). Overall, the Team believed that a healthy, self-sustaining population should include at least 100 interbreeding wolves.
The Red Wolf Recovery/Species Survival Plan's objective is to reestablish 3 or more wild populations totalling about 220 within the historic range. The Mexican and red wolf recovery plans include maintenance of captive populations and assume intensive management of both captive and wild populations. Long-term maintenance of these captive breeding programs to reinforce the captive and wild programs is viewed as a necessity (USFWS 1982, USFWS 1989).

The only formal PVAs done to date have been on the Mexican wolf (C. l. baileyi) (not yet completed), the wolf in Italy (Ciucci and Boitani 1991), and the red wolf (Canis rufus)(USFWS 1989). The red wolf analysis used a software program developed by Dr. Jonathan Ballou, whereas Mexican wolf and Italian wolf analyses employed the computer program "VORTEX" (Seal and Lacy 1989). The PVA for the Italian wolf was unique in that it examined an existing wild population (280-300 individuals). This analysis suggested a fairly high probability of extinction within 100 and 60 years for the two presumably isolated sub-populations if any increase in adult mortality occurred, even in the absence of any environmental instability or inbreeding depression, but a high probability of survival if adult mortality was held at 10%. Immediate establishment of a captive population was recommended and management intervention of the wild population(s), i.e. translocation of animals or genetic material, was recommended. Problems for the Italian wolves are greatly exacerbated by the separation of the two main populations. This PVA depicted extreme sensitivity of the Italian population to any increase in adult mortality. Assessment of the predictions of this model should consider the resurgence of this population from around 100 wolves for several decades to its present size. The PVA for the red wolf indicated it would not be possible to maintain a single, contiguous population of the hundreds or thousands that were determined necessary for viability. The chosen approach was to manage as a metapopulation with intensive migration management to preclude genetic and demographic problems. Establishment of 220 red wolves in the wild and 330 in captivity is the goal (USFWS 1989).

Survey of wolf biologists

In November-December 1992, I used a mail questionnaire to ask 43 biologists familiar with wolves whether a scenario as in the Northern Rocky Mountain Wolf Recovery Plan would equate to a viable population. No effort was made to define "viability"; the biologists were expected to use their own inherent understanding of the concept. I asked: (1) whether a population of 10 breeding pairs alone for 3 consecutive years would constitute a viable population, and (2) whether 10 breeding pairs (assumed to be 100-150 wolves) in 3 areas for 3 consecutive years constituted a viable population.

Sixteen of the 25 biologists who responded (64%) felt that 10 breeding pairs sustaining themselves for 3 consecutive years at least met the minimum standards for a viable population. Six of the 16 commented that 10 pairs was marginal for viability and/or was viable only if interchange with another population occurred. Seven respondents believed this number was too few.

When asked if three such groups of 10 breeding pairs in a metapopulation for 3 consecutive years would meet the definition of "viable", 20 of 25 (80%) responded that it would meet the definition, while 2 disagreed (indicating that 10 years or some higher number of wolves was necessary). The remaining 3 respondents were not sure or did not give a distinct response. Two respondents thought that 10 breeding pairs would comprise a population of 30-40 and 50 wolves, respectively, rather than 100+, and 1 of those respondents believed a minimum of 100 (i.e. >10 breeding pairs) was necessary for viability. Thirteen respondents made implication that an isolated single population was likely in for future difficulty, but exchange among 3 sub-populations, or with the Canadian population, would greatly enhance viability of sub-populations. Overall, the capacity for movement of individuals between sub-populations was of considerable concern to respondents. Relatedness of founders was another frequently mentioned consideration.

CONCLUSIONS

Most analyses of MVP have involved small populations of rare taxa. Most treatments of population viability include 2 assumptions: (1) that the population is totally isolated, and (2) that no management would occur. Neither assumption is likely to be valid for wolves in the Northern Rockies of the U.S. First, the Northern Rockies population would be connected to the Canadian population via the Rocky Mountain chain northward from Glacier National Park to the Banff-Jasper Parks in Alberta and B.C. Movement of wolves between those areas has been documented. (That corridor may be vital to the long term future of wolves in the Northern Rockies of the U.S.) Second, there is no reason that a dwindling sub-population could not be augmented by individuals or packs from a nearby area.

The ability of the new population in Yellowstone or Idaho to sustain itself long-term will depend in part on the amount of genetic variability at the start, which depends partly on the number of founders. Very simply, the more wolves starting the population, the stronger the genetic base for the population will be. Note that this argues for reintroduction over natural recovery. In natural recovery the population would be based on a small number (2+) of founders, which could be fairly closely related, as they would be derived from a population in Montana or Idaho that likewise probably was founded by a few animals (a double bottleneck effect). In a reintroduction, not only could more individuals be used, but the degree of genetic variability they carry and their degree of relatedness could be determined prior to reintroduction. Of course the success of a Yellowstone or central Idaho wolf population is contingent on several other factors including a mortality rate low enough to allow population growth to the level of 10 packs. Another advantage of reintroduction is that the sub-populations could be brought up to recovery level fairly synchronously. Components of the metapopulation would then be better able to naturally augment one another (demographically) and the entire population would attain "viability" sooner.

The importance of movement of individuals between sub-populations cannot be overemphasized. The dispersal ability of wolves makes such movement likely, unless wolves were heavily exploited between recovery areas, as could happen in the more developed corridor between central Idaho and Yellowstone National Park. Intensive migration management might become necessary if 1 of the 3 sub-populations should develop genetic or demographic problems. I see no reason why that possibility should be viewed negatively. It will be a necessity in other wolf recovery programs. Some, however, may view such management intervention as 'unnatural.'

It is fairly clear that 10 breeding pairs in isolation will not comprise a "viable" population (i.e. have a high probability of survival for a long period without human intervention). Thirty or more breeding pairs comprising some 300+ wolves in a metapopulation with genetic exchange between sub-populations should have a high probability of long-term persistence. However, if a range or scale of different population sizes could be displayed representing the entire "viability" spectrum (from "minimally viable" to "unquestionably viable"), I believe the definition in the current recovery plan would be on the lower half of the scale.

My conclusion is that the 1987 wolf recovery plan's population goal of 10 breeding pairs of wolves in 3 separate recovery areas for 3 consecutive years is reasonably sound and would maintain a viable wolf population into the foreseeable future. The goal is somewhat conservative, however, and should be considered minimal. The addition of a few extra pairs would add security to the population and should be considered in the post-EIS management planning. That could always be done as a periodic infusion if deemed necessary.

Please let me know if this meets your needs insofar as the wolf EIS is concerned. Note that the published literature to which I referred above is not listed at the end of this discussion, but is available upon request.

"Take Pride in America"

APPENDIX 10. SUMMARY OF UNGULATE MORTALITY IN THE YELLOWSTONE AND CENTRAL IDAHO PRIMARY ANALYSIS AREAS

Table A10-1. Annual estimated losses of ungulates/year from all causes that would occur to maintain stable ungulate population in the Yellowstone primary analysis area.

					Estimated losses[a]	
Species	Postharvest population	Adult females	Young born /adult female/year	Number born/year	Hunter	Other losses[b]
Elk	56,100	33,660 (60%)	0.72	24,235	8,334	15,901
Deer	29,500	16,225 (55%)	1.2	19,470	5,287	14,183
Moose	5,800	3,480 (60%)	0.8	2,784	551	2,233
Bighorn	3,900	2,340 (60%)	0.5	1,170	130	1,040
Bison	3,600	1,800 (50%)	0.5	900	131	769
Total	98,900	57,505		48,559	14,433	34,126

[a] Total ungulate loss/year = 48,559 (hunting 30%, other 70%). Estimated wolf caused ungulate mortalities/year = 1,200 or 2.5% increase/year at recovered level (100 wolves).
[b] Other ungulate losses include disease, starvation, winter kill, wounding loss, poaching, predation, accidents, road kill, fighting, etc.

Table A10-2. Annual estimated losses of ungulate/year from all causes that would occur to maintain stable ungulate populations in the central Idaho primary analysis area.

					Estimated losses[a]	
Species	Postharvest population	Adult females	Young born/adult female/year	Number born/year	Hunters	Other[b]
Elk	76,300	43,673	0.72	31,445	12,094	19,351
Deer	159,600	99,750	1.20	119,700	21,000	98,700
Moose	1,700	1,020	0.80	816	163	653
Bighorn	1,800	1,187	0.50	594	66	528
Mountain Goat	2,000	1,230	0.80	984	35	949
Total	241,400			153,539	33,358	120,181

[a] Total ungulate loss/year = 153,539 (hunting 22% , all other 78%). Estimated wolf caused ungulate mortalities/year = 1,600 or 1% at recovered level (100 wolves).
[b] Other ungulate losses include disease, starvation, winter kill, wounding loss, poaching, predation, accidents, road kill, fighting, etc.

NOTE: These tables are intended to be representative estimates of overall mortality rates from all causes in ungulate populations (newborn-adult) rather than a prediction of the precise ungulate population dynamics/mortality in the primary analysis areas in the Yellowstone and central Idaho areas.

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