

**DRAFT
CONSERVATION STRATEGY FOR THE
GRIZZLY BEAR IN THE
YELLOWSTONE AREA**

Developed by the Interagency Conservation Strategy Team

March 2000

PUBLIC REVIEW DRAFT

Dear Reader:

This is the IGBC/YES public review copy of the Conservation Strategy for Grizzly Bear Management in the Yellowstone Area. This proposed Conservation Strategy DOES NOT CHANGE the Threatened legal status of the Yellowstone Area (Yellowstone) grizzly bear population, NOR DOES IT PROPOSE SUCH A CHANGE. It describes how grizzly bears and grizzly bear habitat in the Yellowstone area would be managed after delisting, if this population was to be delisted.

The objective of the grizzly bear recovery program in the Yellowstone is to provide and maintain habitat and population management that results in maintenance and persistence of a viable, well-distributed grizzly bear population.

The purpose of this Conservation Strategy is to:

- 1) Describe and summarize the coordinated efforts to manage the grizzly bear population and its habitat, and the public education/involvement efforts that will be applied to ensure continued conservation of the grizzly bear in the greater Yellowstone area; and
- 2) Document the regulatory mechanisms that exist to maintain the Yellowstone population as recovered through the legal authorities, policy, guidelines, management programs, monitoring programs, and the commitment of participating agencies.

A Memorandum of Understanding (MOU) between agencies signatory to this document will be developed to facilitate implementation.

Comments on this document should be directed to:

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Executive Summary

This document is the draft management document for the Yellowstone grizzly bear population upon recovery and delisting. This document contains the best currently available methods to accomplish the goals of the Conservation Strategy. As new methods and better scientific data become available, they will be implemented and described in revisions of this document as necessary. The document will be used by the grizzly bear management agencies to guide the management process. The document has the following key sections:

- It defines the area within which this management plan applies. This is the Primary Conservation Area (PCA) and is the same area called the Yellowstone Grizzly Bear recovery zone in the Grizzly Bear Recovery Plan (USFWS 1993).
- It defines who will implement this Conservation Strategy and make management decisions within the PCA. Federal and State management agencies will maintain a formal management committee called the Yellowstone Grizzly Management Committee that will meet twice a year and use their resources to implement this Conservation Strategy. These management agencies agree to implement this document by signing a Memorandum of Understanding (MOU). This Conservation Strategy will be updated by the management agencies every 5 years, or as necessary, allowing for public input in this updating process.
- This is a document that relies upon dynamic management. The Yellowstone ecosystem is a dynamic environment and the monitoring systems in this document will allow dynamic management as environmental issues important to grizzly bears change. The agencies are committed to be responsive to the needs of the grizzly by dynamic management actions based on the results of detailed annual monitoring of the Yellowstone grizzly population and its habitat. Specific targets must be measured and maintained for both population and habitat requirements. A protocol is established which provides a mechanism to reassess problems and to respond with specific actions to either remedy the problem or relist the grizzly bear in the Yellowstone area under the Endangered Species Act (ESA).
- It defines population management objectives and assigns monitoring responsibilities and methodology for population characteristics. Specifically, it requires annual calculation of population parameters and meeting these specific, measurable targets:
 - Monitoring unduplicated females with cubs-of-the-year (COY) and requiring that at least 15 females with cubs be maintained on a running 6-year average. Grizzly bear females with cubs will be counted within the PCA and within 10 miles outside the PCA boundary. Females with cubs are counted within 10 miles outside the PCA boundary to count those females whose home ranges are likely to include portions of the area within the PCA during the year, and are thus part of the PCA population.

- Using the number of sightings and resightings of unduplicated females with cubs inside the PCA and within 10 miles outside the PCA boundary, several scientific methods will be used to conservatively estimate the total number of females with cubs in the population each year. This number will then be divided by 27.4%, which is the most recent estimate of the percentage of the population that is adult females, to yield a total population estimate. This total population estimate will be used to set the mortality limits for both known total human-caused mortality and known human-caused female mortality annually.
- Monitoring the distribution of females with young of all ages and having a target of at least 16 of 18 Bear Management Units (BMUs) occupied at least one year in every 6, and no two adjacent BMUs can be unoccupied over any 6 year period.
- Monitoring known total human-caused mortality and allowing no more than 4%¹ of the total population estimate for that year to be human-caused mortality. All grizzly bears dying from human-caused mortality within the PCA and within 10 miles outside the PCA boundary will be counted against this mortality limit. Human-caused mortalities are counted within 10 miles outside the PCA boundary to count the deaths of those bears whose home ranges likely include portions of the area with the PCA during the year, and are thus part of the PCA population.
- Monitoring known female human-caused mortality over the most recent 3 years and allowing no more than 30% of the annual mortality limit (4%¹ of the total population estimate) to be females. All female grizzly bears dying from human-caused mortality within the PCA and within 10 miles outside the PCA boundary will be counted against this mortality limit.
- Monitoring population trend with the Lotka equation, using female survivorship and reproductive rate data for the most recent period inside the PCA and within 10 miles outside the PCA boundary, and requiring a stable to increasing population using the calculation of population trend reported with 95% confidence intervals.
 - To gain the necessary data to monitor and calculate the above population targets, the USGS-led Interagency Grizzly Bear Study Team (IGBST) is tasked with monitoring protocols that will be implemented annually. These require reporting and investigating the details of all sightings and reports of females with cubs and females with young, and human-caused mortalities. In addition, the agencies implementing this Conservation Strategy will make every effort to maintain 25 adult female grizzly bears well distributed throughout the PCA with functional radio collars. Radio-collared adult females will provide the data necessary to calculate population trend and to judge the impacts of changes in human activity and possible changes in natural foods on the grizzly population.
- It lists mortality reduction actions that are either already underway and will be continued, or will be implemented, inside the PCA and in the area within 10 miles

¹ Note: efforts are currently underway to recalculate the unknown mortality level based on data from radio collared bears. As this work proceeds, this 4% rate may change and will be appropriately changed in this document after scientific peer review.

outside the PCA boundary to continue to minimize human-caused grizzly mortality and improve human safety.

- It defines genetic management objectives and a system to monitor genetic diversity in the Yellowstone population.
- It defines the habitat management objectives and who will monitor these habitat characteristics and how these characteristics will be monitored.

NOTE: The draft grizzly bear habitat criteria for the Yellowstone Ecosystem were published for public comment on July 15, 1999 and the comment period closed on November 15, 1999. These draft habitat criteria, which will be the habitat standards that must be met to achieve recovery of this population, are very similar to the habitat management objectives in this draft Conservation Strategy. This is because the agencies agreed that whatever habitat needs are necessary to get the grizzly population to recovery should also be maintained after recovery in order to assure recovered status. The management agencies are still in the process of reviewing and modifying the draft habitat criteria in response to public comments received. This process has taken longer than expected due to a 60-day extension of the comment period on these habitat criteria and to the complexity of the comments received. There was a commitment to get this draft Conservation Strategy out for public comment by 1 March 2000. Public comments on this draft Conservation Strategy will be used in conjunction with comments previously received on the draft habitat criteria to finalize both documents during 2000. If you have previously commented on the draft habitat criteria, be assured that your comments will be considered during the finalization of both the draft habitat criteria and this Conservation Strategy.

The relationship between bears and habitat is extremely complex and difficult to quantify. The following measurable habitat targets are considered the best currently available. As better scientific approaches to quantifying habitat relationships for grizzly bears become available, such techniques will be incorporated. Specifically, it requires annual calculation of the following criteria and meeting these specific, measurable habitat targets (as appended to the Grizzly Bear Recovery Plan (1993)):

- Access¹ measured using the moving window GIS technique (Mace et al. 1996) will be managed as per the following:
- Percent of area at or below the existing level of Open Motorized Access Route Density (OMARD) as of 1998 > 1 mile/square mile within each subunit in season 1 (3/1 – 7/15) and season 2 (7/16-11/30). There are no access standards in the winter season (12/1 – 2/28).
- Percent of area at or below the existing level of Total Motorized Access Route Density (TMARD) as of 1998 > 2 miles/square mile within each subunit in season 1 (3/1 – 7/15) and season 2 (7/16-11/30). There are no access standards in the winter season (12/1 – 2/28).

- To maintain secure habitat¹ at or above the existing percentage of secure habitat on public land within each subunit as of 1998 in season 1 (3/1 – 7/15) and season 2 (7/16-11/30). There are no secure habitat standards in the winter season (12/1 – 2/28).
- Access values for certain subunits are in need of improvement including Henrys Lake #1, Henrys Lake #2, Gallatin #3, Plateau #1, the non-park portion of Plateau #2, and Madison #2. In these subunits, the managers will improve the Secure, OMARD, and TMARD values on public land. The above-mentioned subunits on the Targhee National Forest will be acceptable for Secure, OMARD, and TMARD values upon complete implementation of the access management changes in the revised Targhee Forest Plan Revision (1997). For subunits not needing improvement, a 1% reduction below the values in Table 9 for the purpose of habitat management only, with a resulting 1% increase in OMARD and TMARD, will be allowed in any subunit of a BMU within any 10-year period. Exceptions to this 10-year period limit for a subunit could be considered for salvage due to fire, insects, or blowdown as long as such exceptions did not exceed the 1% limit per subunit at any one time and the activities are limited in time as much as possible. Projects, including road obliteration, will not exceed 3 years in duration, all associated roads will be obliterated, and only one project at a time will be permitted per BMU. For subunits identified as needing improvement, a 1% reduction in secure area will be allowed in one subunit of a BMU for the purpose of habitat management only, as long as the reduction is mitigated² with an equal increase in secure area in other subunits in the BMU which will remain in place for 10 years. The result is that after project completion, the amount of secure area in the subunit is returned to the level in Table 9 and the overall secure area within the BMU is increased. In subunits needing improvement, projects, including road obliteration, will not exceed 3 years in duration, all associated roads will be obliterated, and only one project at a time will be permitted per BMU.
- Access values will temporarily increase and secure habitat will temporarily decrease from 1998 values for subunits Gallatin #3 and Hilgard #1 due to the

¹ Secure habitat is defined as those areas having no motorized access routes and no high use trails, >500 meters from motorized access routes and high use trails, in place for a minimum of 10 years, no helicopter use for resource extraction between 3/1 and 11/30, and any new secure habitat that is created to compensate for loss of existing secure habitat will be equivalent or greater in habitat quality using CEM or equivalent technology (Tables 10 and 11), and such areas will be of equivalent area and block size. High-use non-motorized trails defined by the 1998 CEM database. Current data as of 1998 on high use trails will be used to manage secure habitat. There will be no changes in secure area calculations within subunits as a result of future trail use reclassifications until further research can document the influence of human trail use on grizzly bear displacement and mortality risk. It is suggested that research on this issue be a topic for the IGBST. Yellowstone National Park currently closes 21% of the Park at various seasons as per the YNP Bear Management Plan and this further addresses mortality risk and displacement effects within the Park. The existing access management system in YNP meets the needs of the grizzly in YNP. These access standards for motorized use and high use trails do not include over snow use at this time. There are no available data to indicate that snow machines have either effects or no effects on grizzly bear habitat displacement or mortality risk. It is suggested that research on this issue be a topic for the IGBST. As more information becomes available on this issue, the agencies will respond with appropriate management action as necessary.

² Any mitigation will be in place prior to the habitat modification.

Gallatin Range Consolidation Act. Upon completion of this sale and land exchange, access values and secure habitat in these subunits will be improved above the 1998 baseline.

- **Subunits will be managed so there will be no likelihood of detrimental impact to grizzly bears due to increases in the number of developed sites¹ or expansion of existing sites on public lands. Any proposed increase, expansion, or change of use of existing developed sites beyond current site influence boundaries will be analyzed and effects documented through a biological evaluation or assessment to demonstrate no likelihood of detrimental impact to grizzly bears, otherwise any impacts will be mitigated with equal quantity and quality of habitat within that subunit.**
- **Inside the PCA, no new livestock allotments will be created. There will be no increases in permitted sheep AMs. Existing sheep allotments will be phased out as the opportunity arises.**
- **It defines general habitat monitoring parameters that will be measured and reported annually to the Yellowstone Grizzly Management Committee and will be appended to the IGBST annual reports and used to judge the maintenance of sufficient habitat for a recovered grizzly population. These include:**
 - **Monitoring of four major foods. Food abundance data will be compared with information on numbers of human/bear conflicts, grizzly bear management actions, human-caused grizzly mortalities, and changes in distribution of bears. These data will be compiled by the IGBST including interpretations on influences of food availability on population parameters and human/bear conflict rates. Results will be presented in the annual reports of the IGBST. The agencies will use all available means to maintain these foods at or above current levels. Foods that will be monitored include:**
 - **Cutthroat trout spawning numbers in sampled streams.**
 - **Bear use of army cutworm moths and the distribution and number of bears feeding on such moth occurrence sites.**
 - **Ungulate carcass numbers and trends on established transects.**
 - **Whitebark pine cone production and incidence of whitepine blister rust in sampled areas.**
 - **Habitat effectiveness, which is defined as a measure of the availability and accessibility of quality habitat to bears, will be measured in each subunit and BMU inside the PCA by application of the best available system. The Cumulative Effects Model (CEM) will be used to measure relative changes in habitat effectiveness.**
 - **Control actions and human/bear conflicts including bear-livestock depredations inside and surrounding the PCA, will be monitored and reported annually to the Yellowstone Grizzly Management Committee in order to direct management effort at areas of conflict and to better understand the dynamics of the population in relation**

¹ Developed sites include all sites on public lands developed or improved for human use or resource development including campgrounds, trailheads, lodges, resource development, and permitted sites such as oil and gas exploratory wells, production wells, or mines.

to human development and possible changes in food resources.

- **Development on private lands inside the PCA** will be monitored by human/bear conflicts in such areas. Annual reports of such conflicts will be used to identify areas of human/bear conflict related to private land development and to direct management actions and education and outreach efforts to minimize impacts if necessary. In addition, a system is provided that evaluates private land importance to grizzly bears. Land conservation organizations are encouraged to use this system to aid them in prioritizing lands for voluntary conservation easements and other land conservation techniques in cooperation with land owners.
- **Number of elk hunters** inside the PCA and within 10 miles outside the PCA boundary, and number of hunter-related bear deaths will be reported using the best available data annually so that management actions and education and outreach efforts to minimize impacts can be implemented if necessary.
- It outlines **a system to measure and report on all of the above-mentioned parameters and a protocol to respond to population and habitat criteria that are below target levels.** The Interagency Grizzly Bear Study Team (IGBST), a USGS/BRD agency, is tasked with annual scientific analysis and reporting of the population criteria and in being a key participant in the monitoring of the habitat criteria. These data will be reported annually in IGBST annual reports. Should any of the criteria not meet target levels or should there be a combination of events, such as changes in food levels resulting in increased management actions, the IGBST or any member of the Yellowstone Grizzly Management Committee can call for a review of why the criteria are not being met and for a formal report on the impacts to maintaining a recovered population. This review process will be initiated at the end of the calendar year after presentation of the annual summary of all monitoring efforts to the Yellowstone Grizzly Management Committee. Two levels of review are specified:
 - A **management review** is the first step in review of the status of the population in response to falling below population or habitat target levels or other combinations of events, such as reductions in major foods, raising concern about the population or its habitat. The IGBST or any member of the Yellowstone Grizzly Management Committee can initiate a management review by requesting one based on deviations from desired conditions for population, mortality reduction, and habitat parameters as stated in this Conservation Strategy. A team appointed by the Yellowstone Grizzly Management Committee conducts a management review. The IGBST will be a participant in the team that develops the management review report. The report is presented the following spring to the Yellowstone Grizzly Management Committee and made available to the public in written form. This report will detail the problem and what should be done to rectify the situation. The Yellowstone Grizzly Management Committee will act on this report to implement necessary responsive actions.
 - A **status review** is the second step in review of the status of the population. The Fish and Wildlife Service at the request of the Yellowstone Grizzly Management Committee can undertake a status review. There are three ways a status review

can be initiated. It can be initiated by the Yellowstone Grizzly Management Committee based on the results of a management review or continued decline in population and and/or habitat targets. The Fish and Wildlife Service can also independently initiate a status review based on concerns about the population. A petition to the Fish and Wildlife Service to relist the grizzly bear that is deemed to be warranted under Section 4 of the Endangered Species Act can also initiate a status review. To be warranted, such a petition must present credible scientific information that the petitioned action may be warranted. The result of a status review can be relisting the grizzly bear under the Endangered Species Act.

- It details an information and education program that will be ongoing with the public to maintain support for bears and the necessary population and habitat management for a recovered population.
- It lists all existing legal authorities that the Federal and State agencies have that will allow them to implement this Conservation Strategy and to maintain a recovered population.
- It outlines a nuisance bear management protocol and how this protocol will be implemented inside the PCA.
- It outlines responsibilities for the major monitoring and research activities under this Conservation Strategy.
- It details costs for each agency to implement the actions detailed in this Conservation Strategy.

Chronological Listing of Grizzly Bear Recovery Process for the Yellowstone area

- I. Grizzly Bear Recovery Plan revision (1993).
- II. Workshop on habitat-based recovery criteria.
Development of habitat-based recovery criteria draft for Yellowstone area
Agency review
Public comment
Incorporation of comments
Appending criteria to the Recovery Plan
- III. Conservation Strategy Development for the Yellowstone area, including habitat-based recovery criteria.
Agency review.
Public comment.
Incorporation of comments.
Final Conservation Strategy.
MOU to implement the Conservation Strategy signed by all agencies.
- IV. Achievement of recovery targets in the Recovery Plan for demographic values and for habitat criteria specified for that grizzly bear population.
- V. Formal consideration of status change.
- VI. Preparation of Proposed Rule if warranted. Publication of Proposed Rule in Federal Register. Proposed Rule documents the status of the population according to the five factors in ESA Section 4(a)(1) including population and habitat status and references Conservation Strategy for documentation of the existence of adequate regulatory mechanisms.
- VII. Public comment period with public hearings.
- VIII. Consideration and incorporation of public comments and any new information developed as a result of the comment period.
- IX. Publication of Final Rule in Federal Register of status change or continuation of listed status.

MEMORANDUM OF UNDERSTANDING DETAILING AGENCY AGREEMENT TO IMPLEMENT THIS CONSERVATION STRATEGY

The agencies signing this Conservation Strategy agree to use their authorities to maintain and enhance the recovered status of the grizzly bear in the Yellowstone Area by applying the regulatory mechanisms, interagency cooperation, and population and habitat management and monitoring as per the details and responsibilities described in this document.

SIGNATURE PAGE

Regional Director
U.S. Fish and Wildlife Service
Region 6 _____
Date: _____

Regional Director
U.S. Fish and Wildlife Service
Region 1 _____
Date: _____

Regional Forester
U.S. Forest Service
Region 1 _____
Date: _____

Regional Forester
U.S. Forest Service
Region 2 _____
Date: _____

Regional Forester
U.S. Forest Service
Region 4 _____
Date: _____

Director
Idaho Department Fish and Game _____
Date: _____

Director
Montana Department of Fish, Wildlife and Parks _____
Date: _____

Director
Wyoming Game and Fish Department

Date: _____

Director
National Park Service
Intermountain Field Area

Date: _____

Regional Chief Biologist
Central Region
USGS Biological Resources Division

Date: _____

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BACKGROUND

The Yellowstone Area grizzly bear population currently occupies over 6 million acres of habitat, with expansion into adjacent suitable areas occurring or anticipated. Historically, the management of this population and area has been one of intense public interest. Therefore, and because of past high levels of human-caused mortality and the need for humans and grizzlies to coexist, the management of grizzly bears and grizzly bear habitat is intertwined with both social and biological factors.

The management of grizzly bears and their habitat affects human lives both socially and economically. The recovery of grizzly bears in the Yellowstone Area has relied heavily on social acceptance of grizzly bears and agency efforts to manage bears. This continued social acceptance will be a major factor in determining the future success of grizzly bear conservation efforts. Coordination of management and a clear understanding of objectives are important for public understanding, acceptance, and support.

The Yellowstone Area is comprised of diverse land ownership and managed by agencies (State, Federal and local) with dissimilar responsibilities for habitat and species management. Therefore, it is necessary to continue a coordinated grizzly bear management and monitoring program after recovery that crosses jurisdictional and geographic boundaries. This document will guide the coordinated management of the grizzly bear in the Yellowstone Area after the grizzly bear is delisted.

The purpose of this document is to:

1. Describe and summarize the population and habitat management that will apply to the grizzly bear and its habitat in the Yellowstone area after the species is recovered and delisted under the Endangered Species Act; and
2. Demonstrate the adequacy and continuity of agency application of population and habitat management regulatory mechanisms required to assure that the grizzly bear population be maintained.

This document will specifically define those measures needed after recovery and delisting to reasonably assure the population will remain at or above recovery levels described in the Grizzly Bear Recovery Plan (U.S. Fish and Wildlife Service, 1993).

The Conservation Strategy demonstrates and reaffirms agency commitment to continue implementation of management measures that provide reasonable assurance of maintenance of the Yellowstone grizzly and its habitat. The Conservation Strategy will be the primary long-term management guide for management and monitoring of grizzly bear populations and habitat to maintain recovery after delisting.

The agencies commit to careful monitoring of habitat and population values and to responding in a positive adaptive management fashion to problems or changes that may occur. The agencies

commit to use the best available science to modify the size and shape of the PCA or the population and habitat parameters if new information or research indicates this is necessary. This responsive management system is a reasonable approach given the uncertainty in trying to estimate absolute amounts of habitat or absolute numbers of grizzly bears necessary to maintain a recovered and healthy grizzly population.

All agencies signing this document are committed to the continued monitoring and evaluation of the information listed herein as necessary to assess the status of the Yellowstone population and to securing the funding necessary for implementation of the Conservation Strategy.

A strong foundation of State law, legal direction, policy, wildlife agency initiatives, and information and education programs in Montana, Wyoming and Idaho, attest to a State commitment to manage the grizzly bear above recovery levels. In a similar manner, Federal laws and Federal land management plans and policies, Indian Tribal ordinances, local ordinances and private land conservation programs attest to Federal and private landowner commitment to the bear and its habitat in the Yellowstone area.

In summary, continued cooperation among all agencies and the public will ensure necessary support, application of best scientific principles, and interagency management required to maintain a grizzly bear population at or above recovery objectives in the Yellowstone Area. This Conservation Strategy details the structure, procedures, and authorities needed to maintain this cooperative integrated working relationship.



Figure 1. The Primary Conservation Area (PCA) showing Bear Management Unit (BMU) and subunit boundaries.

I. MANAGEMENT DIRECTION

INTRODUCTION

The future management of the Yellowstone grizzly bear population is envisioned as one in which the grizzly and its habitat are conserved as integral parts of the Yellowstone area. Within the Yellowstone area, an area larger than the existing recovery zone, the grizzly bear population and its habitat will be managed utilizing a simple management approach that identifies a Primary Conservation Area (PCA) (Figure 1) and adjacent areas where occupancy by grizzly bears is anticipated and acceptable. The PCA is the existing Yellowstone Grizzly Bear recovery zone as identified in the Grizzly Bear Recovery Plan (USFWS 1993). The size of the existing recovery zone is not being expanded in this approach. Upon implementation of this Conservation Strategy for the Yellowstone area, management through the use of a Recovery Zone line and grizzly bear Management Situations will no longer be necessary, except for those management units such as the Targhee National Forest where the use of the Management Situation lines is an integral part of management under their revised forest plan. The PCA boundary will replace the recovery zone boundary.

Table 1. Area of lands within the PCA by management type.

Management Type	Area (sq. mi.)	% of PCA
NPS (YNP and GTNP)	3640	39.5
USFS Wilderness	3324	36.1
USFS Non-Wilderness	2087	22.7
Private	158	1.7
	9209	

Overall management direction is described for both the PCA and adjacent areas within the YEA. State grizzly bear management plans, Forest Plans and other appropriate planning documents will provide specific management direction for the adjacent areas outside the PCA.

This Conservation Strategy was developed to be the document guiding management and monitoring of the Yellowstone population and its habitat upon recovery and delisting. This approach will remain in place beyond recovery and delisting. Ongoing review and evaluation of the effectiveness of this Conservation Strategy is the responsibility of the State and Federal managers in the Yellowstone area. This Conservation Strategy will be updated by the management agencies every 5 years or as necessary, allowing for public comment in this updating process. Currently, this management group is the Yellowstone Ecosystem Subcommittee of the Interagency Grizzly Bear Committee (IGBC) with technical and scientific review and input by the IGBST. A committee similar in composition and structure to the existing Yellowstone interagency management subcommittee will be responsible for implementing the activities described in this document after recovery and delisting. This committee will be known as the Yellowstone Grizzly Management Committee and will function as a forum through

individual agencies communicate about their roles in implementing this Conservation Strategy. The State and Federal agencies in the Yellowstone area will continue to work together in an organized fashion as a functional committee with chairs and co-chairs rotating between members.

THE AREA NECESSARY FOR A RECOVERED POPULATION

The overall objective of the grizzly bear recovery program is to assure the long term existence of a grizzly population in all areas where a viable population can be sustained south of Canada. The available habitat for bears is largely determined by human activities. The issue of how many grizzlies can live in any specific area is a function of overall habitat productivity, annual production and availability of important foods, and the levels and type of human activities. There is no known way to calculate the number of grizzly bears that can live in an area in relation to ongoing changes in habitat values nor to fully understand the social system of the grizzly and how it is influenced by changes in bear density and related social interactions at various densities. As food availability fluctuates, there are corresponding changes in bear density in important use areas and changes in social tolerance within the bear population. This in turn will affect age-specific survivorship. Additional numbers of bears in many areas will result in increasing human/bear conflicts and resulting erosion of public support for bears and expansion of bear range. All these factors interact.

A viable and therefore recovered population is one that has high long term prospects for survival within acceptable levels of risk. Population size is an important factor in understanding population survival (Boyce 1992, Caughley 1994). However there is no quantitative way to precisely estimate the number of animals required for a viable population of any species (Boyce 1992, 1993). The current Yellowstone grizzly population is growing at approximately 3-4% or more per year (Eberhardt et al. 1994, Boyce 1995, Boyce et al. in press) but other interpretations exist (Pease and Mattson 1999). Boyce (1995) has calculated that the Yellowstone population currently has a probability of extinction of 0.0004 (4/10,000) - a very low probability. But as Boyce points out (1995 p. 6), "Population size alone is not a sufficient criterion for evaluating population viability", and "Even though a population may have increased or decreased over the past 10-20 years, this offers no indication that the population will continue on the same trajectory in the future." The best way to assure a healthy population of grizzly bears is to closely monitor population and habitat parameters and respond when necessary with adaptive management (Walters and Holling 1990) addressing the problems of the population in a dynamic way. That is what this Conservation Strategy is designed to accomplish.

The area within the PCA is 9,209 square miles. It has provided the vast majority of habitat for the currently increasing population in the Yellowstone area. This area will continue to be carefully managed and monitored to maintain habitat effectiveness and habitat security, and to limit access-related disturbance and developed sites on public lands to at or below current (1998) levels. The area where the total population size and human-caused mortality will be monitored is within the PCA and within 10 miles outside the PCA boundary, an area of 14,497

square miles.

OVERALL MANAGEMENT DIRECTION

Primary Conservation Area

The PCA is the present Yellowstone Grizzly Bear Recovery Zone (Figure 1). This area is 9,209 square miles (23,833 square kilometers) in size. It contains the seasonal habitat components needed to support a recovered population within the Yellowstone Area as defined by the Grizzly Bear Recovery Plan (USFWS 1993). A recovered population is one having a high probability of existence into the foreseeable future (> 100 years) and one for which the factors in Section 4(a)(1) of the Endangered Species Act have been successfully addressed. These factors are:

- the present or threatened destruction, modification, or curtailment of its habitat or range;
- overutilization for commercial, recreational, scientific, or educational purposes;
- disease or predation;
- the inadequacy of existing regulatory mechanisms;
- other natural or manmade factors affecting the population's continued existence.

Management emphasis within the PCA (Figure 1) will be to maintain habitat for a recovered grizzly population and to minimize grizzly bear/human conflicts. Management decisions will favor the needs of the grizzly bear population when grizzly habitat and other land uses cannot be made compatible. Individual grizzly bear(s) may be removed or relocated when conflicts occur. Such actions will follow the nuisance bear guidelines in this document and, as such, will not threaten the population. Female bears will receive a higher level of protection than males.

Where human developments result in conditions that make grizzly presence untenable for humans and/or grizzlies (such as campgrounds, summer homes and resorts) grizzly bear presence and factors attracting bears will be carefully managed or actively discouraged. Grizzlies frequenting such developments will be managed according to the nuisance bear guidelines in this document.

Area Outside Primary Conservation Area

This area can be described as those lands outside the (PCA) where the habitat is of value to grizzly bears and where the population is likely to expand, primarily on contiguous public lands.

Where grizzly bear occupancy occurs outside the PCA, or is anticipated and is acceptable (as defined in State grizzly bear management plans and Federal Land Management Plans), minimization of bear/human conflicts will receive high management priority. Management direction will accommodate and incorporate grizzly bear needs with other land use practices, as possible. Individual State wildlife and Federal land management agencies through coordinated

planning processes will establish specific management direction.

The land management agencies recognize the importance of the lands and their management in the area within 10 miles outside the PCA boundary. For this reason grizzly bears will be a part of any impact analysis for all proposed actions in this area.

As State management plans are developed and new information gathered, mortality rates outside the PCA will be reviewed to accommodate population expansion objectives or to limit population expansion where it is undesirable or not feasible.

In developments (such as campgrounds, summer homes, and resorts) where human presence results in conditions, which make grizzly presence untenable for humans and/or grizzlies, grizzly bear presence and factors contributing to their presence, will be actively discouraged. Grizzlies frequenting such developments outside the PCA will be managed according to nuisance bear guidelines developed in State management plans. Care must be exercised in management of activities that can contribute to human/bear conflict within 10 miles outside the PCA boundary as grizzly mortalities from such conflicts in this area count against the mortality limits of the population.

POPULATION CRITERIA

Introduction

The Grizzly Bear Recovery Plan (Recovery Plan) (USFWS 1993) defined a recovered grizzly bear population as one that could sustain a defined level of mortality and is well distributed throughout the recovery zone. The Recovery Plan outlined a monitoring scheme that employed 3 demographic sub-goals to measure and monitor recovery of the Yellowstone grizzly bear population. This Conservation Strategy will require continued monitoring of the parameters required by the Recovery Plan and some additional parameters. The monitoring area will be the PCA and within 10 miles outside the PCA boundary for unduplicated FWCs and for human-caused grizzly mortalities because grizzlies in this area have home ranges that extend into the PCA, making them part of the PCA population. The population criteria to be monitored in this Conservation Strategy include:

- Number of unduplicated sightings of females with cubs of the year seen annually within the PCA and within 10 miles outside the PCA boundary calculated on a running 3 year average;
- Distribution of females with young or family groups throughout the PCA; and
- Limits on annual total and known human-caused bear mortalities within the PCA and within 10 miles outside the PCA boundary.

An additional demographic goal for the Yellowstone population as established in this Conservation Strategy is:

- A stable to increasing population trend as calculated with survival and reproductive rates.

The goal for unduplicated sightings of females with cubs of the year (FWCs) is measured to demonstrate adequate reproduction and to estimate an average minimum population size. Six year averages of the minimum number of FWCs account for two breeding cycles, based on an average 3 year breeding interval. The number of FWCs also demonstrates that a minimum number of adult females are alive within the population to reproduce and offset mortality.

The goal for distribution of females with young (cubs or older offspring) is designed to demonstrate adequate distribution of the reproductive cohort within the PCA. Distribution of family groups also indicates likely future occupancy of these areas because grizzly bear female offspring tend to occupy habitat within or near the home range of their mother after weaning.

Current information indicates that if total human-caused bear mortality exceeds 6.5% (Harris 1986), a stable or increasing population is unlikely in the long term. Mortality limits for the PCA will be set so that no more than 4%¹ of the current total population estimate should be known human-caused mortalities, of which no more than 30 percent should be female. The 6.5 percent level suggested by Harris (1986) was reduced to a conservative four percent limit on known, human-caused mortality to:

1. Facilitate recovery and population expansion into desirable areas;
2. Use a conservative approach; and
3. Assure that unknown, unreported human-caused mortality when added to the known mortality level is not likely to exceed 6.5 percent of the population estimate¹.

Specific Demographic Criteria

The following population conditions will be monitored and maintained:

1. A minimum of 15 unduplicated females with cubs must be confirmed by the Interagency Grizzly Bear Study Team (IGBST) inside the PCA and within 10 miles outside the PCA boundary (14,497 square miles), calculated as a running 6 year average.

Using the number of sightings and resightings of unduplicated females with cubs inside the PCA and within 10 miles outside the PCA boundary, statistical techniques (Appendix I) will

¹ Note: efforts are currently underway to recalculate the unknown mortality level based on data from radio collared bears. As this work proceeds, this 4% rate may change and will be appropriately changed in this document after scientific peer review.

be used to estimate the total number of females with cubs in the population each year. The most recent 3 years of females with cubs calculated with these methods will be summed. The resulting number will be divided by 27.4% (the most recent estimate of the percentage of the population that is adult females (Eberhardt and Knight 1996)) to yield a total population estimate. This total population estimate will be used to calculate the mortality limits for both known total human-caused mortality and known human-caused female mortality that year.

2. Sixteen of 18 Bear Management Units (BMUs) within the PCA and areas adjacent to the boundary BMUs within 10 miles outside the PCA boundary occupied by females with young as confirmed by documented reports by the IGBST from a 6 year sum of observations; and no two adjacent BMUs may be unoccupied during the same 6 year period. Occupancy by family groups is only monitored within the PCA.
3. The running 3-year average for total known, human-caused mortality as confirmed by documented reports by the IGBST is not to exceed 4%¹ of the total population estimate. This is calculated using methods under development as noted in Appendix I, for the most recent year within the primary conservation zone and within 10 miles outside the PCA boundary. The running 3-year average annual known, human-caused female grizzly bear mortality is not to exceed 30 percent of the average four percent mortality limit over the most recent 3 year period. This average mortality limit will be recalculated annually by the IGBST based on the most recent data. Human-caused mortality shall include all known, human-caused mortality from illegal kills, management removals, accidental kills, self-defense kills, and possible sport hunting. The mortality limit will be calculated and must be met within the larger area of the PCA plus 10 miles outside the PCA boundary.
4. Population trend as calculated from survivorship and reproductive rate data from the most recent period shall have a stable or positive trajectory as measured using the Lotka equation and the most recent female survivorship, and reproductive rate data (Eberhardt et al. 1994, Eberhardt and Knight 1996). Population trend will be calculated and must be met with data from within the PCA plus 10 miles outside the PCA boundary.

Mortality Reduction Efforts

Significant reductions in the human-caused bear mortality rate has been the primary reason the bear population is now meeting or close to meeting the demographic sub-goals established in the Grizzly Bear Recovery Plan (USFWS 1993). The following management actions have been underway in the Yellowstone area in the past and have been found to be effective in limiting grizzly bear mortality and human bear conflicts.

¹ Note: efforts are currently underway to calculate the unknown mortality level based on data from radio collared bears. As this work proceeds, this 4% rate may change and will be appropriately changed in the final version of document after scientific peer review.

Mortality reduction actions to continue within the PCA:

1. Human/bear conflicts and grizzly mortalities reviewed annually by the Yellowstone Grizzly Management Committee. An annual analysis of the conflicts and mortalities that identifies causes and proposed management solutions prepared by the IGBST.
2. Experienced staff to work with both Federal and non-Federal landowners in limiting grizzly bear mortality and human bear conflicts.
3. Food storage regulations on public lands.
4. Information and education outreach programs, with emphasis on mortalities associated with identified problem activities. Non-agency participation in the program will be encouraged.
5. When reclaiming or obliterating motorized access routes or restricting motorized or non-motorized access, priority to be given to areas with histories of grizzly/human conflict or areas where such conflicts are probable.
6. Carcasses of livestock and road-killed wildlife are to be managed to minimize grizzly/human interaction. In addition, hunters are encouraged to quickly care for and remove hunter-killed big game carcasses to minimize human/grizzly interactions.
7. Operating plans, grazing permits and special use permits to include a clause for the cancellation or temporary cessation of activities to resolve a grizzly/human conflict, or to eliminate operations that refuse to or are ineffective in complying with food storage orders and sanitation requirements.
8. Inside the PCA, no new allotments created or increases in permitted sheep AMs, existing sheep allotments will be phased out as the opportunity arises.
9. Continue law enforcement efforts including continued cooperation between State and Federal law enforcement agents. A task force of state and federal prosecutors and enforcement personnel from each state and federal jurisdiction will work together to make recommendations to all jurisdictions, counties, and states, on uniform enforcement, prosecution, and sentencing relating to illegal grizzly bear kills.

Mortality reduction actions to be implemented in occupied grizzly habitat outside the PCA to improve public safety and minimize bear mortality:

1. Human/bear conflicts and grizzly mortalities reviewed annually by the Yellowstone Grizzly Management Committee. An annual analysis of the conflicts and mortalities that identifies causes and proposed management solutions prepared by the IGBST and State agencies.

2. Experienced staff to work with both Federal and non-Federal landowners in limiting grizzly bear mortality and human bear conflicts.
3. Strongly encourage mandatory food storage regulations on public lands where bears are present to enhance public safety.
4. Information and education outreach programs, with emphasis on limiting mortalities associated with identified problem activities. Non-agency participation in the program will be encouraged.
5. Encourage management of carcasses of livestock and wildlife to minimize grizzly/human interaction.
6. Operating plans, grazing permits and special use permits to include a clause with information and details on ways to limit grizzly/human conflict. Encourage eliminating operations that refuse to or are ineffective in minimizing bear conflicts and sanitation requirements.
7. Continue law enforcement efforts including continued cooperation between State and Federal law enforcement agents. A task force of state and federal prosecutors and enforcement personnel from each state and federal jurisdiction will work together to make recommendations to all jurisdictions, counties, and states, on uniform enforcement, prosecution, and sentencing relating to illegal grizzly bear kills.

HABITAT CRITERIA

NOTE: The draft grizzly bear habitat criteria for the Yellowstone Ecosystem were published for public comment on July 15, 1999 and the comment period closed on November 15, 1999. These draft habitat criteria, which will be the habitat standards that must be met to achieve recovery of this population, are very similar to the habitat management objectives in this draft Conservation Strategy. This is because the agencies agreed that whatever habitat needs are necessary to get the grizzly population to recovery should also be maintained after recovery in order to assure recovered status. The management agencies are still in the process of reviewing and modifying the draft habitat criteria in response to public comments received. This process has taken longer than expected due to a 60-day extension of the comment period on these habitat criteria and to the complexity of the comments received. There was a commitment to get this draft Conservation Strategy out for public comment by 1 March 2000. Public comments on this draft Conservation Strategy will be used in conjunction with comments previously received on the draft habitat criteria to finalize both documents during 2000. If you have previously commented on the draft habitat criteria, be assured that your comments will be considered during the finalization of both the draft habitat criteria and this Conservation Strategy.

The broad historic distribution of grizzly bears depicts a species with wide adaptive flexibility to the habitats where it existed. Grizzly bears are intelligent and individualistic and have a great capacity for learning during extended maternal care and over a relatively long life. The capacity for life-long learning and adaptability to a variety of food resources, while a great advantage to grizzly survival, makes complete and exact understanding of habitat/ population relationships difficult.

Under conditions without the influence of humans, principally the availability of food resources and the density of bears would determine the distribution and productivity of grizzly bears in the Yellowstone area. However, this is not the present case with humans and bears interacting in most landscapes. The relationship between bear population dynamics and landscape conditions is not fully understood. It is known that it may take years after desired habitat levels are eroded before it is possible to detect long-term effects on the population. By then, the impacts of habitat alteration may be irreversible. Therefore, it is necessary to monitor habitat values important to grizzly bears in addition to monitoring demographic parameters.

Evaluation of habitat effectiveness at the landscape level is best-accomplished using Geographic Information System (GIS) technology. Various analytical processes are available. These include the Cumulative Effects Model (CEM, A model for assessing effects on Grizzly Bears 1990; ICE9 Tool Kit 1997; Mattson et al. in prep.), that defines habitat value (HV) and habitat effectiveness (HE), and the IGBC Motorized Access Management process (IGBC 1994, updated 1998) that evaluates total motorized access route density (TMARD), open motorized access route density (OMARD), and percent secure habitat within bear management subunits.

Motorized access is one of the most influential factors affecting grizzly bear use of habitats (Mace et al. 1996). Open road density has been utilized historically as a measure of human impacts to grizzly bear habitat. Research indicates that in addition to open road density, restricted roads, and motorized trails are important factors in determining habitat use and mortality risk for grizzly bears (Mace et al. 1996, Mace and Waller 1996, Mace and Waller 1997).

HABITAT MANAGEMENT GOAL

It is the goal of habitat management agencies to maintain or improve habitat conditions as of 1998 as measured within each subunit within the PCA.¹

SPECIFIC HABITAT CRITERIA

The following specific habitat parameters will be monitored and maintained on public lands within all subunits:

¹ Land managers of administrative units may proactively improve or rehabilitate habitat to correct past human-caused degradation of habitat effectiveness. Habitat improvements may then be used at a future date to mitigate for impacts of proposed projects of that administrative unit within that subunit.

1. Access¹ measured using the moving window GIS technique (Mace et al. 1996) will be managed as per the following:
 - a. Percent of area at or below the existing level (Table 9) of Open Motorized Access Route Density (OMARD) as of 1998 > 1 mile/square mile within each subunit in season 1 (3/1 – 7/15) and season 2 (7/16-11/30). There are no access standards in the winter season (12/1 – 2/28).
 - b. Percent of area at or below the existing level (Table 9) of Total Motorized Access Route Density (TMARD) as of 1998 > 2 miles/square mile within each subunit in season 1 (3/1 – 7/15) and season 2 (7/16-11/30). There are no access standards in the winter season (12/1 – 2/28).
 - c. To maintain Secure habitat² at or above the existing percentage (Table 9) of secure habitat on public land within each subunit as of 1998 in season 1 (3/1 – 7/15) and season 2 (7/16-11/30). There are no secure habitat standards in the winter season (12/1 – 2/28).
 - d. Access values for certain subunits are in need of improvement including Henrys Lake #1, Henrys Lake #2, Gallatin #3, Plateau #1, the non-Park portion of Plateau #2, and Madison #2. In these subunits, the managers will improve the Secure, OMARD, and TMARD values on public land. The above-mentioned subunits on the Targhee National Forest will be acceptable for Secure, OMARD, and TMARD values upon complete implementation of the access management changes in the revised Targhee Forest Plan Revision (1997). For subunits not needing improvement, a temporary 1% reduction below the secure habitat values in Table 9 for the purpose of habitat management only, with a resulting 1% increase in OMARD and TMARD, will be allowed in any subunit of a BMU. Projects including road obliteration will not exceed 3 years in duration, all associated roads will be obliterated, and only one project at a time will be permitted per BMU. For subunits identified as needing improvement, a temporary 1% reduction in secure area will

¹ These access standards for motorized use and high use trails do not include over snow use at this time. There are no available data to indicate that snow machines have either effects or no effects on grizzly bear habitat displacement or mortality risk. It is suggested that research on this issue be a topic for the IGBST. As more information becomes available on this issue, the agencies will respond with appropriate management action as necessary.

² Secure habitat is defined as those areas having no motorized access routes and no high use trails, >500 meters from motorized access routes and high use trails, in place for a minimum of 10 years, no helicopter use for resource extraction between 3/1 and 11/30, and any new secure habitat that is created to compensate for loss of existing secure habitat will be equivalent or greater in habitat quality to the 1998 levels using CEM or equivalent technology (Tables 7, 11 and 12) and such areas will be of equivalent area and block size. High-use non-motorized trails defined by the 1998 CEM database. Current data as of 1998 on high use trails will be used to manage secure habitat. There will be no changes in secure area calculations within subunits as a result of future trail use reclassifications until further research can document the influence of human trail use on grizzly bear displacement and mortality risk. It is suggested that research on this issue be a topic for the IGBST. Yellowstone National Park currently closes 21% of the Park at various seasons as per the YNP Bear Management Plan and this further addresses mortality risk and displacement effects within the Park. The existing access management system in YNP meets the needs of the grizzly in YNP. These access standards for motorized use and high use trails do not include over snow use at this time. There are no available data to indicate that snow machines have either effects or no effects on grizzly bear habitat displacement or mortality risk. It is suggested that research on this issue be a topic for the IGBST. As more information becomes available on this issue, the agencies will respond with appropriate management action as necessary.

be allowed in one subunit for the purpose of habitat management only, as long as the reduction is mitigated¹ with an equal increase in secure area in other subunits in that BMU which will remain in place for 10 years. The result is that after project completion, the secure area in the subunit is returned to the level in Table 9 and the overall secure area within the BMU is increased. In subunits needing improvement, projects including road obliteration, will not exceed 3 years in duration, all associated roads will be obliterated, and only one project at a time will be permitted per BMU.

e. Access values for subunits Gallatin #3 and Hilgard #1 will temporarily decline below 1998 values due to the Gallatin Range Consolidation Act. Upon completion of this sale and land exchange, access values and secure habitat in these subunits will be improved from the 1998 baseline (Table 9).

2. Subunits will be managed so there will be no likelihood of detrimental impact to grizzly bears due to increases in the number of developed sites² or expansion of existing sites on public lands. Any proposed increase, expansion, or change of use of existing developed sites beyond current site influence boundaries will be analyzed and effects documented through biological evaluation or assessment to demonstrate no likelihood of detrimental impact to grizzly bears, otherwise any impacts will be mitigated³ with an equal quantity and quality (Tables 11 and 12) of habitat in that subunit.
3. Inside the PCA, no new allotments created. No increases in permitted sheep AMs. Existing sheep allotments will be phased out as the opportunity arises.

GENERAL HABITAT MONITORING PARAMETERS

The following general habitat parameters will be monitored and reported annually and used to judge maintenance of sufficient habitat for grizzly bears:

1. Major Foods – There are four food items that have been identified as major components of the Yellowstone Ecosystem grizzly bear diet (Mattson et al. 1991). These are seeds of whitebark pine, army cutworm moths, large ungulates, and spawning cutthroat trout. These foods represent the most concentrated sources of energy available to grizzlies and are very important. Abundance and distribution of these foods will be monitored and reported annually. Introduced organisms, habitat loss, and other human activities have the potential to impact negatively the abundance and distribution of these foods. Research findings indicate that in years of natural food shortages there are more human/bear conflicts and grizzly bear mortalities. Because of natural annual changes in abundance and distribution of these four major foods, threshold values of abundance for each food have not been

¹ Any mitigation will be in place prior to the habitat modification.

² Developed sites include all sites on public lands developed or improved for human use or resource development including campgrounds, trailheads, lodges, resource development, and permitted sites such as oil and gas exploratory wells, production wells, or mines.

³ Any mitigation will be in place prior to the habitat modification.

established. It is important to closely monitor these major foods and the impacts of change to grizzly bears. To monitor these major foods and their importance to grizzly bears, we intend to survey and report on each food annually as per the detailed food monitoring protocols in Appendix III. Food abundance data will be compared with information on numbers of human/bear conflicts, grizzly bear management actions, human-caused grizzly mortalities, and changes in distribution of bears. This analysis will be completed by the IGBST including interpretations of influences of food availability on population parameters and human/bear conflict rates. Results will be presented in the annual reports prepared by the IGBST. If declines in certain foods occur and, using the best available scientific data and techniques, the IGBST concludes these are related to significant increases in bear mortalities and that such increases could threaten the Yellowstone grizzly population, the IGBST shall recommend a status review to the Yellowstone Grizzly Management Committee. Significant declines in important foods could also result in reductions in cub production. Since both human-caused mortality and numbers of females with cubs are measurable criteria monitored annually for the population, any significant decline in important foods would also be reflected in changes in these measurable population criteria.

2. Habitat Effectiveness (HE) - The agencies will measure habitat effectiveness in each BMU and subunit by regular application of the best available system. The Cumulative Effects Model (CEM) will be used to measure relative changes in continued habitat effectiveness (see Tables 7, 11, and 12).
3. Control actions and human/bear and bear-livestock conflicts - All nuisance bear control actions and conflicts will continue to be reported annually by responsible agencies to IGBST and presented to the Yellowstone Grizzly Management Committee. This report details the cause and location of each conflict. Most conflicts are due to availability of human foods or human developments or livestock in bear habitat, and close encounters with backcountry users. This report provides a monitoring tool for identification of locations and causes of habitat conflicts that lead to bear capture and/or removal. It will also display an annual spatial distribution of conflicts that can be used by the managers to identify where problems occur and to compare trends in locations, sources, land ownership, and types of conflicts.
4. Private land development – Categories of development of private land will be gathered and reported by the States in cooperation with land conservation groups to judge changes in development of such areas inside the PCA. This information will be used to direct management and outreach efforts to minimize human/bear conflicts. This information will also be used to judge the effectiveness of efforts to limit conflicts on private lands by comparing changes in development to changes in conflicts on private lands. It is recognized that agencies do not have direct management authority over private lands and that agencies do not have the ability to compensate for all private land development by management actions on public lands. As private lands are developed and as secure habitat on private lands declines, agencies will consider compensatory management in important areas when and if possible on public lands. Where this is not possible, agencies recommend that appropriate organizations seek conservation easements on or direct purchase of these

valuable grizzly habitats.

II. MONITORING AND EVALUATION

INTRODUCTION

The monitoring of the parameters in this Conservation Strategy is dependent upon appropriations to agencies to carry out this work.

The maintenance of a grizzly bear population at or above recovery objectives in the PCA requires careful population and habitat management and monitoring. Monitoring will provide the data necessary for agencies and the public to be assured of a bear population at or above recovery with minimal risk of extinction. Such a monitoring program will provide evidence of the status of the population and its habitat so that necessary responsive conservation measures can be instituted should problems be detected. The population and habitat monitoring program currently in place is a coordinated effort of data collection and verification. Implementation of the coordinated monitoring effort will be continued.

The Interagency Grizzly Bear Study Team (IGBST) will continue to coordinate population and habitat monitoring activities throughout the YEA. The IGBST will synthesize population and habitat monitoring data. The IGBST will prepare an annual scientific analysis of the data and an annual monitoring report. The data and analysis of these data in this annual report will be the basis for judging the status of the population and the habitat in the PCA.

AREA TO BE MONITORED

Monitoring of population parameters will occur throughout the entire YEA. Data will be stratified to the PCA and within 10 miles outside the PCA boundary, and beyond 10 miles outside the PCA boundary. Habitat parameters will be monitored within the PCA. Monitoring of habitat parameters outside the PCA is encouraged.

In an area as large and diverse as the PCA, it is necessary to divide the area into smaller units (referred to as Bear Management Units (BMUs) and subunits. This division facilitates:

1. Assessment of the effects of existing and proposed activities on the bear population and bear habitat without having the effects diluted by consideration of too large an area;
2. Addressing unique habitat characteristics and bear activity/use patterns;
3. Identifying contiguous complexes of habitat, which meet seasonal or year-long needs of the grizzly bear;
4. Establishing priorities for areas where land use management needs would require CEM application; and

5. Evaluating distribution of reproductive females within the PCA. Eighteen Bear Management Units comprised of forty subunits are currently delineated within the PCA.

Table 2. Number of unduplicated females with cubs-of-the-year, average litter size, and 6 year running averages for the years 1973-1998 (IGBST 1999).

Year	F w/COY	Total #	Mean litter size	6-Year running averages		
		cubs		F w/COY	Cubs	Litter size
1973	14	26	1.9			
1974	15	26	1.7			
1975	4	6	1.5			
1976	17	32	1.9			
1977	13	25	1.9			
1978	9	19	2.1	12.0	22.3	1.8
1979	13	29	2.2	11.8	22.8	1.9
1980	12	23	1.9	11.3	22.3	1.9
1981	13	24	1.8	12.8	25.3	2.0
1982	11	20	1.8	11.8	23.3	2.0
1983	13	22	1.7	11.8	22.8	1.9
1984	17	31	1.8	13.2	24.8	1.9
1985	9	16	1.8	12.5	22.7	1.8
1986	25	48	1.9	14.7	26.8	1.8
1987	13	29	2.2	14.7	27.7	1.9
1988	19	41	2.2	16.0	31.2	1.9
1989 ^a	16	29	1.8	16.5	32.3	2.0
1990	25	58	2.3	17.8	36.8	2.0
1991 ^b	24	43	1.9	20.3	41.3	2.1
1992	25	60	2.4	20.3	43.3	2.1
1993 ^a	20	41	2.1	21.5	45.3	2.1
1994	20	47	2.4	21.7	45.8	2.1
1995	17	37	2.2	21.8	47.2	2.2
1996	33	72	2.2	23.2	49.5	2.1
1997	31	62	2.0	24.3	52.7	2.2
1998	35	70	2.0	26.0	54.8	2.1

^a One female with cubs of the year was observed more than 10 miles outside the PCA boundary.

^b One female observed with unknown number of cubs. Average litter size was calculated using 23 females.

POPULATION MONITORING

Monitoring the population is to focus on the demographic criteria, and associated parameters established in the Recovery Plan and in this Conservation Strategy. Additional factors that provide necessary information on the status of the population will also be monitored. The following parameters will be monitored:

Unduplicated Females with Cubs

Monitoring unduplicated FWCs will provide information to demonstrate adequate reproduction and to estimate population size. Total population size will be estimated using the sightings of unduplicated females with cubs and the statistical approach described in Appendix I. Information will be collected both within the PCA and within 10 miles outside of the PCA boundary (Figure 2). The number of FWCs can also be used to demonstrate that a sufficient number of adult females are alive within the population to reproduce and offset existing levels of human-caused mortality. These data will be stratified so they can be evaluated in regards to population management conditions established for the PCA.

Sightings of FWCs and females with yearlings will be obtained from numerous sources, including radio tracking flights, confirmed sightings, and observation flights. Observation flights are primarily designed to survey all existing BMUs to obtain these data. The number of flights conducted in each BMU is standardized to assure equal effort in obtaining data. The specific details on the protocol for survey flights are under development by the IGBST, statistical consultants, and cooperating agencies and will be available in 2000. The IGBST and State wildlife agencies will verify reliability of all sightings. The IGBST will plot all sightings and summarize data for unduplicated females and numbers of cubs seen for the entire population (Fig. 3). Methodology developed by Knight et al. (1995) will be used to separate duplicated from unduplicated sightings.

Unduplicated females with cubs sightings will be reported as an annual total and as a 6 year running average. The number of unduplicated females with cubs will be reported for the PCA and within 10 miles outside the PCA boundary.

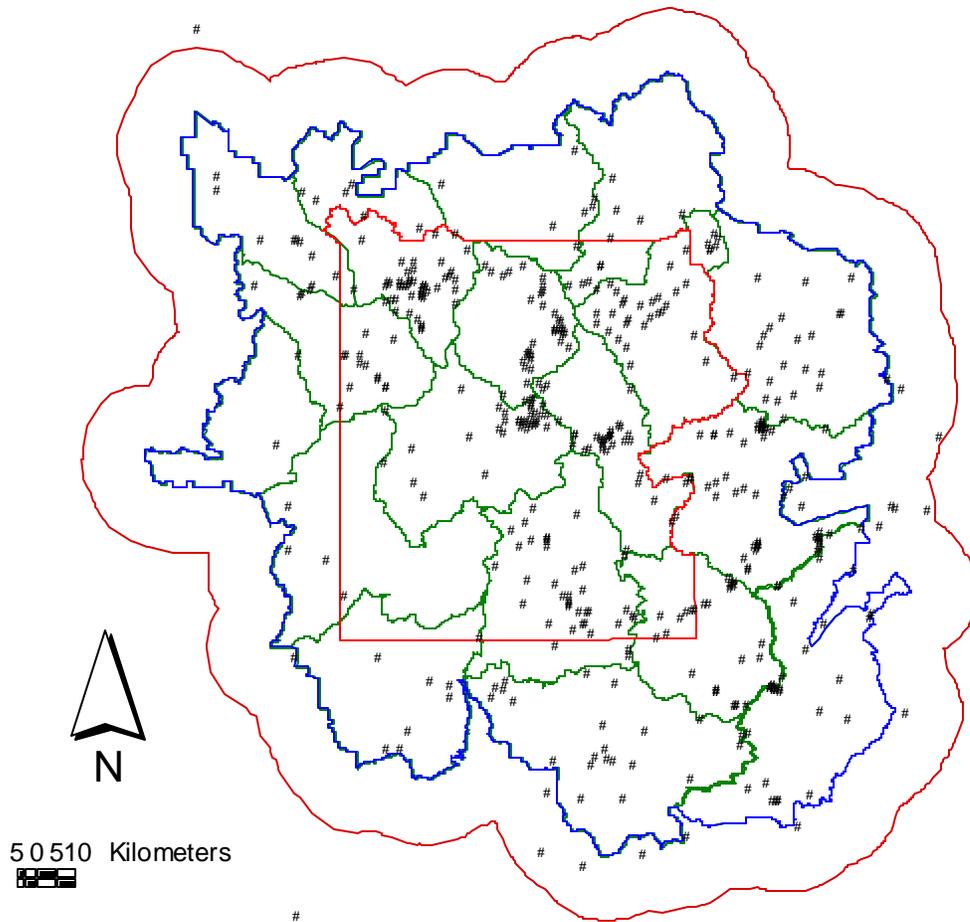


Figure 2. Distribution of unduplicated sightings of females with cubs in the Yellowstone area 1973-98 (IGBST data).

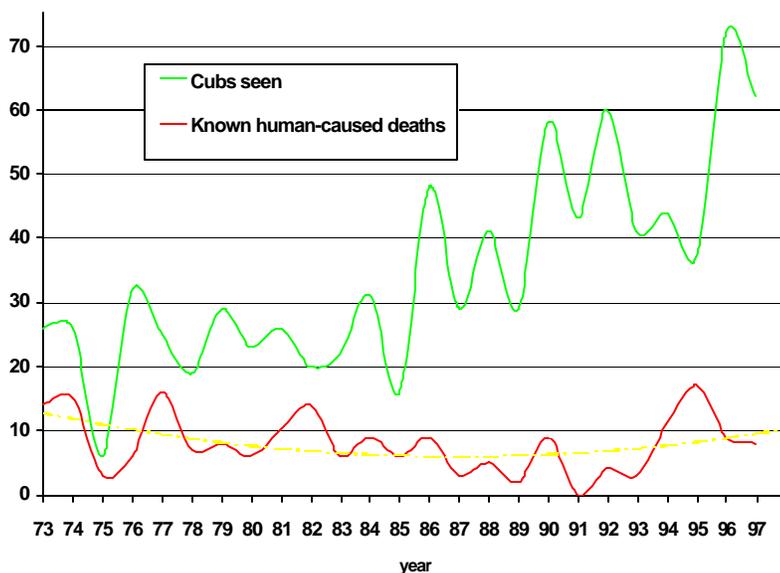


Figure 3. Cubs known to be born compared with all known human-caused deaths, Yellowstone area, 1973-1997.

These data will be maintained by the IGBST and will be used to estimate both minimum and total population size. The total population estimate will be used with the methods presented in Appendix II to set the annual human-caused mortality limits. These calculations will be completed annually by the IGBST and reported in the IGBST annual report.

Unduplicated females with cubs outside the 10-mile boundary of the PCA will also be documented, but will not be used in estimating population size for the PCA.

Distribution of the Population

Monitoring will focus on the distribution of females with young. This effort will provide information to assess distribution of the reproductive cohort within the PCA and adjacent areas. A recovered population will be well-distributed throughout the PCA. Successful reproduction can be one indicator of habitat sufficiency, thus distribution of family groups is one indicator of suitable habitat in areas where such sightings occur. Since subadult females usually establish home ranges adjacent to that of their mother, the distribution of family groups is also an indication of future occupancy of these areas by grizzly bears.

Table 3. Bear Management Units occupied by verified female grizzly bears with young (cubs-of-the-year, yearlings, 2 year olds, or young of unknown age) for the years 1992-1998 (IGBST 1999).

Bear Management Unit	1993	1994	1995	1996	1997	1998	Years occupied
1) Hilgard	X	X	X		X		4
2) Gallatin	X	X	X	X	X	X	6
3) Hellroaring/Bear	X				X		2
4) Boulder/Slough			X	X	X	X	4
5) Lamar	X	X	X	X	X	X	6
6) Crandall/Sunlight	X		X		X	X	4
7) Shoshone	X	X	X	X	X	X	6
8) Pelican/Clear	X	X	X	X	X	X	6
9) Washburn	X	X		X	X	X	5
10) Firehole/Hayden	X	X	X	X	X	X	6
11) Madison	X	X			X	X	4
12) Henrys Lake			X		X	X	3
13) Plateau		X					1
14) Two Ocean/Lake	X	X	X	X	X	X	6
15) Thorofare	X	X	X	X	X	X	6
16) South Absaroka	X	X	X	X	X	X	6
17) Buffalo/Spread Creek	X	X	X	X	X	X	6
18) Bechler/Teton	X		X	X	X	X	5
Totals	15	13	13	12	17	15	

Each BMU within the PCA will be monitored on an annual basis to determine occupancy by females with young. As with monitoring of unduplicated FWCs, only reliable data will be used to monitor this criterion. Data will be maintained by the IGBST. Radio tracking flights, observation flights and agency personnel sighting reports will be the primary methods employed. The IGBST will verify all reports and keep a record of locations.

The number of BMUs occupied by females with young will be reported as an annual total and a running 6-year sum of observations in each BMU. Females with young outside the PCA will also be reported, but only those females with young within the PCA and within 10 miles outside the PCA boundary will be monitored to document achievement of population criteria.

Table 4. Known (includes probable) grizzly bear deaths, 1973-1998 (IGBST 1999).

Year	All bears				All adult females			
	Man-caused		Other ^a		Man-caused		Other	
	In ^b	Out ^b	In ^b	Out ^b	In ^b	Out ^b	In ^b	Out ^b
1973	14	0	3	0	4	0	0	0
1974	15	0	1	0	4	0	0	0
1975	3	0	0	0	1	0	0	0
1976	6	0	1	0	1	0	0	0
1977	16	0	1	0	6	0	0	0
1978	7	0	0	0	1	0	0	0
1979	8	0	0	0	1	0	0	0
1980	6	0	4	0	1	0	0	0
1981	10	0	3	0	3	0	2	0
1982	14	0	3	0	4	0	0	0
1983	6	0	1	0	2	0	0	0
1984	9	0	2	0	2	0	0	0
1985	6	0	7	0	2	0	0	0
1986	9	0	2	0	2	0	0	0
1987	3	0	0	0	2	0	0	0
1988	5	0	8	0	0	0	2	0
1989	2	0	1	0	0	0	0	0
1990	9	0	0	0	6	0	0	0
1991	0	0	0	0	0	0	0	0
1992	4	0	4	0	0	0	0	0
1993	3	0	2	0	2	0	1	0
1994	11	0	1	0	4	0	0	0
1995	17	0	1	0	3	0	0	0
1996	9	0	6	0	3	0	0	0
1997	8	2	9	0	3	0	0	0
1998	1	2	-	-	1	0	-	-

^a Includes deaths from natural and unknown causes.

^b In refers to inside the PCA (formerly the recovery zone) or within 10 miles outside the PCA boundary. Out refers to more than 10 miles outside the PCA boundary.

Table 5. The list of 1997 grizzly bear mortalities showing the level of detail reported. Probable mortalities are those where there is evidence of death that validates the death of a bear such as excessive blood and tissue at a shooting site or a cut-off radio collar. This level of detail will continue to be maintained under this Conservation Strategy (IGBST 1998).

Bear	Sex	Age	Date	Type	Location ^a	Cause
unm	Unk	Cub	10/15	Known	Wapiti Cr., GNF	Unk: scavenged carcass found
unm	M	Ad	10/26	Known	Tom Miner, GNF	Man: self defense by hunter
297	M	Ad	10/4	Known	Little Wapiti Cr., GNF	Man: self defense by hunter
unm	M	Cub	5/21	Known	Diamond G Rch, WY	Nat: suspected bear predation
unm	M	SAd	5/8	Known	W. of Red Lodge, MT	Man: illegal ^b
G62	M	Cub	6/18	Known	Norris Geyser, YNP	Nat: suspected bear predation ^c
unm	M	Cub	6/7	Known	Diamond G Rch, WY	Nat: suspected bear predation
293	M	SAd	8/26	Known	Upper Green R., BTNF	Man: mgt removal ^b
254	F	Ad	9/15	Known	Cabin Cr., GNF	Man: self defense by hunter
unm	F	Ad	9/15	Known	Silvertip Cr., BTNF	Man: self defense by hunter ^d
unm	F	Yrl	9/15	Known	Silvertip Cr., BTNF	Man: self defense by hunter ^d
unm	M	Yrl	9/15	Known	Silvertip Cr., BTNF	Man: self defense by hunter ^d
unm	M	Yrl	9/15	Known	Silvertip Cr., BTNF	Man: self defense by hunter ^d
unm	Unk	Ad	10/5	Probable	Thorofare, BTNF	Nat: unk., injured bear obs. by hunter
unm	Unk	Cub	5/6-7/22	Probable	Hellroaring R., CNF	Nat: unknown, cub disappeared
unm	Unk	Cub	5/6-7/22	Probable	Hellroaring R., CNF	Nat: unknown, cub disappeared
unm	F	Ad	9/2	Probable	Coyote Cr., BTNF	Man: self defense by hunter (2 COY)
unm	Unk	Cub	9/20-26	Probable	Swan Flats, YNP	Nat: unknown, cub disappeared
unm	Unk	Cub	9/3-9	Probable	Dunoir R., SNF	Nat: unknown, cub disappeared
unm	F	Ad	10/5	Possible	Copper Cr., GNF	Hunter shot at bear during/after mauling

^a GNF=Gallatin National Forest, YNP=Yellowstone National Park, BTNF=Bridger-Teton National Forest, CNF=Custer National Forest, SNF=Shoshone National Forest

^b Greater than 10 miles outside the PCA boundary

^c Injured cub was captured, examined, and euthanized

^d All shot by same hunting party in one encounter

Mortality

The mortality calculation method is detailed in Appendix II. Harris (1986), reported that grizzly bear populations having the characteristics of those in the interior Rocky Mountains can sustain 6.5 percent human-caused mortality without population decline when no more than 30 percent of the mortalities are females. The most recent 3 year sum of unduplicated FWCs from within the PCA and in the 10 mile area outside the boundary of the PCA, minus the number of known human-caused adult female (5 years of age or older) deaths, divided by the percentage of the population that is adult females derived from capture data, have been used in the past to calculate a minimum population estimate. New methods using sightings and resightings of females with cubs (noted in Appendix I) will be used to calculate total population size and 4%¹ of this total population size will be the mortality limit. Efforts to calculate the unknown, unreported mortality level continue¹. The continued use of the 4% known human-caused mortality level for Yellowstone will be modified if necessary pending the results of the recalculation of unknown, unreported mortality. The current ratio is 2 known mortalities : 1 unknown mortality, thus known mortality is 66.6% of actual mortality (2 known of 3 total mortalities). If we allow an upper limit of documented mortality of 4%, then the actual limit is 6% (0.04/0.666)¹.

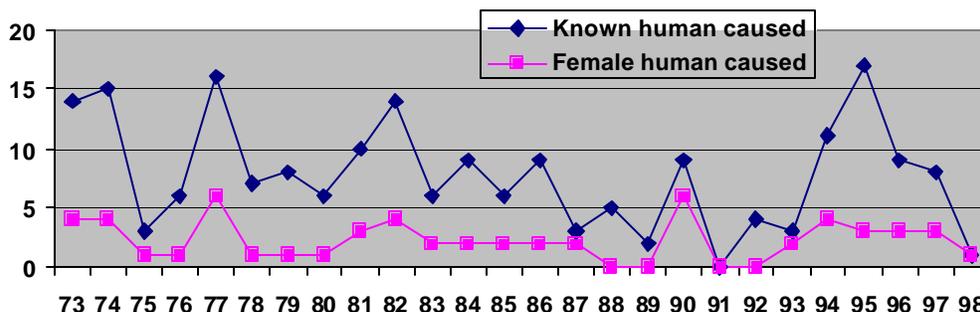


Figure 4. Known human-caused mortality for grizzly bears in the recovery zone (Primary Conservation Area) and within 10 miles outside the boundary, 1973-98 (IGBST data).

The area within 10 miles outside the PCA boundary is intended to assure that adult females living along the periphery, which may spend some time both inside and outside the area, are counted as part of the population. All human-caused mortalities within the PCA and within 10 miles outside the PCA boundary will be managed not to exceed this four percent limit.

Known, human-caused mortality will be limited to no more than 4%¹ of the population size calculated for the PCA and within 10 miles outside the PCA boundary in order to:

¹ Note: efforts are currently underway to recalculate the unknown mortality level based on data from radio collared bears. As this work proceeds, this 4% rate may change and will be appropriately changed in the final version of this document after scientific peer review.

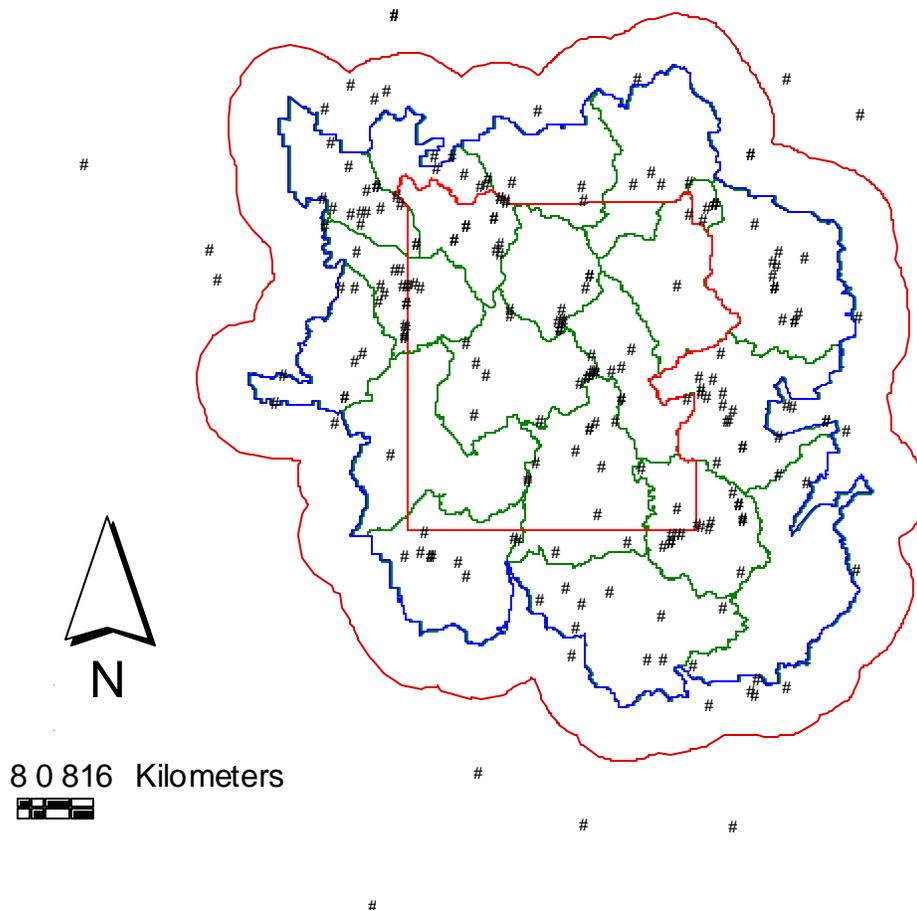


Figure 5. Distribution of 232 known and probable human-caused grizzly bear mortalities in the Yellowstone area. Outer line is 10 miles beyond the Primary Conservation Area boundary. 1975-1998 data (IGBST data).

1. Maintain secure recovered status and assure a vigorous population;
2. Assure human-caused mortality is within sustainable limits; and
3. Account for unknown, unreported human-caused mortality.

Mortality will be monitored by reports from all sources. Each State wildlife agency and National Park will provide mortality information to Montana Fish Wildlife and Parks (MDFWP) who will annually summarize all mortality information as to location, type, date, sex, and age for the Yellowstone Area (YEA). This report will be appended to the IGBST annual report for that year.

Population Trend

Although the most frequently asked question about any population is "how many are there?", whether or not the population is increasing or decreasing is of more value. Total counts of grizzly bear populations are difficult to obtain without specific sighting data and the application of techniques as noted in Appendix I. Such counts usually provide only a single picture of the population with no information as to trend.

Estimates of population trend using critical population parameters can yield the rate of change in a population and also proximate causes for the change. Using the statistical method called bootstrapping and the Lotka equation as described in Eberhardt et al. (1994) and Eberhardt (1995), it is now possible (given sufficient data) to estimate the population trajectory of a grizzly bear population with confidence limits. To use this method, female survivorship and reproductive rate must be monitored.

The agencies will strive to maintain a minimum of 25 adult female grizzly bears fitted with mortality-sensing radio collars and monitored at all times. These 25 females will be spatially distributed throughout the PCA to adequately sample survivorship. The target distribution of these 25 radio-collared adult females is: 40% (10) in Wyoming, 40% (10) in Yellowstone National Park (YNP), 15% (4) in Montana, and 5% (1) in Idaho. This distribution of the target number of radio-marked adult females may be changed as necessary by the IGBST. Each female will be monitored once per week (weather permitting) with aerial telemetry flights during the non-denning period. These data will be collected in conjunction with other regularly scheduled relocation flights. When a radio collar indicates that a bear may have died, a field crew will evaluate the actual status of the female and determine cause of death.

At the end of each bear year (spring through fall) the survival information will be combined with that of previous years to arrive at a composite female survivorship rate for the most recent period. This survivorship rate along with the most recent reproductive rate information will be recalculated regularly by the IGBST to update the trend of the population. Data from females with one or more complete reproductive cycles will be used in these calculations.

Genetic Diversity Monitoring

Appendix IV presents a review of the issue of monitoring genetic diversity in populations of grizzly bears. This includes continued baseline monitoring of all populations and those contiguous populations in Canada. The Yellowstone population is of most concern because it is the only isolated population, other than the North Cascades (where no data are currently available), and in any isolated population, genetic declines over time are to be expected. Data on population fitness indicates that current levels of genetic diversity in the Yellowstone population are not resulting in deleterious effects, although it is likely that the genetic diversity is lower now than when the population was contiguous with other populations. An ongoing loss below current levels could lead to detrimental conditions, therefore maintenance of existing levels of diversity at a minimum are desirable. Table 6 shows the current level of

genetic diversity in the NCDE and Yellowstone as compared to some other healthy North American brown bear populations (from Waits, et al. 1998).

Table 6. Genetic variability within healthy North American brown bear populations based on nuclear DNA microsatellite analysis averaged over 8 loci (from Waits et al, 1998).

Population	Alleles	Diversity	Sample size
Kodiak Island, Alaska	2.1	26.5%	34
Kluane National Park, Canada	7.4	76.2%	24
East Slope, Alberta, Canada	6.4	65.6%	30
NCDE, Montana, USA	6.8	70.3%	35
Yellowstone, USA	4.4	55.5%	46

Diversity is calculated by $h = (1 - \sum x_i^2) / (n - 1)$, where x_i is the frequency of the i th lineage (allele) and n is the sample size.

The purpose of genetic monitoring is to assure no significant decline from current levels of genetic diversity in the Yellowstone population. To maintain a sample of the genetics of all populations, all cooperating agency personnel handling grizzly bears for research or management purposes will collect samples of blood and tissue from each new individual captured, and all dead bears not previously sampled. Techniques for collection and handling of samples will be developed and distributed to all agencies by the IGBST. Samples will be tested for genetic heterozygosity by a cooperative effort of the IGBST and recognized genetic experts. Changes in genetic monitoring and augmentation criteria will be made as necessary.

Although there is some concern about the ability to detect changes in diversity in the population with the limited number of samples collected each year and the limited number of loci sampled, changes in genetic heterozygosity will be measured comparing at least 16 of the same DNA microsatellite loci from each bear sampled¹. Statistically significant declines will be measured using a paired T-test with the significance level to be determined through ongoing consultations with genetic experts. ($p < 0.05$).

Simulations of genetic heterozygosity changes per generation will be conducted using data gathered by ongoing sampling and new techniques as available, and the results will be used to aid in interpretation of the allele frequency data from field collections.

¹ Diversity or heterozygosity will be calculated by $h = (1 - \sum x_i^2) / (n - 1)$, where x_i is the frequency of the i th lineage (allele) and n is the sample size.

Given that continued isolation of the Yellowstone population will eventually result in declines in genetic diversity, opportunities to enhance and maintain linkage between Yellowstone and other grizzly populations to the north should be pursued. Such linkage will increase the probability that bears may eventually move between Yellowstone and other populations and would decrease declines in genetic diversity.

HABITAT MONITORING

Habitat Effectiveness

GIS databases of human activities, vegetation, and key grizzly bear foods are in various stages of completion for the PCA. These GIS databases and an associated cumulative effects analysis model (CEM, A model for assessing effects on Grizzly Bears, 1990 and ICE9 Tool Kit, 1997) are the result of more than a decade of interagency effort. Interagency mapping protocols and procedures (Despain and Mattson 1986) have been developed and approved for the PCA. Emphasis and funding to complete databases and validate both the databases and CEM will continue.

The Interagency Grizzly Bear Study Team is presently evaluating the application of the CEM. CEM will not be used as a specific habitat monitoring tool until it is thoroughly tested. Instead, CEM will be used as a general habitat monitoring tool to measure relative changes in habitat.

One of the outputs of the CEM is habitat effectiveness or HE. Habitat effectiveness for grizzly bears incorporates such factors as vegetal foods, security cover, roads, edge, and animal food protein sources into one cumulative index reflecting base available habitat. Habitat effectiveness reflects existing condition of the habitat. It represents the potential value of the habitat minus the reduction in value due to human activity. Seasonal habitat effectiveness will be monitored and reported for each subunit and BMU. The 1998 HE values for each subunit are presented in Table 7.

Unique Food Sources

Within the Yellowstone PCA, grizzly bears utilize several food sources that are limited in distribution and annual availability but are extremely important to segments of the population if not the population as a whole. These food sources are accounted for in the overall base habitat value of a BMU or subunit of a BMU. Continued monitoring is necessary to quantify the annual production of these foods and to update and calibrate the CEM. Monitoring these important foods provides managers with some ability to predict seasonal bear habitat use, estimate, prepare for, and avoid human/bear conflicts due to a shortage of one or more foods, and develop an awareness of any changes in future existence or availability of these major foods that may impact grizzly bear recovery.

Army cutworm moths (*Euxoa auxiliaris*), ungulates, cutthroat trout (*Oncorhynchus clarki*), and

whitebark pine (*Pinus albicaulis*), are some of the highest sources of digestible energy available to grizzly bears in the Yellowstone area (Mealey 1975, Servheen et al. 1986,

Pritchard and Robbins 1990, Craighead et al. 1995). These food sources may exert a positive influence on grizzly bear fecundity and survival. Each of these food sources is limited in distribution and subject to wide annual fluctuations in availability. During years when these food sources are abundant there are very few human/bear conflicts in the Yellowstone ecosystem (Gunther et al. 1997). In contrast, during years when there are shortages of one or more of these foods, human/bear conflicts are more frequent and there are generally higher numbers of human-caused grizzly bear mortalities (Mattson et al. 1992a, Mattson et al. 1992b, Gunther et al. 1997).

Whitebark pine, ungulates, cutthroat trout, and army cutworm moths are currently monitored either directly or indirectly on an annual basis. Existing monitoring programs will be continued under this Conservation Strategy, however, these programs may be changed to incorporate new technological advances in monitoring techniques or new knowledge of bear habitat use in the Yellowstone ecosystem. Existing monitoring programs may be expanded beyond the PCA to areas currently being used by bears or areas predicted for future use by bears. Detailed study plans for each of the existing monitoring programs described in this section are available from the IGBST.

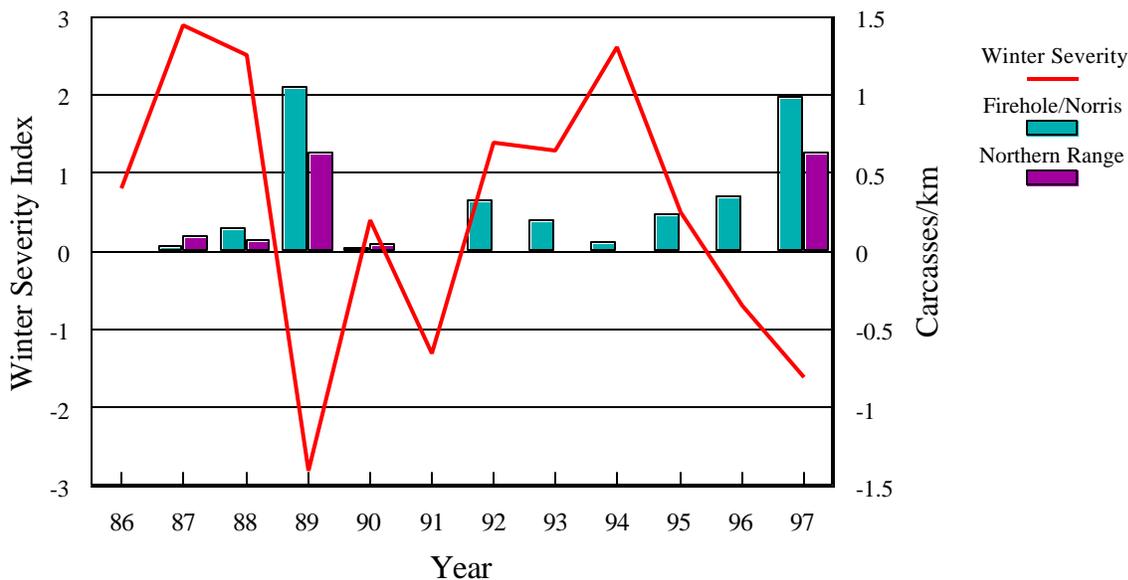


Figure 6. Ungulate carcasses observed per kilometer for two survey areas plotted against winter severity index for elk on the northern range of Yellowstone (IGBST 1998). The lower the number on the y-axis, the worse the winter.

The four major grizzly bear food monitoring methods are:

Winter-killed Ungulate Carcass Surveys

The Yellowstone ecosystem is unique among areas in North America inhabited by grizzly bears in that ungulates are a major food source, as indicated by bear scats (Mattson 1997), feed site analysis (Mattson 1997), and bear hair isotope analysis (Hilderbrand, et al. 1999). On average, approximately 79% of the diet of adult male and 45% of the diet of adult female grizzly bears in the Yellowstone ecosystem is meat (Hilderbrand, et al. 1999). In contrast, in Glacier National Park, over 95% of the diets of both adult male and female grizzly bears is vegetation (Hilderbrand, et al. 1999). Ungulates rank as the second highest source of net digestible energy available to grizzly bears in the Yellowstone Area (Mealey 1975, Pritchard and Robbins 1990, Craighead et al. 1995). Ungulates are also important to bears because they provide a high quality food source during early spring before most vegetal foods become available. Grizzly bears with home ranges in areas with few vegetal foods depend extensively on ungulate meat (Harting 1985). Grizzly bears feed on ungulates primarily as winter-killed carrion from March through May (Mattson and Knight 1992, Green et al. 1997). There are currently 30 spring ungulate carcass survey routes in YNP and 11 on the GNF (IGBST 1998). Data from these survey efforts will be used to update protein values in the CEM. Under this Conservation Strategy, monitoring of winter-killed ungulate carcass availability will continue and the results summarized and reported annually. Current survey methods may be redesigned or modified when appropriate. For instance, use of annual ungulate population counts in conjunction with a winter severity index and periodic field surveys (once every 5 or 10 years) may be a more cost effective method for estimating carcass availability than methods currently used.

Grizzly bears also obtain ungulate meat through predation on elk calves (Cole 1972, Craighead et al. 1995) primarily from mid-May through early-July (Gunther and Renkin 1989), although some individual bears successfully prey on elk calves all through the spring, summer, and fall seasons (YNP unpubl. data). As part of this Conservation Strategy, the need and feasibility of monitoring elk calf production in the Yellowstone ecosystem will be examined by appropriate agencies. Elk calf production may be incorporated into long term ungulate monitoring programs.

Cutthroat Trout Spawning Stream and Associated Bear Use Surveys

Due to their high digestibility and protein and lipid content, spawning cutthroat trout are one of the highest sources of digestible energy available to bears in YNP (Mealey 1975, Pritchard and Robbins 1990). Grizzly bears are known to prey on cutthroat trout in at least 36 different streams tributary to Yellowstone Lake (Hoskins 1975, Reinhart and Mattson 1990). In 1987, Reinhart and Mattson (1990) estimated that approximately 44 different bears were making use of spawning streams around Yellowstone Lake.

Surveys of spawning cutthroat trout and associated bear use are currently conducted by YNP and IGBST personnel on 21 tributary streams around Yellowstone Lake (Figure 7). In

addition, YNP fisheries biologists run several weirs and a large scale gill-netting trout monitoring program on Yellowstone Lake. Under this Conservation Strategy, monitoring of the cutthroat trout population will continue on a long term basis. Current surveys may be modified to incorporate new techniques and technological advances. The surveys are conducted to monitor the timing and relative magnitude of cutthroat trout spawning runs and associated bear activity along spawning streams (Andrascik 1992, Olliff 1992). YNP uses the information to manage recreational activity in developed areas that are adjacent to clusters of spawning streams and to reduce the potential for human/bear conflict in these areas (Andrascik 1992, Olliff 1992). In 1994, non-native lake trout (*Salvelinus namaycush*) were discovered in Yellowstone Lake. The potential effects on the native cutthroat trout populations and associated bear fishing activity are severe (National Park Service 1994). YNP intends to revise its monitoring program for Yellowstone Lake cutthroat trout to provide

Table 7. Cumulative Effects Model (CEM) outputs for 1998 Habitat Effectiveness (HE) values for each of 4 seasons for each of the 40 Yellowstone ecosystem grizzly bear management subunits.¹

	Spring (3/1-5/15)	Estrus (5/16-7/15)	Early Hyperphagia (7/16-8/31)	Late Hyperphagia (9/1-11/30)
Subunit	HE	HE	HE	HE
Crandall/Sunlight#1	53	94	78	800
Crandall/Sunlight#2	52	82	124	329
Crandall/Sunlight#3	53	50	156	208
Plateau#1	26	49	36	109
Plateau#2	75	81	56	442
Gallatin#1	139	144	198	635
Gallatin#2	104	97	105	585
Gallatin#3	78	69	89	599
Buffalo/Spread Cr#1	79	86	78	267
Buffalo/Spread Cr#2	58	98	125	863
Shoshone#1	39	50	115	264
Shoshone#2	51	56	1424	387
Shoshone#3	65	57	583	484
Shoshone#4	57	78	327	392
South Absaroka#1	55	57	392	399
South Absaroka#2	41	45	339	250
South Absaroka#3	46	73	303	551
Firehole/Hayden#1	96	189	162	244
Firehole/Hayden#2	45	843	66	342
Thorofare #1	84	488	298	956
Thorofare #2	79	82	295	583
Boulder/Slough#1	105	105	119	853
Boulder/Slough#2	123	112	111	521
Hellroaring/Bear#1	85	74	95	678
Hellroaring/Bear#2	117	99	98	628
Hillgard#1	99	68	91	614
Hillgard#2	81	97	132	902
Lamar#1	127	118	136	571
Lamar#2	132	167	180	795
Madison#1	53	115	227	390
Madison#2	41	60	147	63
Pelican/Clear#1	103	324	105	560
Pelican/Clear#2	105	2253	203	997
Two Ocean/Lake#1	115	1300	64	426
Two Ocean/Lake#2	117	2401	107	1079
Washburn#1	121	110	126	404
Washburn#2	99	86	85	272
Bechler/Teton#1	116	64	44	274
Henry's Lake#1	41	39	32	178
Henry's Lake#2	41	41	33	225

¹ Bevins 1997, Mattson et.al. in prep, USDA Forest Service 1990

data for evaluating long term trends in cutthroat trout population dynamics and associated grizzly bear fishing activity. The park is implementing a long term control program to reduce the impact of lake trout on the native cutthroat population. Results of these efforts will be reported annually and adaptive management techniques will be used to refine control efforts and aquatic monitoring programs. Data from these surveys will be used to update CEM values and evaluate long term trends in numbers of spawning cutthroat trout.

Moth Aggregation Sites

Alpine moth aggregations are an important food source for a significant portion of the Yellowstone grizzly bear population (Mattson et al. 1991). As many as 51 different grizzly bears have been observed feeding at moth sites on a single morning (French et al. 1994). Some bears may feed almost exclusively on moths for a period of over one month (French et al. 1994). Moths have the highest caloric content per gram of any other bear food (French et al. 1994) and are available during the late summer-early fall periods when bears are consuming large quantities of foods in order to acquire sufficient fat levels for winter (Mattson et al. 1991). A grizzly bear feeding extensively on moths over a 30 day period can consume 47%, close to half, of its annual energy budget of 960,000 calories (White 1996). Moths are also valuable to bears because they are located in relatively remote areas, thereby reducing the potential for human/bear conflict during the late-summer tourist months. During years when moths are abundant on high elevation moth sites, there are few grizzly human/bear conflicts at nearby low elevation human developments (Gunther et al. 1997). During years when moths are absent from the high elevation talus slopes, there are generally more grizzly human/bear conflicts at nearby low elevation human developments (Gunther et al. 1997). Bear use of moth aggregation sites has been noted during radio tracking and observation flights. Bear use of these sites will be used as an indirect measure of moth abundance. Aerial surveys for moth use will be conducted annually on representative moth feeding sites. Results will be summarized and reported in the IGBST annual report. The IGBST, WGF, and YNP are currently evaluating potential alternative methods for monitoring moth abundance and ecology.

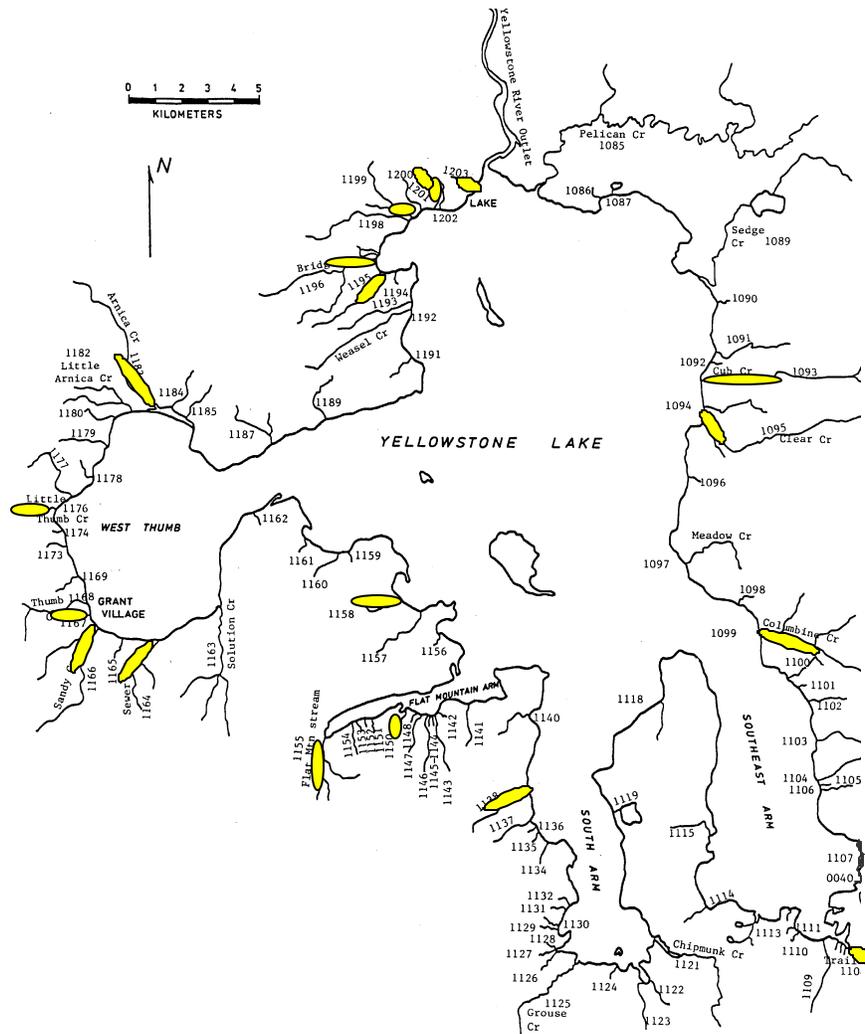


Figure 7. Yellowstone Lake and location of cutthroat trout spawning streams surveyed (highlighted) for spawner numbers and grizzly bears use (IGBST 1998).

Whitebark Pine Cone Production Surveys

Due to their high fat content and potential abundance as a pre-hibernation food, whitebark pine seeds are an important fall food for bears in the Yellowstone ecosystem (Mattson and Jonkel 1990). Yellowstone grizzly bears consume whitebark pine seeds extensively when whitebark cones are available. Bears may feed almost predominately on whitebark pine seeds when production exceeds 22 cones per tree (Mattson et al. 1992). During years of low

whitebark pine seed availability, grizzly bears often seek alternate foods at lower elevations in association with human activities and the number of nuisance bear management actions and human-caused grizzly bear mortalities both increase during fall (Mattson et al. 1992, Knight and Blanchard 1994, Gunther et al. 1997). During years when whitebark pine nuts are abundant, there are generally very few grizzly human/bear conflicts during the fall season (Mattson et al. 1992, Gunther et al. 1997).

Currently there are 19 whitebark pine cone production transects (Fig. 8) within the Yellowstone Area, nine of which have been monitored on an annual basis since 1980 (Knight et al. 1997). Monitoring of whitebark pine cone production using current or modified methods will continue under this Conservation Strategy. New transects may be added or methods changed as knowledge of bear use of this resource evolves. Results will be summarized and reported annually in the IGBST annual report.

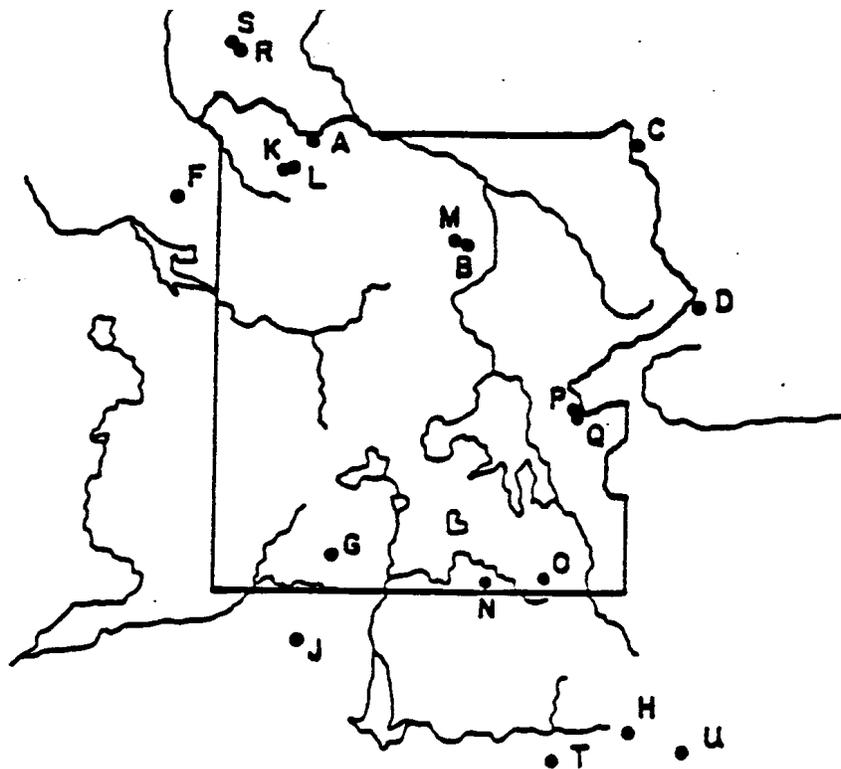


Figure 8. Location of whitebark pine cone transects.

Whitebark Pine Blister Rust Infection

Whitebark pine trees throughout the northwest U.S. have been extensively killed by infections of white pine blister rust (*Cronartium ribicola*). Whitebark pine mortality due to blister rust exceeds 90% throughout much of the northwest (Kendal and Arno 1990). Although tree mortality has been low to date, some whitebark pine stands in the Yellowstone ecosystem

are known to be infected with blister rust. The extent of the blister rust infection and the future effects it will have on whitebark pine in the Yellowstone ecosystem are unknown at this time. Along each whitebark pine cone transect, each tree is examined for presence of blister rust and the data recorded. Results will be recorded and reported annually by the IGBST.

Table 8. The rule set for access management¹ in the Yellowstone PCA.

Criteria	Definition
Map pixel size	30 meter
Unit of measure	Miles/square mile
Window size	Square mile
Motorized access routes counted	All routes having motorized use including motorized trails, highways, and forest roads. Private roads counted.
Calculation software	ARC INFO
Motorized access route database	Count all roads and trails having motorized use
High use trail	As per the Yellowstone CEM
Security area	More than 500 meters from a motorized access route and high use trails. Must be greater than or equal to 10 acres in size.
Open access route density	1 mile/sq mi density developed from the moving window analysis. High use trails not counted.
Total access route density	2 mi/sq mi density developed from the moving window analysis. High use trails not counted.
Season definitions	Spring – 1 March to 15 July. Summer/fall – 16 July to 30 November
Habitat considerations	Habitat quality not part of the standards but road closures should consider seasonal habitat needs
Rule set for security areas	No motorized use or high-use non-motorized trails ² . In place for a minimum of 10 years. New secure habitat created to compensate for loss of existing secure habitat must be equivalent or greater in habitat quality, equivalent in block size, and left in place for at least 10 years. No helicopter use between 3/1 and 11/30 for commercial resource extraction and exploration. A 1% reduction in secure area will be allowed in one subunit for the purpose of habitat management only, as long as the reduction is mitigated ³ with an equal increase in secure area in other subunits in that BMU which will remain in place for 10 years. Any such reductions must be agreed to by all agencies prior to implementation.
Rule set outside secure areas when ORD, TRD, and security values are being met in that subunit	No more than an average of one vehicle trip per day (a round trip is 2 trips) by season. Season one has 137 days, thus 68 round trips are allowed in season one. Season two has 138 days, thus 69 round trips are allowed in season two. Motorized vehicle activities limited to within .25 miles of a restricted road.

¹ These access standards for motorized use and high use trails do not include over snow use at this time. There are no available data to indicate that snow machines have either effects or no effects on grizzly bear habitat displacement or mortality risk. It is suggested that research on this issue be a topic for the IGBST. As more information becomes available on this issue, the agencies will respond with appropriate management action as necessary.

² High-use non-motorized trails defined by the 1998 CEM database. Current data as of 1998 on high use trails will be used to manage secure habitat. There will be no changes in secure area calculations within subunits as a result of future trail use reclassifications until further research can document the influence of human trail use on grizzly bear displacement and mortality risk. It is suggested that research on this issue be a topic for the IGBST. Yellowstone National Park currently closes 21% of the Park at various seasons as per the YNP Bear Management Plan and this further addresses mortality risk and displacement effects within the Park.

³ Any mitigation will be in place prior to the habitat modification.

Motorized Road and Trail Density

Motorized access is one of the most influential factors affecting grizzly bear use of habitats. Open road density has been utilized historically as a measure of human impacts to grizzly bear habitat. Recent research has indicated that, in addition to open road density, restricted roads and motorized trails are important factors in evaluating habitat potential for and mortality risk to grizzly bears (Mace et al. 1996). Motorized access routes and human use associated with such routes should be defined and measured in a standard way. This includes all open and restricted roads, as well as motorized trails. Utilizing cumulative effects GIS databases, open motorized access route density, and total motorized access route density will be monitored and reported annually on public lands within each subunit in the IGBST annual report. (See Table 8 for access management rule set.)

Secure Habitat Areas

Grizzly bear researchers and managers generally agree that security areas, defined as those areas more than 500 meters (550 yards) from a motorized access route during the non-denning period, are important to the survival and reproductive success of grizzly bears, especially adult female grizzly bears. This is a habitat criterion that must be monitored and maintained to meet the needs of a recovered grizzly population (IGBC 1998). For the Yellowstone PCA, the amount, distribution, (Table 9) and habitat value (Table 11 and 12) of secure habitat per subunit will be established at or above the 1998 level¹ except for the Targhee where secure areas will be acceptable with full implementation of the revised Targhee Forest Plan (1997). Certain subunits are in need of improvement in secure habitat including Henrys Lake #1, Henrys Lake #2, Gallatin #3, Plateau #1, Plateau #2, and Madison #2 (Table 9). In the above subunits, the managers will work to improve secure habitat, OMARD, and TMARD values on public land. Subunits mentioned above on the Targhee will be improving with implementation of the revised Forest Plan. Security area percentages will be monitored by annual application of GIS techniques if there is any change in motorized access routes within that subunit.

¹ For subunits not needing improvement, a 1% reduction below the values in Table 9 for habitat management only, with a resulting 1% increase in OMARD and TMARD, will be allowed in any subunit of a BMU. Projects including road obliteration, will not exceed 3 years in duration, all associated roads will be obliterated, and only one project at a time will be permitted per BMU. For subunits identified as needing improvement, a temporary 1% reduction in secure area will be allowed in one subunit for habitat management only, as long as the reduction is mitigated with an equal increase in secure area in other subunits in the BMU which will remain in place for 10 years. The result is that after project completion, the secure area in the subunit is returned to the level in Table 9 and the overall secure area within the BMU is increased. In subunits needing improvement, projects including road obliteration, will not exceed 3 years in duration, all associated roads will be obliterated, and only one project at a time will be permitted per BMU. Any such reductions must be agreed to by all agencies prior to implementation.

Table 9. The 1998 values for secure habitat, Open Road Density > 1 mi/sq mi (ORD) , and Total Road Density > 2 mi/sq mi (TRD). Includes USFS, county, and private roads.

NAME	BMU #	ORD % > 1		TRD% > 2 (mi / sq.mi.)	% Secure		SIZE (sq.mi)
		(mi / sq.mi.)			Habitat		
		S1	S2		S1	S2	
Hilgard #1	1	25	25	11	71	70	202
Hilgard #2	1	16	18	6	75	56	141
Gallatin #1	2	2	2	0	96	91	128
Gallatin #2	2	8	8	4	84	77	155
Gallatin #3	2	41	41	17	56	53	218
Hellroaring/Bear #1	3	19	20	12	76	71	185
Hellroaring/Bear #2	3	0	0	0	98	88	229
Boulder/Slough #1	4	2	2	0	94	84	282
Boulder/Slough #2	4	1	1	0	98	83	232
Lamar #1	5	6	7	3	91	80	300
Lamar #2	5	0	0	0	100	95	181
Crandall/Sunlight #1	6	11	16	3	80	58	130
Crandall/Sunlight #2	6	15	16	9	83	82	316
Crandall/Sunlight #3	6	13	16	7	81	81	222
Shoshone #1	7	1	1	1	98	98	122
Shoshone #2	7	1	1	0	99	99	132
Shoshone #3	7	3	3	1	97	97	141
Shoshone #4	7	4	4	1	94	94	189
Pelican/Clear #1	8	1	1	0	98	87	108
Pelican/Clear #2	8	3	3	0	94	90	257
Washburn #1	9	12	12	3	78	70	178
Washburn #2	9	4	4	1	92	86	144
Firehole/Hayden #1	10	6	6	1	87	79	339
Firehole/Hayden #2	10	7	8	1	85	84	177
Madison #1	11	18	25	10	74	66	227
Madison #2	11	34	34	22	63	60	157
Henrys Lake #1	12	42	42	24	45	45	201
Henrys Lake #2	12	45	45	25	42	42	153
Plateau #1	13	19	19	10	68	68	286
Plateau #2	13	7	7	2	87	81	431
Two Ocean/Lake #1	14	2	2	0	97	92	485
Two Ocean/Lake #2	14	0	0	0	100	100	143
Thorofare #1	15	0	0	0	100	94	274
Thorofare #2	15	0	0	0	100	93	180
South Absaroka #1	16	0	0	0	99	99	163
South Absaroka #2	16	0	0	0	100	100	191
South Absaroka #3	16	3	3	2	97	96	348
Buffalo/Spread Creek #1	17	10	10	4	88	82	222
Buffalo/Spread Creek #2	17	13	14	10	81	76	508

Bechler/Teton #1	18	13	13	4	78	75	534
mean % secure/ Total area					86%	81%	9210

TABLE 10. The 1998 values by ownership for core secure habitat, Open Road Density (ORD), and Total Road Density (TRD) in each subunit.

NAME	BMU #	ORD % > 1 mi/sq		TRD % > 2 mi/sq	% CORE SECURE HABITAT		SIZE (sq.mi.)
		S1	S2		S1	S2	
Hillgard #1	1	25	25	11	71	70	202
National Park Service		0	0	0			
USFS Multiple Use		15	15	6			
Private / Other		9	9	6			
Hillgard #2	1	16	18	6	75	56	141
National Park Service		0	0	0			
USFS Multiple Use		13	14	4			
Private / Other		3	3	2			
Gallatin #1	2	2	2	0	96	91	128
National Park Service		2	2	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Gallatin #2	2	8	8	4	84	77	155
National Park Service		8	8	4			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Gallatin #3	2	41	41	17	56	53	218
National Park Service		0	0	0			
USFS Multiple Use		26	26	8			
Private / Other		15	15	8			
Hellroaring/Bear #1	3	19	20	12	76	71	185
National Park Service		0	0	0			
USFS Multiple Use		14	15	8			
Private / Other		4	4	4			
Hellroaring/Bear #2	3	0	0	0	98	88	229
National Park Service		0	0	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			

NAME	BMU #	ORD % > 1mi/sq mi		TRD % > 2 mi/sq mi	% CORE SECURE HABITAT		SIZE (sq mi)
		S1	S2		S1	S2	
Boulder/ Slough #1	4	2	2	0	94	84	282
National Park Service		0	0	0			
USFS Multiple Use		2	2	0			
Private / Other		0	0	0			
Boulder/Slough #2	4	1	1	0	98	83	232
National Park Service		1	1	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Lamar #1	5	6	7	3	91	80	300
National Park Service		2	2	0			
USFS Multiple Use		3	3	2			
Private / Other		1	1	1			
Lamar #2	5	0	0	0	100	95	181
National Park Service		0	0	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Crandall/ Sunlight #1	6	11	16	3	80	58	130
National Park Service		0	0	0			
USFS Multiple Use		11	16	3			
Private / Other		1	1	0			
Crandall/ Sunlight #2	6	15	16	9	83	82	316
National Park Service		0	0	0			
USFS Multiple Use		13	14	8			
Private / Other		2	2	1			
Crandall/ Sunlight #3	6	13	16	7	81	81	222
National Park Service		0	0	0			
USFS Multiple Use		10	13	5			
Private / Other		3	3	2			

NAME	BMU #	ORD % > 1mi/sq mi		TRD % > 2 mi/sq mi	% CORE SECURE HABITAT		SIZE (sq mi)
		S1	S2		S1	S2	
Shoshone #1	7	1	1	1	98	98	122
National Park Service		0	0	0			
USFS Multiple Use		1	1	1			
Private / Other		0	0	0			
Shoshone #2	7	1	1	0	99	99	132
National Park Service		0	0	0			
USFS Multiple Use		1	1	0			
Private / Other		0	0	0			
Shoshone #3	7	3	3	1	97	97	141
National Park Service		0	0	0			
USFS Multiple Use		3	3	1			
Private / Other		0	0	0			
Shoshone #4	7	4	4	1	94	94	189
National Park Service		0	0	0			
USFS Multiple Use		4	4	1			
Private / Other		0	0	0			
Pelican/Clear #1	8	1	1	0	98	87	108
National Park Service		1	1	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Pelican/Clear #2	8	3	3	0	94	90	257
National Park Service		3	3	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Washburn #1	9	12	12	3	78	70	178
National Park Service		12	12	3			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			

NAME	BMU #	ORD % > 1mi/sq mi		TRD % > 2 mi/sq mi	% CORE SECURE HABITAT		SIZE (sq mi)
		S1	S2		S1	S2	
Washburn #2	9	4	4	1	92	86	144
National Park Service		4	4	1			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Firehole/ Hayden #1	10	6	6	1	87	79	339
National Park Service		6	6	1			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Firehole/ Hayden #2	10	7	8	1	85	84	177
National Park Service		7	8	1			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Madison #1	11	18	25	10	74	66	227
National Park Service		1	1	0			
USFS Multiple Use		14	21	8			
Private / Other		3	3	2			
Madison #2	11	34	34	22	63	60	157
National Park Service		4	4	1			
USFS Multiple Use		28	28	19			
Private / Other		3	3	2			
Henry's Lake #1	12	42	42	24	45	45	201
National Park Service		0	0	0			
USFS Multiple Use		39	39	22			
Private / Other		3	3	2			
Henry's Lake #2	12	45	45	25	42	42	153
National Park Service		0	0	0			
USFS Multiple Use		39	39	20			
Private / Other		6	6	5			

NAME	BMU #	ORD % > 1mi/sq mi		TRD % > 2 mi/sq mi	% CORE SECURE HABITAT		SIZE (sq mi)
		S1	S2		S1	S2	
Plateau #1	13	19	19	10	68	68	286
National Park Service		0	0	0			
USFS Multiple Use		18	18	10			
Private / Other		1	1	0			
Plateau #2	13	7	7	2	87	81	431
National Park Service		0	0	0			
USFS Multiple Use		6	6	2			
Private / Other		0	0	0			
Two Ocean/Lake #1	14	2	2	0	97	92	485
National Park Service		2	2	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Two Ocean/Lake #2	14	0	0	0	100	100	143
National Park Service		0	0	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Thorofare #1	15	0	0	0	100	94	274
National Park Service		0	0	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
Thorofare #2	15	0	0	0	100	93	180
National Park Service		0	0	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
South Absaroka #1	16	0	0	0	99	99	163
National Park Service		0	0	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			

NAME	BMU #	ORD % > 1mi/sq mi		TRD % > 2 mi/sq mi	% CORE SECURE HABITAT		SIZE (sq mi)
		S1	S2		S1	S2	
South Absaroka #2	16	0	0	0	100	100	191
National Park Service		0	0	0			
USFS Multiple Use		0	0	0			
Private / Other		0	0	0			
South Absaroka #3	16	3	3	2	97	96	348
National Park Service		0	0	0			
USFS Multiple Use		3	3	2			
Private / Other		0	0	0			
Buffalo/Spread Crk #1	17	10	10	4	88	82	222
National Park Service		8	8	3			
USFS Multiple Use		1	1	0			
Private / Other		1	1	0			
Buffalo/Spread Crk #2	17	13	14	10	81	76	508
National Park Service		0	0	0			
USFS Multiple Use		13	14	10			
Private / Other		1	1	0			
Bechler/Teton	18	13	13	4	78	75	534
National Park Service		1	1	0			
USFS Multiple Use		11	11	4			
Private / Other		0	0	0			

- The above figures have an estimated +/- 2% error. Lakes have been subtracted from secure area calculations.

Total National Park
Lands For the PCA
3640 sq. mi.

Total Forest Service for
the PCA
5411 sq. mi.

Total Private / Other
Lands for the PCA
158 sq. mi.

Total USFS Multiple
Use for the PCA
2087 sq. mi.

Table 11. Percent of 6 habitat categories in each of 40 Yellowstone ecosystem grizzly bear management subunits and percent of the 6 habitat value categories in secure habitat in each subunit for season 1 (3/1 - 7/15)¹.

Subunit	mi ²	Habitat Value Category Percent of Subunit ²						Secure Habitat mi ² (% of subunit)	Habitat Value Category Percent of Secure Habitat ²					
		VL	L	LM	HM	H	VH		VL	L	LM	HM	H	VH
BECHLER/TETON	534	11	20	15	49	1	4	416(78)	14	20	13	48	1	4
BOULDER/SLOUGH_#1	282	12	1	40	45	2	0	266(94)	13	1	42	43	2	0
BOULDER/SLOUGH_#2	232	9	6	33	52	1	0	227(98)	9	6	34	50	1	0
BUFFALO/SPREAD_CR_#1	220	25	20	13	39	2	0	194(88)	25	20	14	39	2	0
BUFFALO/SPREAD_CR_#2	508	14	12	21	51	3	0	412(81)	14	10	22	52	2	0
CRANDALL/SUNLIGHT_#1	130	10	34	43	11	2	0	104(80)	11	35	42	10	2	0
CRANDALL/SUNLIGHT_#2	316	5	30	34	30	1	0	263(83)	4	32	34	29	1	0
CRANDALL/SUNLIGHT_#3	222	2	43	42	13	1	0	180(81)	1	45	42	12	0	0
FIREHOLE/HAYDEN_#1	339	2	4	65	21	5	3	296(87)	1	2	69	21	4	3
FIREHOLE/HAYDEN_#2	177	3	7	68	7	1	14	150(85)	1	7	74	6	1	10
GALLATIN_#1	128	6	1	29	62	1	0	123(96)	6	1	29	62	1	0
GALLATIN_#2	155	2	8	27	63	1	0	130(84)	2	4	29	65	1	0
GALLATIN_#3	218	18	17	13	51	1	0	121(56)	21	12	12	55	1	0
HELLROARING/BEAR_#1	185	17	20	12	51	0	0	141(76)	17	15	11	57	0	0
HELLROARING/BEAR_#2	229	21	5	26	47	2	0	225(98)	21	5	26	46	2	0
HENRYS_LAKE_#1	191	47 ³	7	10	36	0	0	90(47)	31 ³	9	11	50	0	0
HENRYS_LAKE_#2	141	7 ³	19	26	46	2	1	65(46)	9 ³	17	24	50	0	1
HILLGARD_#1	202	19	12	18	51	1	0	142(71)	20	10	19	51	0	0
HILLGARD_#2	141	13	8	17	61	1	0	105(75)	15	8	13	64	1	0
LAMAR_#1	300	4	2	26	68	1	0	272(91)	4	1	25	70	0	0

¹ Habitat value or habitat productivity as measured by the Yellowstone grizzly bear cumulative effects model (CEM) (Mattson et al. 1999). Large lakes >0.9 mi² were excluded from this analysis. As such, area totals and percentage of secure habitat per subunit may differ slightly from other tables with values on subunits in this document where lakes were included.

² Six-part categories were determined from raw CEM habitat value outputs that provide relative comparisons across seasons. VL = Very Low (0-15), L = Low (16-42), LM = Low Moderate (43-122), HM = High Moderate (123-355), H = High (356-1032), VH = Very High (>1032). Percent rounded to the nearest whole number.

³ Includes Henrys Lake Flat (private land) where habitat map data was not available and was counted as having no value in this analysis.

Table 11 (continued). Percent of 6 habitat categories in each of 40 Yellowstone ecosystem grizzly bear management subunits and percent of the 6 habitat value categories in secure habitat in each subunit for season 1 (3/1 - 7/15)¹.

Subunit	mi ²	Habitat Value Category Percent of Subunit ²						Secure Habitat mi ² (% of subunit)	Habitat Value Category Percent of Secure Habitat ²					
		VL	L	LM	HM	H	VH		VL	L	LM	HM	H	VH
LAMAR_#2	181	4	1	34	60	1	0	181(100)	4	1	34	60	1	0
MADISON_#1	227	4	12	52	21	10	2	168(74)	5	12	58	17	8	1
MADISON_#2	149	2	6	69	19	3	2	98(66)	0	4	79	14	2	1
PELICAN/CLEAR_#1	108	1	8	6	80	6	0	106(98)	1	7	7	79	6	0
PELICAN/CLEAR_#2	257	2	8	33	33	7	16	240(94)	2	8	34	33	7	17
PLATEAU_#1	286	2	29	58	11	0	0	195(68)	1	28	58	13	0	0
PLATEAU_#2	420	0	19	37	42	0	1	365(87)	0	20	36	42	0	1
SHOSHONE_#1	122	1	53	45	2	0	0	120(98)	1	53	45	2	0	0
SHOSHONE_#2	132	2	63	29	6	0	0	131(99)	2	63	29	6	0	0
SHOSHONE_#3	141	1	47	43	9	1	0	137(97)	1	48	43	7	1	0
SHOSHONE_#4	189	2	40	35	23	1	0	178(94)	1	41	34	23	1	0
SOUTH_ABSAROKA_#1	163	2	3	86	9	0	0	162(99)	2	3	86	9	0	0
SOUTH_ABSAROKA_#2	191	1	2	93	3	1	0	191(100)	1	2	93	3	1	0
SOUTH_ABSAROKA_#3	348	1	4	90	2	4	0	337(97)	1	4	90	2	3	0
THOROFARE_#1	274	5	2	82	3	5	3	274(100)	5	2	82	3	5	3
THOROFARE_#2	180	8	2	83	1	5	0	180(100)	8	2	83	1	5	0
TWO_OCEAN/LAKE_#1	374	1	2	74	3	9	12	360(96)	1	2	74	3	8	12
TWO_OCEAN/LAKE_#2	126	1	1	71	3	6	18	126(100)	1	1	71	3	6	18
WASHBURN_#1	178	6	8	18	68	1	0	139(78)	6	6	22	66	1	0
WASHBURN_#2	144	27	2	40	30	1	0	132(92)	27	1	41	30	1	0

¹Habitat value or habitat productivity as measured by the Yellowstone grizzly bear cumulative effects model (CEM) (Mattson et al. 1999). Large lakes >0.9 mi² were excluded from this analysis. As such, area totals and percentage of secure habitat per subunit may differ slightly from other tables with values on subunits in this document where lakes were included.

²Six-part categories were determined from raw CEM habitat value outputs that provide relative comparisons across seasons. VL = Very Low (0-15), L = Low (16-42), LM = Low Moderate (43-122), HM = High Moderate (123-355), H = High (356-1032), VH = Very High (>1032). Percent rounded to the nearest whole number.

Table 12. Percent of 6 habitat value categories in each of 4 Yellowstone ecosystem grizzly bear management subunits and percent of the 6 habitat value categories in secure habitat in each subunit for season 2 (7/16 - 11/30)¹.

Subunit	mi ²	Habitat Value Category Percent of Subunit ²						Secure Habitat mi ² (% of	Habitat Value Category Percent of Secure Habitat ²					
		VL	L	LM	HM	H	VH		VL	L	LM	HM	H	VH
BECHLER/TETON	534	11	3	36	25	18	7	398(75)	14	1	32	25	19	8
BOULDER/SLOUGH_#1	282	10	39	7	9	10	26	238(84)	11	42	6	7	9	26
BOULDER/SLOUGH_#2	232	4	30	15	18	18	15	192(83)	5	32	14	19	16	16
BUFFALO/SPREAD_CR_#1	220	3	11	13	40	32	2	181(82)	2	13	10	43	30	2
BUFFALO/SPREAD_CR_#2	508	5	18	7	16	27	27	384(76)	6	20	6	14	21	33
CRANDALL/SUNLIGHT_#1	130	10	19	6	7	19	38	75(58)	10	20	6	4	23	38
CRANDALL/SUNLIGHT_#2	316	5	28	23	19	15	11	258(82)	4	26	27	17	13	13
CRANDALL/SUNLIGHT_#3	222	2	56	15	9	13	6	180(81)	1	56	16	9	12	6
FIREHOLE/HAYDEN_#1	339	30	1	1	39	25	5	270(79)	30	1	1	42	22	4
FIREHOLE/HAYDEN_#2	177	17	0	0	56	20	7	149(84)	17	0	0	60	15	8
GALLATIN_#1	128	0	13	5	21	48	12	117(91)	0	14	4	22	47	13
GALLATIN_#2	155	0	24	20	9	34	14	119(77)	0	25	16	7	34	18
GALLATIN_#3	218	6	7	28	18	22	20	116(53)	7	6	21	19	22	25
HELLROARING/BEAR_#1	185	7	9	35	13	15	22	131(71)	8	9	30	11	14	28
HELLROARING/BEAR_#2	229	6	24	14	21	17	18	202(88)	7	26	14	20	16	18
HENRYS_LAKE_#1	191	47 ³	3	20	6	22	3	90(47)	31 ³	2	25	7	31	5
HENRYS_LAKE_#2	141	7 ³	6	32	22	23	11	65(46)	9 ³	3	28	15	30	15
HILLGARD_#1	202	8	13	24	16	16	22	141(70)	10	14	27	15	12	21
HILLGARD_#2	141	3	7	11	14	34	32	79(56)	4	7	13	14	28	34

¹ Habitat value or habitat productivity as measured by the Yellowstone grizzly bear cumulative effects model (CEM) (Mattson et al. 1999). Large lakes >0.9 mi² were excluded from this analysis. As such, area totals and percentage of secure habitat per subunit may differ slightly from other tables with values on subunits in this document where lakes were included.

² Six-part categories were determined from raw CEM habitat value outputs that provide relative comparisons across seasons. VL = Very Low (0-15), L = Low (16-42), LM = Low Moderate (43-122), HM = High Moderate (123-355), H = High (356-1032), VH = Very High (>1032). Percent rounded to the nearest whole number.

³ Includes Henrys Lake Flat (private land) where habitat map data was not available and was counted as having no value in this analysis.

WASHBURN_#2 144 0 38 6 41 10 5 124(86) 0 38 6 43 8 5

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Developed Sites on Public Lands

Displacement from habitat, habituation to human activities, and increased grizzly mortality risk can be indirectly assessed by monitoring numbers of developed sites¹. The objective on public lands is not to increase the number of developed sites that displace grizzly bears or lead to conflict or grizzly bear mortality. The existing (1998) numbers of developed sites are considered the level that can be accommodated on public lands under the assumption that the 1998 level of site development is allowing a stable to increasing grizzly population.

The number and type of developed sites on public lands will be reported annually within each subunit. Subunits will be managed so there will be no likelihood of detrimental impact due to increases in the number of developed sites¹ or expansion of existing sites on public lands. Any proposed increase, expansion, or change of use of existing developed sites beyond current site influence boundaries will be analyzed and effects documented through a biological evaluation or assessment by the action agency to demonstrate no likelihood of detrimental impact to grizzly bears. If there are any impacts they will be mitigated with equal quantity and quality of habitat within that subunit. Any deviation from the 1998 site development level in any subunit will require prior mitigation to create an equivalent quantity (Table 9) and quality (Tables 11 and 12) of secure habitat within that subunit.

Developed sites on public lands are currently inventoried in existing GIS databases and are an input item to the CEM. These facilities will be monitored with the CEM or equivalent tool and reported at the available resolution. Both numeric and GIS map outputs will be produced and evaluated.

Estimates of the number, distribution, and density of all back-country uses including campsites, high and low use non-motorized trails, and dispersed uses, will be updated annually by land management agencies. The CEM data base contains such estimates.

The cumulative effects database reflects the current best available information regarding back-country use. However, continual additional information is needed to periodically update the human use levels assigned to activity features in the cumulative effects database. Representative trails or access points, where risk of grizzly bear mortality is highest, will be monitored when funding is available.

Hunter Numbers in Relation to Grizzly Mortalities

Data from State wildlife agencies on herd units or hunting districts will be used as an index to back country use during the hunting season. Back country use levels combined with numbers

¹ Developed sites include all sites on public lands developed or improved for human use or resource development including campgrounds, lodges, trailheads, and permitted resource development sites such as oil and gas exploratory wells, production wells, or mines.

of human/bear conflicts will be used to identify when and where to increase public education efforts and possibly restrict human use in order to minimize human/bear conflicts and resulting bear mortality.

While the number of hunters using the PCA in Wyoming has not increased significantly, the number of self defense shootings of grizzly bears by hunters and/or licensed outfitters and guides have statistically increased in the last ten years ($P < 0.05$). There is disagreement as to why this is occurring. Theories range from too many hunters in occupied grizzly habitat, bears learning to seek food at the sound of gunshots, to more bears increasing the odds of bear-hunter encounters. The reasons for the increase in bear mortality are not that clear-cut, however, the most consistent theme is that most of the bear losses could have been avoided if people had acted according to recommended safety standards.

The number of elk hunters in Wyoming who recreate in the PCA (Table 13) were estimated and compared to grizzly bear mortalities, both verified and probable from 1988 to 1997 to determine if bear mortality is correlated to hunter numbers. The data show there is little relationship between hunter numbers and human-caused grizzly mortality.

State and Federal wildlife agencies have attempted to reduce the loss of bears to hunters by expanding information and education programs. “Living in Bear Country” workshops are conducted annually in most of the gateway communities in Wyoming, Idaho, and Montana, and licensed outfitters and guides have instituted increased training for their members and clientele.

Table 13. Total elk hunters in Wyoming portions of the PCA and within 10 miles outside the PCA boundary by hunting area, 1988-1997.

Area	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average
50	580	504	466	497	590	479	493	491	429	588	511.7
51	431	438	391	402	464	571	623	645	644	656	526.5
52	634	632	432	476	503	559	594	615	521	707	567.3
53	208	244	248	202	195	226	245	303	337	244	245.2
54	151	140	161	158	161	152	171	170	95	188	154.7
55	530	532	330	454	442	380	428	549	467	560	467.2
56	463	387	299	322	334	332	302	387	299	443	356.8
57	388	349	328	320	339	380	422	374	961	314	417.5
58	498	392	401	555	633	118	119	93	94	111	301.4
59	183	146	131	154	212	452	501	492	444	522	323.7
60	313	416	413	345	485	409	572	531	401	663	454.8
61*	368	471	398	424	379	314	343	333	428	556	401.4
62*	299	242	180	192	183	185	174	169	178	174	197.6
63*	92	88	65	80	91	93	90	98	112	93	90.2
67*	2183	2135	2101	2172	2309	2309	2565	2454	2633	2849	2371
68*	875	915	773	705	990	1147	941	757	683	768	855.4
70	1096	2296	2002	1482	1436	1289	1355	1409	1138	1374	1487.7
71	639	1126	958	1150	1434	1365	1008	1132	959	1160	1093.1
73*	238	363	427	387	411	371	321	340	300	315	347.3
74	343	1001	814	998	856	915	667	782	641	729	774.6
75,7 6,79	2006	1985	2148	2262	2495	2534	2695	2958	2526	2294	2390.3
81	1862	2871	2562	2326	1969	2293	2191	2298	1843	2032	2224.7
83*	109	169	162	170	243	232	233	184	150	118	177
Total	14489	17842	16190	16233	17154	17105	17053	17564	16283	17458	16737.1

* - A percentage of total hunter numbers was used because a portion of Hunt Area is outside the PCA.

Table 14. The number of elk hunters including archery and gun hunters inside the PCA and within 10 miles outside the PCA boundary in Idaho, 1987-97.

Year	87	88	89	90	91	92	93	94	95	96	97
Number	2673	2782	2069	2259	2068	2252	2837	2423	2177	2223	2535

Table 15. The number of elk hunters including both archery and gun hunters inside the PCA and within 10 miles outside the PCA boundary in Montana, 1987-96.

Year	87	88	89	90	91	92	93	94	95	96
Number	12826	13626	11957	14647	20645	18411	17232	14852	16789	14406

Control Actions and Conflict Situations

The number of control actions including management captures and grizzly bear damage complaints will be monitored and reported annually by each State wildlife agency and national park to identify problem areas and causes of such interactions. Yellowstone National Park will summarize and report this information for the area on an annual basis. Numbers and types of control actions will be related to the human-caused mortality limits by the IGBST in its annual reports. High numbers of human-caused mortalities related to control actions and conflict situations will trigger a management review or status review as per the Evaluation Process.

Livestock Grazing

Interaction between livestock and grizzly bears has historically led to removal of grizzly bears. While past losses of grizzly bears have been tied primarily to domestic sheep allotments, there has been a recent increase in bear depredations on cattle in the Yellowstone Area. Number of livestock, class of livestock and season of use of allotments where any bear conflicts occur will be monitored and reported annually at the subunit levels. Both numeric and GIS map outputs will be produced and evaluated.

Private Land Development

While the existing cumulative effects database accounts for private land development effects within the PCA, influences outside this area are not included. Outside the PCA, there are several factors that influence State and Federal grizzly bear management programs. Among the most important is the rapidly accelerating growth of human populations in some areas in grizzly bear habitat in western Montana, southeast Idaho, and northwest Wyoming. This growth results not only in increased visitor use but also increased residential development on important wildlife habitat adjacent to public lands. This increased human use, primarily residential development, results in the loss of wildlife habitat and permanent increases in human/bear conflict resulting in higher bear mortality rates. Human-caused grizzly mortalities will be counted and must meet the limits for total and female mortality both inside the PCA and within 10 miles outside the PCA boundary. Thus, human-caused mortality related to private land conflicts will be monitored and must be controlled to meet the standards in this Conservation Strategy. This requires ongoing efforts to limit human/bear conflicts on private lands inside and outside the PCA.

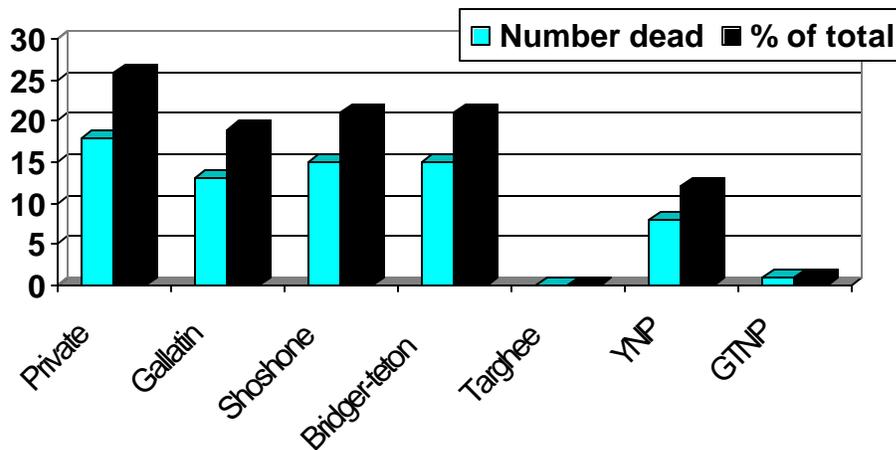


Figure 9. Land ownership where known human-caused grizzly bear deaths occurred in the PCA and within 10 miles of the PCA boundary, 1987-1997.

Development of private lands presents risks of increased human/bear conflicts and bear mortality within the PCA and throughout the Yellowstone area as indicated by the positive correlation between grizzly bear mortality and permanent human presence. Activities associated with permanent human presence often result in continual management actions that adversely impact bears. Many of these activities occur on or are associated with private lands.

Private lands account for a disproportionate number of bear deaths (Figure 9). The management agencies will continue to devote significant efforts toward private landowner outreach programs to minimize human/bear conflicts and to manage bears and potential conflict situations on such sites. Both the Montana Fish, Wildlife, and Parks Department and the Wyoming Game and Fish Department employ bear management specialists devoted specifically to managing human/bear conflicts on private lands and to working with private landowners to minimize such conflicts. Such programs will continue and efforts will be reported annually to the Yellowstone Grizzly Management Committee and the public.

To assist in minimizing human/bear conflicts on private lands, a need exists to develop a protocol to categorize private lands and report changes. The objective is to provide a system for monitoring the status of grizzly bear habitat on private lands within the PCA, and to direct management efforts, conservation action by private organizations, and outreach efforts to the public in areas where private lands are being developed. The protocol should provide a qualitative and quantitative system for classifying the potential of private land parcels as productive and secure grizzly bear habitat.

While the sole responsibility for monitoring the status and condition of private lands does not lie with the States, the States will assist private non-profits and other entities to categorize and

prioritize potential lands suitable for permanent conservation. The quality and availability of land parcel data varies greatly within and among States and is generally available through the various county governments. Therefore, the methodology to monitor private land status and condition will be specific to data availability by County/State.

A monitoring protocol should address the following:

Actual acres of private lands important to grizzly bears relative to:

1. Total acres of private land under in-perpetuity conservation easement
2. Total acres of private land in an undeveloped State without easements
3. Total acres of private land in a developed State

In the land class without in-perpetuity easements, consider two basic categories - undeveloped and developed. The undeveloped category may be further summarized as:

1. Undeveloped
2. Undeveloped-agriculture
3. Undeveloped-but platted residential

The developed category may be summarized as:

1. Developed for mineral, or oil/gas extraction
2. Developed commercial/recreational (commercial facilities and dispersed summer homes)
3. Developed residential

Private lands in the undeveloped categories provide opportunities for pursuing conservation easements. The breakdown in this category can lead to a prioritization of where and how conservation efforts should be directed. Habitat values, using CEM, can also be identified in the areas of these parcels to prioritize efforts for long-term conservation of the most important lands. CEM classification maps of those areas mapped with CEM will be made available to anyone interested in private land conservation efforts.

Private lands in developed categories are permanently removed from any opportunity for long-term conservation. However, use of this classification system will allow those working to limit bear problems in developed areas to coordinate education and management efforts to minimize problems on such lands.

Following the initial acreage determined by status and condition of private land parcels within in each State, data bases should be updated on a regular basis as possible given funding and personnel. (Parcels 160 acres in size or smaller should be considered as developed residential.)

By monitoring the above information, natural resource managers can annually identify areas of

concern where increasing human development will require more intensive bear education programs and management of possible nuisance bears.

Natural resource agencies must translate scientific data into useable information for use by County decision makers and the local publics. The importance of the private-public land interface relative to wildlife habitat in general and grizzly bears specifically should be stressed in communication efforts, public relations programs and education in the schools. Special efforts must be made to maintain and enhance communication and liaison with county governments and officials to promote information and policies that will lead to minimizing human/bear conflicts.

IMPLEMENTATION AND EVALUATION

Objectives

The existing Yellowstone Ecosystem Subcommittee of the IGBC will continue to operate (See Appendix V for charter of the IGBC) as the management body responsible for implementation and evaluation of grizzly bear conservation efforts specified in this Conservation Strategy. This committee shall be named the Yellowstone Grizzly Management Committee and it shall function as such upon recovery and delisting of the Yellowstone grizzly population. The primary objectives of the Yellowstone Grizzly Management Committee will be to:

1. Implement this Conservation Strategy.
2. Assure that population and habitat data specified in this Conservation Strategy are collected and evaluated annually to monitor the current status of the grizzly bear population.
3. Share information and implement management actions in a coordinated fashion.
4. Propose management policy changes as necessary.
5. Establish necessary task forces to implement management reviews and approved actions when necessary.
6. Identify research needs and financial needs for management.
7. Implement management and status reviews as necessary to assure responsiveness of the agencies to changing circumstances of the grizzly or its habitat in Yellowstone.
8. Direct and coordinate information and education efforts.

Evaluation Process

The evaluation of the effectiveness of grizzly bear conservation measures detailed in this conservation strategy will be an ongoing process shared by all the members of the Yellowstone Grizzly Management Committee.

As detailed in the monitoring portion of this strategy, the IGBST will take the lead in preparing an annual monitoring report with staff support from the Yellowstone Grizzly Management Committee. Responsible agencies for monitoring major demographic and habitat parameters are listed in Appendix VII. Monitoring results along with an analysis will be presented to the Yellowstone Grizzly Management Committee by the IGBST. Upon review of this information, a determination will be made by the committee as to whether a management review should be initiated.

Management Review

Under this Conservation Strategy, a management review is a process carried out by the IGBST who can also involve others as they see fit. A management review can examine management of habitat, populations, or both in response to results from the annual monitoring program, or it can be initiated upon request of an agency member of the Yellowstone Grizzly Management Committee based on concerns about a pending action or condition. The purpose of a management review is to identify the reasons why parameter objectives have not been achieved and to modify management as necessary, or to consider potential impacts of a proposed action, or to consider possible changes in management due to changed conditions in the ecosystem. Management reviews will be submitted as written reports by the IGBST to the Yellowstone Grizzly Management Committee.

A management review is generally triggered by negative deviations from the desired conditions established in this Conservation Strategy for population, mortality reduction and habitat parameters. The IGBST can recommend a management review if they deem it necessary. The management review will make recommendations as to whether a status review should be made. This recommendation shall be based upon the magnitude of the threat that the deviation from the desired condition poses to the maintenance of a recovered population.

If the situation, after completion of the management review, is such that some or all of the desired population and habitat conditions specified in this Conservation Strategy are not being met, and cannot be met in the opinion of the Yellowstone Grizzly Management Committee or any of its members, then the Yellowstone Grizzly Management Committee will ask the Fish and Wildlife Service for a status review.

Status Review

Under this Conservation Strategy, a status review is a process that requires the U.S. Fish and Wildlife Service to review the status of the Yellowstone Area grizzly bear population upon the request of the Yellowstone Grizzly Management Committee. This request from the Yellowstone Grizzly Management Committee will be accompanied by the available specific biological data on the population and its habitat sufficient to judge its status as a recovered population as per the requirements of this Conservation Strategy. A status review will evaluate all factors affecting the population and result in a finding that summarizes the current status of the population. For purposes of a status review, the status of the entire Yellowstone Area grizzly bear population, both within and outside the PCA, will be considered.

A status review can be initiated independently by the Fish and Wildlife Service based on concerns about the population. It can also be initiated by a petition from an individual or an organization under section 4 of the Endangered Species Act to relist the grizzly bear that is deemed to be warranted by the Fish and Wildlife Service. To be warranted, such a petition

must present credible scientific information to support the petition.

If, as the result of the status review, the population is found to be threatened or endangered, as per the criteria of the Endangered Species Act in section 4(a)(1), then the species would be immediately considered for relisting and could potentially be relisted under emergency regulations, per section 4(b)(7) if the threat was severe and immediate.

III. INFORMATION AND EDUCATION

INTRODUCTION

The future of the Yellowstone grizzly bear lies in our ability to learn to coexist with the grizzly and to accept this animal as a cohabitant of the land. Historically, excessive human-caused mortality and loss of habitat are the major factors in grizzly bear population decline. Addressing the source of human/bear conflict is critical to an effective public outreach plan. Public attitudes in large part determine the success of efforts to manage a recovered grizzly bear population in Yellowstone. For the good of the bear and development of positive public attitudes, a coordinated information and education campaign is essential.

Successful long term community involvement in future grizzly bear efforts requires continued use of current effective methods and tools that have contributed to the success story of the recovered population we have today. To meet the needs of an ever-growing human population, it is necessary to develop new processes and outreach tools to further enhance public involvement and appreciation of the grizzly bear and monitor social behavior and attitudes over time. Through close monitoring we will be able to gauge our success in reaching our diverse publics and in minimizing human bear conflicts.

Public education and involvement should result in the belief that it is acceptable and expected human behavior to practice good stewardship and live in harmony with the grizzly bear.

A COORDINATED INFORMATION AND EDUCATION CAMPAIGN

The following components will be incorporated into the information and education campaign:

A coordinated information and education campaign is critical to the success of an effective public outreach campaign in the Yellowstone Area.

This essential element of a public outreach campaign includes:

Continuation of an information and education working group within the Yellowstone Area. Recommended members of this group include national forest and national park personnel, State representatives from Idaho, Montana, and Wyoming, and the information and education specialist from the Interagency Grizzly Bear Committee.

This group will create annual work plans that will be jointly funded by all member agencies. The group will develop initially a five year coordinated strategy which provides for mechanisms to ensure consistency of information, efficient funding strategies, identifying and targeting audiences, developing partnerships, and identifying new tools for implementation (for example a bear primer on bear ecology and behavior).

One key element of this initial campaign will be to develop public outreach materials on this Conservation Strategy document and status change implications.

The working group will identify a process to manage a comprehensive library of grizzly bear educational materials. They will coordinate with other appropriate information and education programs within the area (i.e. the Yellowstone Grizzly Foundation, and the Grizzly Discovery Center). The group will continue to emphasize that information and education outreach is a critical part of the job for all agency personnel. Continued internal training will be provided.

A coordinated information and education campaign is effective only if it facilitates changed human behavior and helps people learn to coexist with bears.

Long term community engagement in grizzly bear issues is necessary to increase the awareness of bear behavior and biology and how these are compatible with human needs and activities. Identification of sources of human/bear conflict and the use of public education as a tool is essential. Some methods to accomplish this goal include:

1. Continue and expand "Living with Bears" workshops for citizens and teachers within the Yellowstone Area. Consider developing similar seminars for specific target groups such as hunters and other back country recreationists.
2. Develop a citizen's involvement group to facilitate information exchange and identify other community interests regarding the grizzly bear.
3. Continue to provide updates and information to all affected interests through various mediums, including news releases and mailings.
4. Encourage State and Federal volunteer programs to identify and provide opportunity for public participation in grizzly bear information outreach and management. This could include trailhead demonstrations on bear resistant camps, distribution of brochures, school education programs, etc.
5. Continue and expand proactive safety messages.
6. Encourage citizens to participate in land management decisions at the project level on State and Federal lands affecting grizzly bear habitat and management. (Emphasize that the Conservation Strategy is not a decision document, and citizens will be involved in resource allocation decision processes in the future).
7. Encourage citizen involvement in private land issues associated with grizzly bear management. This may include sanitation ordinances, conservation easements, developing private land management plans, and supporting informational outreach campaigns to private

landowners.

8. Provide naturalist training for outfitter and guides, scout leaders, 4H groups, hunter check station attendants, and agency personnel. Consider mandatory training for user groups if grizzly mortality increases in relation to specific uses (i.e. hunters and outfitters).

A coordinated information and education campaign is only effective if it cultivates an appreciation of the value of the grizzly bear in the area.

Some methods to accomplish this goal include:

1. Highlight the grizzly bear as an asset to the area, not a liability, in publications and educational outreach.
2. Develop and deliver scientific, aesthetic and spiritual value messages regarding the grizzly bear. These should include ecological, spiritual, philosophical, and socio-economic attributes. Examples include the grizzly bear as an indicator species and a reflection of biodiversity, a symbol of wilderness, a tourism draw, and as an inspiration for art and commercial products.
3. Highlight the area benefits of grizzly bear management for a wide multitude of resources and species, including elk habitat management, and water quality, recreation, and aesthetic values of access management.

As part of the information and education plan, communicate to the public the provisions of the Conservation Strategy, threats associated with grizzly bears, safety issues, and impacts on other resource management, such as livestock grazing.

A coordinated information and education campaign will enhance and develop partnership opportunities.

Partnerships can enhance the national image of the grizzly bear, provide increased opportunities for local participation in grizzly bear issues and provide avenues for better bear management. Partnerships should be continued and others explored that will:

Provide funds for research activities, educational outreach, sanitation measures, management improvement (i.e. bear management specialists and back country rangers).

Include universities, businesses, landowners, conservation groups, local governments, and prominent spokespersons.

A coordinated information and education campaign will target audiences with messages tailored to their needs.

Knowledge about bears and acceptance of grizzly bears by people and groups that live, work, and recreate in grizzly bear country are key to the long term conservation of a healthy grizzly bear population. Continuing specific outreach messages and techniques to these groups is essential. Some of these groups include:

Landowners - Distribute brochures, provide workshops, encourage participation in private land management issues.

Mining Industry - Inform on bear identification, behavior, habitat needs, access issues.

Timber Industry - Same as mining, however include benefits of vegetative and access management to bear habitat.

Firewood gatherers - Same as above, emphasize seasonal bear habits, movement, provide information on bear presence, and encourage use of pepper spray.

Ranchers - Inform of risks associated with bear/livestock interaction. Provide proactive management safeguards (i.e. electric fences around sheep bedding areas, proper disposal of carcasses). Keep informed on livestock depredation reimbursement programs.

Outfitters - Keep informed on food storage requirements, attractant-free camp requirements, offer demonstration workshops, provide resort naturalists, provide information on bear presence, and encourage use of pepper spray.

Anglers - Bear behavior, identification information, provide information on proper visceral disposal, bear presence and movement in area, and encourage use of pepper spray.

Hunters - Same as outfitters and anglers. Include awareness training as part of hunter education classes, and encourage use of pepper spray. Continue to provide and develop multi-media information targeting this critical audience. Mail all big game hunters in the Yellowstone Area information in the "Grizzly Country" series.

Front country visitors - Provide roadside information signs, a variety of information at visitors centers, informative talks on attractants at developed camp grounds, information on proper photography techniques, and encourage use of pepper spray.

Back country visitors - Inform on bear identification, behavior, avoidance, encourage use of pepper spray, and safety techniques. Inform on proper food storage and attractant procedures. Provide bear activity information at trail head kiosks and trail signs. Inform of location of bear boxes and poles, availability of bear resistant containers, etc.

Summer home owners - Inform on proper attractant storage and private land management issues in grizzly habitat. This audience will require special targeting for timing as to when bears are in these areas. More personal contacts (through volunteers or bear management specialists) may be necessary.

Local business owners - Encourage partnerships, discuss the socio-economic importance of grizzly bears.

Developers - Keep informed on habitat fragmentation issues, conservation easements, sanitation concerns, and development of conservation agreements. Promote full disclosure to new residents moving into bear country so they know what is required to minimize conflicts and impacts to bears should they choose to live there.

County Planners - Stress importance of private and public land interface relative to wildlife habitat, especially grizzly bears. Identify linkage zones and places where increased human development will require more intensive education programs to minimize conflicts with wildlife. Encourage county planning.

School children - Continue school presentations. Continue working towards the goal of providing a bear box for every community in the area. Train teachers through workshops.
Employees - Provide appropriate training, brochures, provide information on bear presence, encourage use of pepper spray, and other educational tools at each State and Federal office within the area.

A coordinated information and education campaign will make bear management and scientific information more user friendly.

Information made available to the public should be more open and responsive to public concerns. More open discussions with the public will increase credibility of the grizzly bear management program. Methods to achieve this include:

Work to eliminate perceived secrecy of grizzly bear management activities by clearly explaining management activities such as trapping, tagging, and monitoring.

Give explanations on why certain techniques are used in certain management scenarios.

Make grizzly bear activity and movements public through periodic updates.

Invite interest groups and community leaders to observe and learn about bear management activities.

Communicate bear management activities to non-bear biologist personnel.

Provide training to bear biologists in the use of audio-visual equipment. Develop photo and video libraries and make them available for public use.

Provide clear information on survivorship and mortality of grizzly bears in the Yellowstone Area.

Provide the public information on grizzly bears that is easily understood and jargon-free.

A coordinated information and education campaign will monitor public attitudes about grizzly bears and grizzly bear management.

Information and education efforts are more effective if they influence public attitudes and behavior. In order to measure the success of a public outreach campaign the following is recommended:

A baseline responsive management attitude survey prior to the beginning of any status change proposal.

A second management attitude survey after the completion of the initial 5 year monitoring period.

IV. NUISANCE BEAR GUIDELINES

INTRODUCTION

Humans and grizzly bears occasionally come into conflict in areas where they encounter one another. As few as 10, and as many as 160 grizzly human/bear conflicts per year have been reported in the Yellowstone Area during the last thirteen years (1985-1997)(Gunther et al. 1997).

The objective of management is to minimize human/bear conflicts. In the Yellowstone area, management is essential to successful grizzly conservation and is often necessary to prevent property damage, livestock losses, and human injury or death. Grizzly bears cannot be totally protected. They develop individual traits like other species, and some of those traits developed by some bears are not compatible with coexistence with humans. Management emphasis will shift from protecting every individual in the population to assessing an individual's importance to the entire population prior to instituting management actions. Females will continue to receive a higher level of protection than males. Management of nuisance bears requires rapid response by State and Federal agencies to address situations of human/bear conflict. This agency response will address the sources of the conflict through public education, removal of attractants, or preventative sanitation of human use areas. Agencies will also capture, relocate, or destroy repeat offender grizzly bears when necessary and when other options have been exhausted.

Analysis of human/bear incidents indicates that most property damage incidents are the result of bears attempting to gain access to garbage, human foods, livestock or pet foods, or other human-related foods in areas of human presence. Livestock losses to grizzlies occur primarily on USFS summer ranges of cattle and sheep. Occasionally bears will prey on domestic swine, fowl, goats, or will damage apiaries. They have rarely injured horses.

Although aggression towards people and human injury or death is rare, bears will occasionally harm people. Incidents of injury are usually a result of a surprise encounter, protection of cubs, defense of a food cache, harassment or when bears have become accustomed to obtaining food from humans.

The management of human/bear conflict is based upon the existing laws and authorities of the State and Federal land management agencies as detailed in the authorities section.

Management of nuisance bears usually falls into one or more of the following categories:

- 1) removing or securing the attractant
- 2) deterring the bear from the site through the use of aversive conditioning techniques
- 3) capturing and relocating the nuisance bear

- 4) removal of the bear from the wild including lethal control

Management Zones

Management of nuisance grizzly bears in the Yellowstone Area will vary depending on whether they are inside or outside the PCA. This system will provide increased security for grizzly bears inside the PCA. Bears will be given greater consideration in most human/bear conflicts inside the PCA. The PCA is comprised primarily of public lands managed as National Parks (YNP & GTNP), USFS wilderness and non-wilderness lands, (Table 1) which are essential for continued survival of the bear in the Yellowstone Area. The PCA is the former grizzly bear recovery zone, and includes all lands formerly managed as the recovery zone. Minimization of human/bear conflicts and management of individual nuisance bears is the primary direction for management within the PCA.

Outside the PCA, more consideration will be given to existing human uses in circumstances that result in a nuisance bear situation. Site-specific conflict areas within and outside the PCA will be documented routinely and prioritized to focus proactive management actions to minimize human/bear conflicts and address existing and potential human activities that may cause future conflicts.

Management Guidelines

The focus and intent of nuisance grizzly bear management inside and outside the PCA will be predicated on strategies and actions to prevent human/bear conflicts. It is recognized that active management aimed at individual nuisance bears will occasionally be required in both areas. Management actions outside the PCA will be implemented according to State management plans. These actions will be compatible with grizzly bear population management objectives for each State for the areas outside the PCA.

Within the PCA, management of nuisance bears will be addressed according to the following definitions and criteria.

Definitions

Unnatural aggression by a grizzly bear is defined as behavior that includes active predation on humans, approaching humans or human use areas, such as camps, in an aggressive way, or aggressive behavior when the bear is unprovoked by self-defense, defense of cubs, defense of foods, or in a surprise encounter.

Natural aggression by a grizzly bear is defined as defense of young, food, during a surprise encounter, or self-defense.

A bear is classified as food conditioned when it has received a significant food reward of human foods such as garbage, camp food, pet food, or processed livestock food and persistently seeks these foods.

A bear is classified as habituated when it does not display avoidance behavior around humans or in human use areas such as camps or town sites or within 100 meters of open roads.

Relocation is the capture and movement by management authorities of a bear involved in a conflict with humans or human-related foods to a remote area away from the conflict site, usually after fitting the bear with a radio collar. All relocated bears will be fitted with a radio transmitter unless an exceptional case is determined by the management agencies.

Repeat offense is the involvement of a bear that has been previously relocated in a nuisance situation or, if not relocated, continues to repeat a behavior that constitutes a human/bear conflict.

Removal is the capture and placement of a bear in an authorized public zoological or research facility or destruction of that bear. Removal can also involve killing the bear through active measures in the wild when it is not otherwise possible to capture the bear.

Management authorities are the designated representatives of the agencies in the PCA including Yellowstone National Park, Grand Teton National Park, Wyoming Game & Fish Dept., Montana Fish Wildlife & Parks, Idaho Department of Fish & Game, Interagency Grizzly Bear Study Team, each of the National Forests - Gallatin, Custer, Shoshone, Bridger-Teton, Targhee, and Beaverhead, and the U.S. Fish and Wildlife Service Grizzly Bear Recovery Coordinator, as requested. These authorities will make the decision to classify a bear as "nuisance" inside the PCA in compliance with the nuisance bear criteria. Outside YNP and GTNP within the PCA, subsequent management actions will be coordinated and completed by State wildlife agencies, after discussing with the appropriate management authorities. When nuisance bears are in YNP or GTNP, decisions will be made by park representatives, and coordinated with State and Forest Service representatives when necessary (e.g. for bear relocations).

Criteria for Nuisance Grizzly Bear Determination and Control Inside the PCA

Bears displaying unnatural aggression will be removed from the population.

Bears displaying natural aggression are not to be removed, even if the aggression results in human injury or death, unless it is the judgment of management authorities that the particular circumstances warrant removal.

Bears displaying food conditioning and or habituation may be either relocated or removed

based on specific details of the incident. This judgment will be made by management authorities after considering the cause, location and severity of the incident or incidents

Bears may be preemptively moved when they are in areas where they are likely to come into conflicts with site-specific human activities, but only as a last resort. Such preemptive moves will not count against the bear as nuisance moves.

Bears may be relocated as many times as judged prudent by management authorities. No bear may be removed for any offense, other than unnatural aggression, without at least one relocation unless the reason is documented in writing by representatives of affected agencies.

Bears preying on lawfully present livestock (cows, domestic sheep, horses, goats, llamas, etc.) on public lands will be managed according the following criteria:

1. No male grizzly bear involved in livestock depredations inside the PCA shall be removed unless it has been relocated at least one time and has been found to return and continue livestock depredations.
2. No females involved in livestock depredations inside the PCA shall be removed, even after relocation and subsequent continued depredation on livestock. The only exception to this could be in the case of animals considered dangerous to human safety through their behavior and use of livestock grazing areas where humans are present.

Management of all nuisance bear situations will emphasize removal of the human cause of the conflict, when possible, or management and education actions to limit such conflicts. Relocation and removal of grizzly bears may occur if the above actions are not successful.

Prior to any removal, except in cases of human safety, involved management authorities will consult by phone or in person to judge the adequacy of the reason for removal and the current level of human-caused mortality to avoid exceeding mortality limits through such removals.

The basis for decisions on relocation and removal inside the PCA will be criteria for management of nuisance bears in the Conservation Strategy and best biological judgment of authorities.

Authorized State authorities outside of YNP and GTNP will do removals inside the PCA. Authorized National Park Service authorities will do removals within YNP and GTNP.

Authorities will cooperate to provide adequate and available sites for relocations.

General criteria: Location, cause of incident, severity of incident, history of bear, health/age/sex of bear, and demographic characteristics of animals involved will all be considered in any relocation or removal. Removal of nuisance bears will be conservative and consistent with mortality limits outlined for the population in the PCA in the Conservation Strategy.

Recognizing that conservation of female bears is essential to maintenance of a grizzly population, removal of nuisance females will be minimized. Management actions inside the PCA will be carried out only with conservation of the grizzly bear population in mind, and consistent with State regulations, policy, and State and Federal laws.

Specific criteria for removals: Captured grizzly bears identified for removal may be given to public research institutions or public zoological parks for appropriate non-release educational or scientific purposes as per regulations of States and National Parks. Grizzly bears not suitable for release, research, or educational purposes will be removed as described in appropriate State management plans or in compliance with National Park rules and regulations.

Individual nuisance bears deemed appropriate for removal may be taken by a sport hunter outside of National Parks in compliance with rules and regulations promulgated by the appropriate State wildlife agency commission, as long as such taking is in compliance with existing State and Federal laws, and as long as mortality limits specified for the PCA and within 10 miles outside the PCA boundary as described in this Conservation Strategy are not exceeded.

All grizzly bear relocations and removals will be documented and reported annually in the IGBST annual report. Such actions may be subject to the Management Review process if requested by a member of the Yellowstone Grizzly Management Committee.

Management of nuisance bears outside the PCA will be the sole responsibility of appropriate State wildlife management agencies and is not regulated by the Conservation Strategy.

V. EXISTING AUTHORITIES

INTRODUCTION

The existence of adequate regulatory mechanisms that will serve to maintain the Yellowstone grizzly bear population as recovered is one of the five factors required to change the status of the population to delisted and to assure a healthy grizzly bear population.

The management of populations of grizzly bears and the habitats these bears require for survival is dependent upon the laws and regulations of the Federal and State agencies in the Yellowstone area. These laws and regulations provide the legal basis for controlling mortality, providing secure habitats, managing human/bear conflicts, controlling hunters, limiting access where necessary, controlling livestock grazing, maintaining education and outreach programs to control conflicts, monitoring populations and habitats, and requesting management and status reviews when necessary. Many of these laws provide authorities for a number of these actions and controls.

The following laws and regulations, or portions thereof, exist and are relevant to agency programs regarding management of the grizzly bear and its habitat in the Yellowstone Area. These provisions, whether national or State, have application in terms of agency compliance, agency authority or discretion to act.

The relationship between the existing authorities and the five factors in Section 4)(a)(1) used to consider listing and delisting of a species is presented in Appendix VIII. These five actors are all relevant to maintain a recovered population.

FEDERAL LANDS

Acts of Congress

The Act of Congress March 1, 1872: Set Yellowstone apart as a public park for the benefit and enjoyment of the people" and "for the preservation, from injury or spoilation, of all timber, mineral deposits, natural curiosities or wonders...and their retention in their natural condition". 16 U.S.C. §§21.22(1998)

National Park Service Organic Act, 1916. The National Park Service...shall promote and regulate the use...by such means... 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 a manner...as will leave them unimpaired for future generations. 16 U.S.C. 31(1998)

Lacey Act, Criminal Code Provisions, 18 U.S.C. 42-44. This Act makes it illegal to import, export, transport, sell, receive, acquire, or purchase any fish or wildlife or plant taken or possessed in violation of any law, treaty or regulation of the United States or in violation of any Indian tribal law; to import , export, transport, sell, receive, acquire, or purchase in interstate or

foreign commerce any fish or wildlife taken, possessed, transported, or sold in violation of any law or regulation of any state or in violation of any foreign law. 18 U.S.C. §§42,43 (1998)

Fish and Wildlife Coordination Act, §§16 U.S.C. 661-666c (1998). This Act relates to wildlife as associated with water resource development. This act also authorizes that lands and waters may be acquired by Federal construction agencies for wildlife conservation to mitigate water projects in order to preserve and assure for the public benefit the wildlife potential of the particular water project area.

The Act of Congress September 14, 1950: (Expansion of Grand Teton National Park to include Jackson Hole National Monument) "The national park so established shall, so far as consistent with the provisions of this Act, be administered in accordance with the general statutes governing national parks..." 16 U.S.C. § 406d-1 (1998)

Sikes Act, §§16 U.S.C. 670g (1998). The Secretaries of Agriculture and Interior and the State agencies will cooperate under this act to plan, develop, maintain and coordinate programs for the conservation and rehabilitation of wildlife, fish and game. These programs shall include, but not be limited to, specific habitat improvements projects and related activities and provide adequate protection for species considered threatened or endangered pursuant to section 4 of the ESA.

Multiple-Use Sustained-Yield Act, 16 U.S.C. §§528-531 (1998). It is the policy of the Congress that the National Forests are established and shall be administered for outdoor recreation, range, timber, watershed and wildlife and fish purposes. As used in this Act, "Multiple Use" means the management of all the various resources of the National Forests so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

National Environmental Policy Act, 42 U.S.C. §§ 4321-4331 (1998). The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment: to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality. The Congress authorizes and directs that, to the fullest extent possible: (1) the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the Federal

Government shall--

- (A) Utilize a systematic, interdisciplinary approach that will insure the integrated use of the natural and social sciences and the environmental design arts in planning and decision making which may have an impact on man's environment;
- (B) Identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by Title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations;
- (C) Include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on-
 - (i) The environmental impact of the proposed action
 - (ii) Any adverse environmental effects which cannot be avoided should the proposal be implemented
 - (iii) Alternatives to the proposed action.
 - (iv) The relationship between local short term uses of man's environment and the maintenance and enhancement of long term productivity, and
 - (v) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved.

The Act of Congress August 25, 1972: Authorization to establish John D. Rockefeller, Jr. Memorial Parkway "... to provide both a symbolic and desirable physical connection between... Yellowstone, and the Grand Teton National Park..." "The Secretary shall administer the parkway as a unit of the national park system in accordance with the authority contained in the Act of August 25, 1916..." Established by the Secretary of the Interior, September 30, 1977.

Endangered Species Act, 16 U.S.C. § 1533 (1998). ESA - Section 4 of the Act gives the criteria for determining a species' status as threatened or endangered. In order to delist a species, it must be shown that the opposite is true. It must be shown that: a) the species' habitat or range is not threatened with destruction, modification or curtailment, b) the species is not being over utilized for commercial, recreational, scientific or educational purposes, c) disease and predation are not significant problems, d) there are adequate regulatory mechanisms in place, and e) there are no significant other natural or manmade factors affecting the continued existence of the species. The Secretary of Interior and States shall effectively monitor recovered species for not less than five years after the species is delisted and no longer protected under the ESA.

Forest and Rangeland Renewable Resources Planning Act, 1974: In recognition of the vital importance of America's renewable resources of the forest, range, and other associated lands to the Nation's social and economic well being, and of the necessity for a long term perspective in planning and undertaking related national renewable resource programs administered by the

Forest Service, the Secretary of Agriculture shall prepare a Renewable Resources Assessment. A strategic plan for all Forest Service activities shall be prepared every five years based on the assessment of renewable natural resources and on all land ownerships every 10 years. It provides direction that land management plans specify guidelines for land management plans, which provide for diversity of plant and animal communities. 16 U.S.C. §1600 (1998).

National Forest Management Act of 1976. Specified that the National Forest System be managed to provide for diversity of plant and animal communities to meet multiple use objectives. Subsequent regulations for planning land and resource management (36 CFR 219), adopted in 1979 augmented the diversity policy by requiring management of habitats to maintain viable populations of vertebrates.

Federal Land Policy and Management Act. Public lands will be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values...that will provide food and habitat for fish and wildlife and domestic animals, and that will provide for outdoor recreation and human occupancy and use. 16 U.S.C. §§ 1701-1777 (998).

Fish and Wildlife Improvement Act, 16 U.S.C. § 742f (1998).

Fish and Wildlife Conservation Act, 16 U.S.C. §§ 2901-2911 (1998). Each State should be encouraged to develop, revise and implement, in consultation with appropriate other agencies, a plan for the conservation of fish and wildlife, particularly those species, which are indigenous to the State. The purpose of this act is to provide financial and technical assistance to the States for the development, revision and implementation of conservation plans and programs for nongame fish and wildlife and to conserve and promote conservation of nongame fish and wildlife and their habitats.

Federal Regulations

36 CFR 1.5 (a)(1): Gives National Park Superintendents the authority to establish for all or a portion, of a park area a reasonable schedule of visiting hours, impose public use limits, or close all or a portion of a park area to all public use or to a specific use or activity in order to protect natural resources or provide for human safety.

36 CFR 1.7(B) 2.10 (d): Gives National Park Superintendents the authority to publish regulations requiring that food, garbage, and equipment used to cook or store food must be stored to not cause human/bear conflicts.

36 CFR 1.7(B) 7.13 (I), Gives National Park Superintendents the ability to regulate activities conducted by National Parks, or their agents, relative to the management and handling of grizzly bears (*Ursus arctos horribilis*). Specifics are described in Park Annual Bear Management Plans.

36 CFR 2.10: Gives the National Park Superintendents authority to designate all or a portion of a park area where food, lawfully taken fish or wildlife, garbage and equipment used to cook or store food must be kept to avoid bear/human conflicts. This restriction does not apply to food that is being transported, consumed, or prepared for consumption.

36 CFR 219. Specifies that the National Forest System be managed to provide for diversity of plant and animal communities to meet multiple use objectives. Subsequent regulations for planning land and resource management and requiring management of habitats to maintain viable populations of vertebrates.

36 CFR 219.19. The regulations stipulate that "fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non native vertebrate species in the planning area.

36 CFR 219.27 (a) (6). Mandates that "all management prescriptions shall... provide for adequate fish and wildlife habitat to maintain viable populations of existing native vertebrate species". The NFMA regulations define a viable population as "... one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area."

36 CFR 261.50 (a) and (b) and (c). Gives Forest Supervisors the authority to impose restriction to minimize human/ bear conflicts.

36 CFR 261.53 (a) and (e). Gives Forest Supervisors the authority to close areas to public entry to avoid human/bear conflicts.

36 CFR 261.58 (e) and (s) and (cc). Gives Forest Supervisors the authority to implement food storage requirements to ensure bears are not rewarded with unnatural foods.

STATES

Wyoming

Wyoming State Statutes

23-1-101(a)(xii). "Trophy game animal" means black bear, grizzly bear, or mountain lion.

23-1-103. Ownership of wildlife. For the purpose of this act, all wildlife in Wyoming is property of the State. There shall be no private ownership of live animals classified as big or trophy game animals.

23-1-302(a)(ii). Powers and duties of the commission. To establish zones and areas in which

trophy game animals may be taken as game animal with a license or in the same manner as predatory animals without a license, giving proper regard to livestock and game industries in those particular areas.

23-1-901. Owner of damaged property to report damage; claims for damages; time for filing; determination; appeal; arbitration. This is a lengthy statute that addresses procedures for filing damage claims.

23-2-101(e). Fees. This statute requires the commission to maintain a \$500,000 balance to be used to compensate landowners for damage done by game animals.

23-3-102(b). License requirements. Requires a license to take a grizzly bear, except as otherwise provided.

23-3-102(d). Provides for a minimum of \$5,000 and a maximum of \$10,000 fine for killing a grizzly bear.

23-3-103(b). Taking predatory animals and trophy animals. Allows trophy game animals to be taken in areas designated by the Commission by the same means as a predatory animal.

23-3-106. Interstate game tag required. Regulates the transportation of bears within and across Wyoming State lines.

23-3-107. Wanton destruction. Prohibits a person from wantonly destroying any grizzly bear.

23-3-109. Use of dogs. Prohibits the use of dogs to hunt, run, or harass big or trophy game animals except as especially permitted by statute.

23-3-112. Firearms. Prohibits the use of certain types of firearms to take game animals.

23-3-115. Taking black bears doing damage. Allows landowner to kill black bears doing damage and requires them to notify the department. Grizzly bears may not be taken.

23-3-301. Importation and sale prohibited. Prohibits the importation and sale of bears.

Wyoming Game and Fish Commission Regulations

Chapter XLIII. Prohibits the taking of any wildlife unless the season is specifically opened by the commission.

Chapter II. Requires the taking of any grizzly to be reported to the department and the U.S. Fish Wildlife Service immediately. Section 7

Chapter III. Prohibits the placement of baits in the current grizzly bear recovery zone. Section

6(a)(v).

Idaho

Idaho State Statutes

36-103 (a). Wildlife property of State - Preservation.- Wildlife Policy. All wildlife, including all wild animals, wild birds, and fish, within the State of Idaho, is hereby declared to be the property of the State of Idaho. It shall be preserved, protected, perpetuated, and managed. It shall only be captured or taken at such times or places, under such conditions, or by such means, or in such manner, as will preserve, protect, and perpetuate such wildlife, and provide for the citizens of this State and, as by law permitted to others, continuous supplies of such wildlife for hunting, fishing and trapping.

36-103 (b). Commission to Administer Policy. Authority, power and duty of the fish and game commission to administer and carry out the provisions of the Idaho fish and game code. The commission is not authorized to change the states' wildlife policy but only to administer it.

36-201. Fish and game commission authorized to classify wildlife. With the exception of predatory animals, the Idaho fish and game commission is hereby authorized to define by classification or reclassification all wildlife in the State of Idaho.

Idaho Fish and Game Commission Regulations

IDAPA 13 G 1.9 Species of Special Concern, Threatened or Endangered Species. Lists the grizzly bear as a Threatened Species. By definition a species likely to be classified as Endangered within the foreseeable future throughout all or a significant portion of its Idaho range.

IDAPA 13 G 2.2 No person shall take or possess those species of wildlife classified as Protected non game, Species of Special Concern, or Threatened or Endangered at any time or in any manner, except as provided in Sections 36-106 (e) 5 and 36-1107, Idaho code or by commission regulation.

Montana

Montana State Statutes

[The current Montana law that as of 2000 allows citizens to kill grizzly bears threatening livestock must be changed to provide adequate protection in order to have adequate regulatory mechanisms as per the opinion of the Senior Attorney in the Federal Solicitors Office. Such a law change is necessary prior to any consideration of delisting.]

Upon such a law change, it will be added to this section]

Section 87-1-301, MCA, Powers of the Commission. Statutes, State of Montana, Department of Fish, Wildlife and Parks.

Requires the Fish, Wildlife and Parks Commission to set policies for the protection, preservation, and propagation of the wildlife, fish, game, furbearers, waterfowl, nongame species, and endangered species of the State and for the fulfillment of all other responsibilities of the department as provided by law.

Section 87-5-301, MCA Policy toward grizzly bear. Statutes, State of Montana, Department of Fish, Wildlife and Parks.

It is hereby declared the policy of the State of Montana to protect, conserve, and manage grizzly bears as a rare species of Montana wildlife.

Section 87-5-302, MCA Commission regulation on grizzly bear. Statutes, State of Montana, Department of Fish, Wildlife and Parks.

The commission shall have authority to provide open and closed seasons; means of taking; shooting hours; tagging requirements for carcasses, skulls, and hides; possession limits; and requirements for transportation, exportation, and importation of grizzly bears.

Section 87-2-101, MCA Definitions. Statutes, State of Montana, Department of Fish, Wildlife and Parks.

By definition under this section bears are classified a game animal in Montana.

Administrative Rules of Montana

MCA 12.9.103 GRIZZLY BEAR POLICY (1) Whereas, the Montana Fish and Game Commission has management authority for the grizzly bear, a resident wildlife species, and is dedicated to the preservation of grizzly bear populations within the State of Montana; and

Whereas the secure habitat for the grizzly has been greatly reduced as a result of human development and population growth from 1850 through 1950 in the bear's traditional range in all western States; and

Whereas, a significant portion of the remaining grizzly bear habitat and population is located in Montana and these Montana populations occur in wildlands such as wilderness, primitive areas, de facto wilderness areas, national forests, national parks, Indian reservations, and seasonally, on adjacent private lands.

Now, therefore, in order to promote the preservation of the grizzly bear in its native habitat, the commission establishes the following policy guidelines for the Montana Department of Fish, Wildlife and Parks action when dealing with grizzly bear.

(a) Habitat. The department shall work to perpetuate and manage grizzly bear in suitable habitats of this State for the welfare of the bear and the enjoyment of the people of Montana and the nation. In performing this work the department should consider the following:

(i) the commission has the responsibility for the welfare of the grizzly and advocates the protection of the bear's habitat;

(ii) management of Montana's wildlands, including the grizzly bear habitat, is predominately, but not exclusively, a responsibility of various Federal agencies and private landowners;

(iii) land use decisions made by these agencies and individuals affect grizzly bear habitat, thus cooperative programs with these agencies and individuals are essential to the management of this species;

(iv) preservation of wildlands is critical to the protection of this species and the commission advocates wildland preservation in occupied grizzly bear habitat; and

(v) while some logging may not be detrimental to grizzly habitat, each logging sale in areas inhabited by grizzly bear should be carefully reviewed and evaluated.

(b) Research. It is recognized by the commission that research on the habitat requirements and population characteristics of the grizzly bear is essential for the welfare of the species. Departmental research programs and proposals directed at defining those habitat requirements are encouraged and supported.

(c) Hunting and recreational use. The commission recognizes its responsibility to consider and provide for recreational opportunities as part of a grizzly bear management program. These opportunities shall include sport hunting, recreational experiences, aesthetics of natural ecosystems, and other uses consistent with the overall welfare of the species.

(i) the department should consider the variability of values between individuals, groups, organizations, and agencies when management programs for various grizzly bear populations are developed.

(ii) sport hunting is considered the most desirable method of balancing grizzly bear numbers with their available habitat, minimizing depredations against private property within adjacent to grizzly bear habitat, and minimizing grizzly bear attacks on humans.

(d) Depredations. Contacts between grizzly bear and humans, or property of humans,

require delicate handling and consideration. When these contacts reach the stage for definite action, the following actions should be carried out:

(i) grizzly bear, in the process of threatening or endangering human life, shall be captured or dispatched immediately.

(ii) where no immediate threat to human life exists, individual bear encounters with humans shall be evaluated on a case-by-case basis and when the attack is abnormal or apparently unprovoked, the individual bear involved shall be captured or dispatched.

(iii) when the attack is normal (e.g. a female defending her cubs, any bear defending its food, or any bear defending itself) but the situation leads itself to no reasonable possibility of leaving the bear in place, then the bear should be removed.

(iv) grizzly bear committing depredations that do not directly endanger human life but that are causing property losses shall be evaluated on an individual case basis.

(v) where removal is determined to be the best resolution to the problem, depredating or nuisance bear shall be trapped, and if determined to be suitable for transplanting, shall be marked and released in suitable habitat previously approved with appropriate land management agencies.

(vi) reasonable efforts shall be made to inform the public of the transplant program, fully explaining the reasons for the capturing and locations of the release area.

(vii) upon request by an authorized scientific investigative agency or public zoological institution, a captured bear may be given to that agency or institution, for appropriate non release research purposes. A reasonable charge may be required to cover costs of handling.

(e) Depredating grizzly bear that are not suitable for release or research because of old age, acquired behavior, disease, or crippling, shall be killed and sent to the department's research facilities for investigation. The public shall be fully informed when these actions are taken and the reasons for these actions shall be fully explained.

(f) Coordination. The department shall consult with appropriate Federal agencies and comply with applicable Federal rules and regulations in implementation of this policy. (History: Sec.87-1-301MCA, IMP, 87-1-201, 87-1-301 MCA; Eff. 12/31/72; AMD, 1977 MAR p.257, Eff. 8/26/77.)

Montana Department of State Lands

Title 75, Chapter 1, MCA - Montana Environmental Policy Act. Establishes policy of the State of Montana to use all practicable means and measures to create and maintain conditions under

which man and nature can coexist in productive harmony.

Title 76, Chapter 14, MCA - Montana Rangeland Resource Act. Establishes a program of rangeland management whereby the importance of Montana's rangeland with respect to wildlife habitat and the natural beauty of the State is recognized.

Title 77, Chapter 1, MCA - Administration of State Lands. Directs the State board of land commissioners to manage State lands to support education and for the attainment of other worthy objectives helpful to the well-being of the people of Montana. It further directs the board to manage State lands under the multiple-use management concept to insure: 1) they are utilized in that combination best meeting the needs of the people and the beneficiaries of the trust; and 2) harmonious and coordinated management of the various resources.

Title 87, Chapter 5, MCA - Nongame and Endangered Species Conservation Act. Establishes Montana policy to manage certain nongame wildlife for human enjoyment and to insure their perpetuation as members of ecosystems. It further declares the policy of the State of Montana to protect, conserve, and manage the grizzly bear as a rare species of Montana wildlife.

Montana Constitution. Article IX - Environment and Natural Resources. Section 1 - Protection and Improvement. The State and each person shall maintain and improve a clean and healthful environment in Montana for present and future generations.

In addition to Federal and State laws the following plans and guidelines provide both direction and guidance for grizzly bear population and/or habitat management.

Federal Plans and Guidelines

National Park Service

NPS-77, Natural Resource Management Guidelines, May 16, 1991: Guides National Park managers to perpetuate and prevent from harm (through human actions) wildlife populations as part of the natural ecosystems of parks.

Final Environmental Impact Statement, Grizzly Bear Management Program, Yellowstone National Park, July 1983:

* Identifies sanitation procedures designed to ensure that human foods and attractants are kept secured from bears. Garbage and other unnatural food attractants will be eliminated before control actions are required. The solid waste handling program will encompass use of trash containers of bear-resistant design, careful and frequent garbage pickup to prevent overflow and overnight accumulations.

* The Superintendent authorizes and approves the YNP Grizzly Bear Management Program that outlines the park's Bear Management Area Program. The Bear Management Area Program restricts recreational activity in areas with seasonal concentrations of grizzly bears.

The goals of these restrictions include: (1) minimize bear-people interactions that may lead to habituation of bears to people (habituation can result in bears being removed from the population for human safety), (2) prevent human-caused displacement of bears from prime food sources, and (3) decrease the risk of bear-caused human injury in areas with high levels of bear activity.

- * Outlines park bear monitoring program.

- * Outlines park bear research goals and objectives.

- *Leaves open the possibility for supplemental feeding of grizzly bears, if deemed necessary.

- * Identifies as an objective that public awareness of exposing bears to unnatural food sources may lead to human injury, or to the bears' destruction, or both. Requires an active information program be directed at both visitors and employees to inform them of policies and goals of bear management, and the reasons for these. Provides guidelines for the distribution of bear safety warning information through entrance stations, signs, visitor contacts, and literature.

Yellowstone National Park Annual Bear Management Plan: Outlines grizzly bear ecology and management information distributed to park employees and the general public by the Bear Management Office.

Grand Teton National Park Human/bear Management Plan, 1989:

- * Identifies sanitation procedures designed to ensure that human foods and attractants are kept secured from bears. Garbage and other unnatural food attractants will be eliminated before control actions are required. The solid waste handling program will encompass use of trash containers of bear-resistant design, and careful and frequent garbage pickup to prevent overflow and overnight accumulations. Containers not of bear-resistant design must be located inside the building served. Large animal carcasses that are near trails, facilities, or roads will be managed in a way to reduce human/bear encounters.

- * Grizzly bear management follows the Interagency Grizzly Bear Guidelines. Management of Situation 1 areas includes area closures and/or activity curtailments to protect the bears.

- * Follows the procedures outlined in the Interagency Grizzly Bear Guidelines. Actions subsequent to capture are coordinated with the U.S. Fish and Wildlife Service Grizzly Bear Recovery Coordinator.

- * All incidents involving human/bear interactions are documented on Bear Sighting/Identification reports. All Park employees and visitors are encouraged to complete these forms for all bear sightings.

- * Outlines park bear research goals and objectives.

- * Outlines a program for the dissemination of information of human/bear relationships, the causes of human/bear conflicts, and how visitors, inholders, Park and concession employees can help alleviate problems through their personal actions and compliance with Park regulations.

U.S. Forest Service

If a change of status for the Yellowstone grizzly bear population under the ESA takes place, Forest Service Regions 1, 2, and 4 will classify the grizzly bear as a sensitive species¹ in the Yellowstone Area. Grizzly bears and their habitats will then be managed as sensitive on National Forest System lands in accordance with Forest Service Manual 2670 (specifically 2670.22, 2670.32, and 2676.1-2676.17e). In addition, existing Forest Plans will continue to follow direction established in National Forest Land Management Plans.

Beaverhead-Deerlodge National Forest Land Resource Management Plan (1986) States the Forest will cooperate in grizzly bear management by documenting all grizzly bear use of the Forest lands and evaluating grizzly bear habitat suitability in the Madison Range. Management actions and protective measures will be implemented consistent with Management Area goals.

Bridger-Teton National Forest Land Resource Management Plan (1989) states a goal of grizzly bear recovery to provide suitable and adequate amounts of habitat for recovery of a viable grizzly bear population in the Yellowstone Area as identified in the Grizzly Bear Recovery Plan. Once recovered, grizzly bear management will be directed by the Forest goal, "Sensitive species are prevented from becoming a Federally listed Threatened species in Wyoming, by providing suitable and adequate amounts of habitat to ensure that activities do not cause: (1) long term or further declines in population numbers or habitats supporting these populations; and, (2) trends towards Federal listing. This will be accomplished by continuing to implement pre-delisting management direction.

Custer National Forest Land Resource Management Plan (1986) states that MS1 areas will not be leased for oil and gas and will be considered for minerals withdrawal.

¹ 2672.1 - Sensitive Species Management. Sensitive species of native plant and animal species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for Federal listing.

There must be no impacts to sensitive species without an analysis of the significance of adverse effects on the populations, its habitat, and on the viability of the species as a whole. It is essential to establish population viability objectives when making decisions that would significantly reduce sensitive species numbers.

2672.11 - Identification of Sensitive Species. Regional Foresters shall identify sensitive species occurring within the Region. They shall examine the following sources as possible candidates for listing as sensitive species:

1. Fish and Wildlife Service or National Marine Fisheries Service candidates for Federal listing (categories 1 and 2) under Federal Register Notice of Review.
2. State lists of endangered, threatened, rare, endemic, unique, or vanishing species, especially those listed as threatened under State law.
3. Other sources as appropriate in order to focus conservation management strategies and to avert the need for Federal or State listing as a result of National Forest management activities.

Gallatin National Forest Land Resource Management Plan (1987) has goals of providing sufficient habitat for recovered populations of threatened and endangered species (such as the grizzly bear), and to strive to prevent any human-caused grizzly bear losses. The Forest applied the grizzly bear guidelines (Gallatin National Forest Plan, Appendix G) to provide for the recovery of the grizzly bear. When recovered, the grizzly bear will fall under the Forest Plan goal of providing habitat for viable populations of all indigenous wildlife species.... In order to assure that the grizzly bear does not have to be relisted as threatened, the grizzly will be added to the sensitive species list for the Forest and will continue to be managed under Appendix G of the Forest Plan and the Conservation Strategy. The Food Storage Order will remain in affect.

Shoshone National Forest Land Resource Management Plan (1986) states a goal of maintaining or improving habitat for threatened and endangered species. Participation in recovery efforts for listed species has contributed to the recovery of the grizzly bear population in the YEA. Grizzly bear management is currently directed by the Forest goal "Manage fish and wildlife habitats, including plant diversity, to maintain viable populations of known native vertebrate species and meet population objectives of management indicator species". The grizzly bear is a management indicator species and a sensitive species on the Forest. The Forest will continue to follow the goal of coordinating Forest wildlife and fish management with the Wyoming Game and Fish Department and the US Fish and Wildlife Service. Other Forest goals for maintaining or improving riparian ecosystems and the quality of habitat on winter range contribute to the maintenance of important grizzly bear habitat.

The Targhee National Forest Land Resource Management Plan revision was completed in 1997. Grizzly bear goals and objectives include:

- Habitat conditions will be sufficient to sustain a recovered population of grizzly bears.
- Allow for unhindered movement of grizzly bears (continuity with Yellowstone National Park and adjacent bear management units).
- Meet recovery criteria in the current Grizzly Bear Recovery Plan.
- Implement guidelines developed by the Interagency Grizzly Bear Committee.
- Provide safe and secure release sites for nuisance bears as defined by the Interagency Grizzly Bear Guidelines.
- Achieve the road density standards in the Bear Management Units within 3 years of the implementation of the ROD in coordination with the USFWS and State management agencies.
- Develop fire management plans for each of the Bear Management Units to address wildfires and prescribed fires.
- Make non-Federal lands within the Bechler-Teton BMU a high priority for acquisition.
- Manage recreation to minimize conflicts with humans.
- The Interagency Grizzly Bear Guidelines for Management Situation (MS) I Habitat apply, except that livestock grazing in existing MS 2 Habitat will continue to be managed under MS 2 guidelines (to allow for the phase-out of existing domestic sheep allotments), and the highly-developed areas in MS 3 Habitat will continue to be managed as MS 3 Habitat.

STATE PLANS AND GUIDELINES

Montana Department of Natural Resources

It is the policy of MDNR to conduct programs and activities in a manner that limits the potential for conflicts between grizzly bears and people and that provides habitat to help achieve and sustain recovery within the Yellowstone Area. Land uses which can adversely affect grizzlies or their habitat will be designed and coordinated in a manner that is compatible with grizzly bear behavior and habitat needs, but not to the extent of excluding other uses.

The Forestry Division of the MDNR has additional policy guidance for management of grizzly bear habitat within the Yellowstone. In 1988, grizzly bear management standards and guidelines were implemented to integrate management of grizzly bear habitat with timber management on State lands within the Yellowstone Area. Performance standards and guidelines cover long range planning, project planning and design, management of bear/human conflicts, and special management areas. These will be implemented until the Forestry Division develops and adopts other guidance through a programmatic planning effort that will incorporate grizzly bear management objectives.

Additional policy guidance will be developed in the near future. The USFWS and MDNR have mutually agreed to develop and implement guidelines for integrating grizzly bear habitat protection and MDNR land management activities. MDNR will continue to consult with MDFWP on specific projects that may adversely affect any species of wildlife in Montana, in an attempt to minimize or avoid adverse impacts to populations or their habitats.

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APPENDIX I

Sightings of unique females with cubs-of-the-year have been used for many years to estimate the minimum size of the Yellowstone grizzly bear population, an approach that inherently underestimates true population size. To obtain more reliable estimates, various statistical methods have been discussed and explored. Early discussions focused on a maximum likelihood estimator (MLE) that assumes all animals are equally sightable. Discussions centered on likely biases in this method. Analyses completed to date represent two different approaches to assessing those biases and both approaches find evidence that sightabilities are unequal among different animals and conclude that, as a result, the application of MLE will likely underestimate the size of the Yellowstone grizzly bear population. Nonetheless, this method yields improved estimates relative to current practices. An alternative method, the negative binomial estimator, is proposed and evaluated in the study by Mark Boyce, Darryl MacKenzie, Bryan Manley, Mark Haroldson, and Dave Moody which has been submitted and is in review for publication in a peer-reviewed scientific journal. Other methods that may yield relatively unbiased estimates and provide a sound basis for assessing the risk of overestimation will be the subject of continuing studies in 2000. Those readers interested in existing statistical treatments on the application of Yellowstone grizzly bear data to estimate total population size may obtain copies of these papers by writing to: USFWS, University Hall, Room 309, University of Montana, Missoula, Montana 59812. These papers are not included in this document due to their size (74 pages).

APPENDIX II

CALCULATION OF MORTALITY LIMITS (These calculations will be updated with new information as it becomes available)

In a recovered population, a limited number of animals can be removed without jeopardizing the viability of the population, and without precluding growth. To assure that human-caused mortality will remain closely regulated, the management agencies will conduct a management review if the running 3 year average of total known human-caused grizzly bear mortality exceeds 4%¹ of the most recent total population estimate, or if the running 3 year average of the most recent known female human-caused mortality exceeds 30% of this 4% limit.

The following assumptions and methods will be used to derive the four percent limit on human-caused mortality:

- a) The grizzly bear population in the Yellowstone Area is assumed to be 50 percent adults and 50 percent subadults (Interagency Grizzly Bear Committee, 1987, pp. 47-59).
- b) The grizzly population in the Yellowstone Area is assumed to be 45.2 percent male and 54.8 percent female, including both adults and subadults (Eberhardt and Knight 1996).
- c) The proportion of adult females in the Yellowstone Area grizzly bear population will be recalculated as new data become available as per the methods in Knight et al. (1993). The most recent data on the percentage of adult females in the population is 27.4% (Eberhardt and Knight 1996).
- d) Calculation of the annual mortality limits is based on the total number of females with cubs in each year calculated using sightings and resightings of females with cubs referenced in Appendix I. The total population estimate will be based on the sum of the most recent 3 years of estimates of the total number of females per year, divided by 0.274 which is the most recent percentage of adult females in the population (Eberhardt and Knight 1996). This method will count all unduplicated sightings of females with cubs inside the PCA and within 10 miles outside the PCA boundary.

The mortality limits for the PCA and the area within 10 miles outside the PCA boundary will be derived by multiplying the total population estimate by 4 percent for total mortality limits, and that 4 percent figure by 30 percent to establish female mortality limits. These mortality limits are conservative because:

- 1) According to Harris (1986), a grizzly bear population can sustain 6.5 percent total human-caused mortality without population decline and; and
- 2) It is recognized that if known human-caused grizzly mortality reaches 4 percent of the

¹ Note: efforts are currently underway to recalculate the unknown mortality level based on data from radio collared bears. As this work proceeds, this section may change in the final Conservation Strategy after scientific peer review.

population estimate, total mortality will exceed this level because some unknown, illegal mortality is likely to occur. The 4 percent mortality limit, and 30 percent female mortality limit are applied to conservative estimators of total population size (see Appendix I).

EXAMPLE: The following data are theoretical for the region of the Yellowstone Area, and are presented to provide a mathematical example for the calculations. It is important to realize that the mortality limits will change each year in response to changes in annual sightings of unduplicated females with cubs.

Year	1995	1996	1997
Annual total estimate for FWCs from resightings	25	35	31

$25 + 35 + 31 = 91$, $0.274 = 332$ as a total population size in this example

The total known mortality limit would be $332 \times 0.04 = 13$ in this example
 The known female mortality limit would be $13 \times 0.30 = 3.9$ in this example

APPENDIX III

EXISTING BEAR FOODS AND RELATED MONITORING PROGRAMS

Winter-killed Ungulate Carcass and Associated Bear Use Survey

During April and May of each year, YNP and IGBST personnel conduct ungulate carcass surveys along 126.5 miles of survey routes on the Northern Winter Range, 82.5 miles of survey routes in the Firehole River drainage, 17 miles of survey routes in the Norris Geyser Basin, and 27 miles of survey routes in the Heart Lake area. Survey routes are hiked, snowshoed, or skied by teams of two people. All ungulate carcasses as well as bears and bear sign (tracks, scat, feeding sign) observed from the survey routes are recorded. Data collected include species, sex, and age class of ungulate carcasses found, estimated date and cause of death, scavenging by bears, species of bear using the carcass, use of carcass by other scavengers, and UTM location.

Cutthroat Trout Spawning Stream And Associated Bear Use Surveys

Beginning 1 May each year, 8 frontcountry streams (Lodge Cr., Hotel Cr., Hatchery Cr., Incinerator Cr., Wells Cr., Bridge Cr., Weasel Cr., and Sand Point Cr.) within or near the Lake Developed area, and 5 frontcountry streams (Sandy Cr., Sewer Cr. Little Thumb Cr., Arnica Cr., and 1167 Cr.) within or near the Grant Village development are checked daily to detect the presence of adult cutthroat trout (Andrascik 1992, Olliff 1992). Once adult trout are found (i.e., onset of spawning), weekly surveys of cutthroat trout on these streams and on an additional 8 backcountry streams (Cub Cr., Clear Cr., Columbine, Flat Mountain Arm Cr., Delusion Lake Outlet, Trail Cr., and 1150 Cr.) are conducted. In each stream on each sample day, two people walk upstream from the stream mouth and record the number of adult trout observed. Sampling continues one day per week until most adult trout return to the lake (i.e., end of spawning). Counts are used to estimate the peak periods, relative magnitude and duration of spawning runs (Reinhart 1990). While making fish counts, observers record bear sign (e.g., bear sightings, fish parts, hair, scats, and tracks) and collect hair from DNA hair collection corrals. Track measurements and DNA from collected hair are used to determine the number, species, and association of family groups of bears.

Cutthroat Trout Population Monitoring Programs

Since the discovery of lake trout in Yellowstone Lake in 1994, park biologists have been developing and refining control techniques for lake trout removal and for assessing potential impacts to native Yellowstone cutthroat trout.

Clear Creek Fish Trap--Clear Creek is a tributary of Yellowstone Lake flowing west from the Absaroka mountains approximately 20.3 km before entering the east shoreline of the lake. Adfluvial Yellowstone cutthroat trout enter Clear Creek from Yellowstone lake to spawn from late April through July (Ball and Cope 1961). Since 1951, the spawning run of cutthroat trout in Clear Creek has been monitored through the presence of a fish trap and weir located near the mouth of the creek (Jones et al. 1984). Since the installation of the trap, fishery information on the numbers of upstream and downstream migrants, and the size and age of the spawning run has been collected on a relatively annual basis. The fish trap is generally installed during the month of May, the exact date depending on winter snow accumulation, weather conditions and spring snow melt. Fish passage, enumeration, and sampling occur through dip-netting trout that enter the upstream and downstream trap boxes and/or visually counting trout as they swim through wooden chutes attached to the trap (Jones et al. 1984). An electronic fish counter is also periodically used. Other data collected include weights, lengths, sex and ages (based on collected scales) of captured fish. Daily instream flows and water temperatures are also collected. The Clear Creek fish trap is generally operated until early to mid-August. Continued operation of the Clear Creek fish trap may be used for long term monitoring of the potential impacts of lake trout on the Yellowstone Lake cutthroat trout population.

Largemouth Gillnetting--A largemouth gillnetting program is also used to monitor the population structure of cutthroat trout in Yellowstone Lake (Jones et al. 1984). At each of 11 sampling sites around Yellowstone Lake, 5 38.1 x 1.8 m monofilament gill nets spaced 100m apart, are set overnight in 2 - 6 m of water. Length, weight, sex, stage of maturity, and scales for aging are collected for each captured fish. Continuation of this gillnetting operation may be used for long term monitoring of the potential impacts of lake trout on the Yellowstone Lake cutthroat trout population.

Whitebark Pine Surveys

Nineteen whitebark pine transects are currently visited annually. Each transect contains 10 marked trees. Cones are counted on each marked tree between July 15 and August 15 depending on annual phenology. The objective is to count cones after maturation, but before cones and seeds have been collected by red squirrels (*Tamiasciurus hudsonicus*) and Clark's nutcrackers (*Nucifraga columbiana*). Data is recorded on standard field forms and sent to the IGBST. The IGBST maintains the official ecosystem database. The presence or absence of blister rust and beetle infestations as well as grizzly bear, black bear, red squirrel, and Clark's nutcracker activity are noted for each transect.

Army Cutworm Moths

IGBST Monitoring Program--The IGBST and Wyoming Game and Fish Department currently monitor bear use of moth aggregation sites during radio tracking and annual grizzly bear observation flights. When army cutworm moths are present on the high elevation talus slopes, concentrations of grizzly bears are observed at the moth aggregation sites during these flights. The presence of bears at the aggregation sites is used as an indirect measure of the presence

or absence of moths during a given year. This monitoring program does not provide direct information on the relative abundance of moths.

State of Montana Monitoring Program--Army cutworm moth larvae are agricultural pests which eat a wide range of host plants including small grains, alfalfa and sugar beets (Blodgett 1997). Moth outbreaks occur sporadically, when insect population potential is high and environmental factors are favorable to the insects' survival (Blodgett 1997). Because army cutworm moths are an agricultural pest, the State of Montana has a cutworm moth monitoring and forecasting program. The forecasting method employed by county extension agents entails trapping for army cutworm moths in agricultural areas between August and October. Extension agents set two army cutworm pheromone traps per county (G. Johnson, Montana State University, pers. commun.). Trap sites are located in agricultural areas often where soil has been tilled to seed winter wheat in the fall as moth larvae prefer such soft soils (G. Johnson, MSU, pers. commun.). Extension faculty find the amount of fall moth activity can be indicative of moth egg lay (Blodgett 1997). When trap catches exceed 800 moths during the August through October trapping period, extension agents forecast potentially damaging larvae populations may appear the following spring (G. Johnson, MSU, pers. commun.).

Many factors can affect moth larval development. Abundant precipitation from May through July is harmful for the worms and can reduce local cutworm populations (Blodgett, MSU, pers. commun.). Army cutworm moth outbreaks have been noted in warm and dry years when rainfall from 1 May through 31 July was less than 4 inches (Blodgett 1997). If serious cutworm problems are suspected, agents see crop damage by the first of April. Fewer adult moths are trapped after warm and dry weather patterns with mild winters when there is a lack of early spring snow cover to insulate and protect larvae from freezing (G. Johnson, MSU, pers. commun.). Dry weather in the fall also contributes to the mortality of moth eggs and larvae (G. Johnson, MSU, pers. commun.). Pesticides also affect larval recruitment. Warrior, a synthetic pyrethroid, is an EPA registered army cutworm moth pesticide for use on wheat crops. Currently, pesticide companies are in the process of registering this pesticide for use on barley crops as well (G. Johnson, MSU, pers. commun.).

Since 1992, a statewide army cutworm moth pheromone trapping program has been conducted in Montana. Twenty counties in Montana participated in the program in 1997 (Blodgett 1997). In fall 1998, MSU extension agents plan to coordinate with extension agents at universities in Wyoming, Colorado and Nebraska to expand the moth trapping program to include county trapping efforts in their respective States. In addition to trapping for moths, extension agents plan to gather daily weather and temperature data to improve their forecasting technique (G. Johnson, MSU, pers. commun.). The IGBST, WGF, and YNP are currently evaluating methods for incorporating State army cutworm moth monitoring programs into existing grizzly bear foods monitoring programs.

APPENDIX IV

FURTHER INFORMATION ON MONITORING GENETIC DIVERSITY IN GRIZZLY BEAR POPULATIONS - A SUMMARY OF KNOWLEDGE AND OPTIONS

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INTRODUCTION

The 22-year history of grizzly bear (*Ursus arctos horribilis*) conservation actions under the Endangered Species Act has taken place in parallel to an explosion of new information and techniques in conservation genetics. The species' 1975 listing as threatened predated publication of seminal works in conservation genetics (Soule and Wilcox 1980; Schonwald-Cox et al. 1983) as well as initial efforts at modeling persistence of bear populations based on demographic and genetic attributes (Shaffer 1978). Even the Grizzly Bear Compendium (NWF 1987), a more recent, encyclopedic examination of grizzly bear ecology and management, devotes only a bit over one page to genetic considerations.

Basic techniques for evaluation of genetic attributes at the population level have been available for many years. For example, the use of protein electrophoresis to describe the genetic structure of wild populations predates grizzly bear listing by several decades (Lewontin 1991). However, use of the diverse suite of genetic tools available today, ranging from DNA fingerprinting using micro- and mini-satellites to mitochondrial DNA analysis, was either in its infancy or undiscovered in 1975. The U.S. Fish and Wildlife Service (Service) has incorporated genetic concerns into recovery plans and environmental review documents for numerous species, including the grizzly bear (USFWS 1993) and gray wolf (*Canis lupus*) (USFWS 1994). The Service also sponsored a workshop on grizzly bear genetics in 1985 (Harris 1985; Allendorf and Servheen 1986). The grizzly bear recovery plan reviews the threats of genetic impoverishment in isolated populations and advocates genetic management through periodic translocation into the isolated Yellowstone population.

The Service recognizes the need for continuing genetic monitoring of listed grizzly bear populations, all of which experience cumulative effects of varied human activities that may act to reduce genetic variability. This review summarizes the rationale for managing for genetic diversity, available assay techniques, and current findings in bear genetics. Using responses from a questionnaire submitted to prominent geneticists, it concludes with options for implementation of a continuing genetic monitoring program for grizzly bears in the contiguous United States.

WHY MANAGE FOR GENETIC DIVERSITY?

Wildlife scientists have long recognized the values of maintaining genetic variability in wild populations. Hunter (1996) places these values in 3 categories: evolutionary potential, loss of fitness, and utilitarian values.

Genetically variable populations retain evolutionary potential because greater genetic diversity results in greater likelihood of evolution in response to changing environmental conditions, and possibly greater dispersal ability.

Similarly, genetically variable populations are thought to maintain fitness, because recessive deleterious alleles are less apt to be expressed and because they may possess more adaptive phenotypic characteristics.

Finally, the utilitarian values of genetic variation can be exemplified by the essential roles played by wild genetic material in development of disease-resistant varieties of crops and productive domestic animals.

Concern for loss of genetic variability is greatest in cases of small and/or isolated populations. Genetic variability in isolated populations is determined largely by the combined actions of natural selection and genetic drift (Nunney and Campbell 1993). Small or fluctuating populations can be expected to lose genetic variability through decrease in the percentage of genes that are polymorphic (heterozygous), and through changes in allele frequency with loss of rare alleles (Awise 1994; Gyllensten 1985). Small, isolated populations may also be subject to increased mating between close relatives ("inbreeding"), with increased possibility of expression of normally recessive, deleterious alleles in a homozygous state (Ralls et al. 1986). Inbreeding depression has been hypothesized as a contributor to decreased fitness in many natural and domesticated animal populations (Allendorf and Leary 1986; Roelke et al. 1993; O'Brien et al. 1985). Early work (Frankel and Soule 1981) suggested that inbreeding causing only a 10% decrease in genetic variation in small populations could result in an up to 25% reduction in reproductive performance.

Other negative consequences of reduced genetic diversity have been hypothesized to include outbreeding depression (mating among divergent genotypes resulting in weak or sterile offspring), and loss of evolutionary flexibility (loss of alleles conferring advantages in adaption to changing environmental conditions)(Primack 1993). (Outbreeding depression is not a negative consequence of reduced genetic diversity. It is a potential negative effect of breeding between evolutionarily divergent individuals that may have genes that are adapted for the local environment and incompatible. This is very different from inbreeding depression. An example would be that breeding between Kodiak Island brown bears and Yellowstone grizzly bears could lead to outbreeding depression since both mtDNA and nuclear DNA studies have demonstrated that these populations have evolved independently for over 1,000 bear generations.)

Adverse physiological effects with apparent genetic associations have been documented in both in situ (Roelke et al. 1993) and ex situ (Ralls and Ballou 1983) populations. The cheetah

(*Acinonyx jubatus*) and Florida panther (*Felis concolor coryi*) are oft-cited examples of possible deleterious inbreeding effects. While recent studies have advanced alternative explanations for cheetah declines, including predation, demographic, and toxic effects (Caughley 1994; Caro and Laurenson 1994), some workers (Roelke et al. 1993) trace a genetic link to the suite of physiological abnormalities prominent in Florida panther populations, including cardiac, spermatozoal, and reproductive tract defects.

Overall, however, empirical evidence for fitness declines in wild populations due to genetic impoverishment has been relatively scarce. Nuclear and mitochondrial genetic analyses of brown bears on Kodiak Island, where the brown bear population has been isolated from mainland populations for an estimated 10,000 years, have revealed little or no genetic variability (Waits et al. undated; Paetkau et al. 1998); however, no apparent loss of fitness has been reported and vital rates appear strong (NWF 1987). Some authors have recently argued that demography, rather than genetics, may be of more immediate importance to conservation of most wild populations (Lande 1988). While debate as to the relative importance of genetic and demographic aspects of small population biology continues, managers increasingly advocate attention to genetic considerations in design of reintroduction schemes (Leberg 1990; IUCN 1995). The inevitable reduction in genetic variability to be expected in isolated grizzly populations (using the Cabinet-Yaak population as an example, reduction in variability has been estimated at 9-17% over 5 generations [Harris 1985]) argues for continuing monitoring, whether or not fitness loss has been detected.

MEASURES AND TECHNIQUES IN CONSERVATION GENETICS

Genetic variation in natural populations can be measured in 2 broad fashions: mean heterozygosity and allelic diversity. Mean heterozygosity measures the proportion of loci (chromosomal positions) at which an individual is heterozygous (has more than one allele). Allelic diversity measures the number of alleles per locus (Leberg 1990; Hunter 1996).

Genetic assay techniques have been developed to examine both nuclear and cytoplasmic genes. The most familiar technique is protein electrophoresis, which indirectly identifies alleles through visualization of the enzymes they code for. At the other end of the spectrum is the most direct family of techniques, DNA sequencing, which identifies the sequence of the 4 nucleotides forming the DNA molecule. Several intermediate techniques cleave DNA using restriction enzymes and characterize the fragments (Hunter 1996; Avise 1994).

Cytoplasmic techniques in animals focus on variability in mitochondrial DNA. Mitochondrial DNA accounts for only a small fraction of the genome (Klug and Cummings 1991; Paetkau and Strobeck 1998), but exhibits several characteristics that make it desirable as a genetic marker, including more rapid evolution than nuclear DNA (note: the average rate of sequence evolution in the mitochondrial genome is higher than the nuclear genome, but there are regions of nuclear DNA such as microsatellite loci that evolve more rapidly than some conserved mtDNA gene regions), maternal inheritance, and lack of recombination (Hutchinson et al. 1974). Thus, it has been advocated as a favored vehicle for phylogeographic analyses (Avise et al. 1987 in Avise 1995).

Several aspects of ursid biology suggest a special role for mitochondrial techniques. Because female bears are generally more sedentary than males, because females and young are spatially associated over time, and because bear populations retain significant demographic autonomy over time, the maternal mitochondrial pathway may offer ways to assay genetic structure in the absence of distinction among autosomal genes (Awise 1995).

Blood and/or tissue have traditionally been used as sources of genetic material from wild populations. Acquisition of these materials has been hindered by the need to live-capture and anesthetize individuals, resulting in substantial cost and risk. However, recent advances in amplifying minute quantities of DNA through the polymerase chain reaction (PCR) have allowed reliable genotyping, with a 99% confidence level, after extraction of only a few picograms of nuclear DNA from hair, feces and forensic or ancient samples (Taberlet et al. 1996; Taberlet and Bouvet 1992).

THE STATE OF KNOWLEDGE OF BEAR GENETICS

Allozyme markers were used in the late 1970s to examine genetic structure of polar bear (*Ursus maritimus*) populations. These studies observed little or no variation in 13 enzyme loci (Allendorf et al. 1979). Data on genetic variation in grizzly bears were first presented in the mid-1980s (Knudson and Allendorf 1985). These initial results, also based on protein electrophoresis, confirmed that substantial genetic divergence existed between Montana and Alaska populations. Recently completed analyses using nuclear microsatellite markers (Paetkau et al. 1998) found high levels of within-population variation in brown bear populations at the core of the North American range, and substantially lower diversity at the southern fringe of the range, in the Northwest Territories, and in southwest Alaska.

Paetkau et al. commented on the apparent substantial drop in heterozygosity in the Yellowstone grizzly population in historic time. Assuming that historic levels of diversity in the population were similar to levels currently found in northwest Montana grizzlies (an assumption that is not confirmable with any existing data), they estimated that they had dropped by 15% to 20% since the population was isolated less than a century ago.

Paetkau et al. also attempted to estimate effective population size (N_e) based on heterozygosity. Their calculated N_e for the Kodiak population corresponded to only 3.7% to 18.7% of the total population size, a fraction much smaller than earlier estimates based on demographic parameters, which had approached 32% (Harris and Allendorf 1989). Recently, much emphasis has been placed on molecular approaches to determining evolutionary history and taxonomic relationships between the 8 extant bear species. Evolutionary trees, which are based on steady but random chromosomal mutation over time, with associated DNA sequence divergence ("genetic distance"), have been constructed that generally agree that the bears diverged from the Procyonidae (raccoons and allies) approximately 30 million years ago. Within the ursid line, the giant panda (*Ailuropoda melanoleuca*) and spectacled bears (*Tremarctos ornatus*) next diverged at 18-25 million years BP and 12-15 million years BP, respectively. The lineages of the remaining 6 ursid bears became distinct between 5-7 million years BP (O'Brien

1993). Within the ursid line, evidence suggests that the sloth bear (Melursus ursinus) emerged 7 million years BP, and the line leading to the Asiatic black bear (Ursus thibetanus) and North American black bear (Ursus americanus) diverged approximately 6 million years BP, with the sun bear (Helarctos malayanus) line diverging soon afterward (5 million years BP).

Close phylogenetic relationships between brown and polar bears have been reported based on mitochondrial DNA analyses; most workers believe that the polar bear originated from a clade of brown bears during the Pleistocene (Talbot and Shields 1996a,b; Shields and Kocher 1991; Waits et al. 1998). Estimates of date of divergence of polar bears from brown bears range from 300-400,000 years BP (Talbot and Shields 1996b) to 146,000-185,000 years BP (Waits et al. 1998).

Recent work has also addressed long standing questions of intraspecies taxonomy in brown bears. Using mitochondrial sequence data revealing substantial sequence divergence and near total geographic distinctness, Waits et al. (1998) have proposed the existence of 4 major phylogeographic clades of North American brown bears. Clade evolution has been attributed to divergence in Pleistocene glacial refugia, multiple migrations across Beringia, and low levels of female dispersal. The proposed clades differ markedly from traditional North American brown bear taxonomies based on morphological features; Waits et al. suggest that morphological differences historically used to define subspecies in brown bears may represent phenotypic plasticity rather than long term genetic isolation.

Similar genetic structures based on mitochondrial analyses have been identified among European brown bear populations (Taberlet and Bouvet 1994; Randi et al.1994). Conversely, little evidence of population structure has been demonstrated in mitochondrial DNA restriction enzyme analysis of black bear populations (Cronin et al.1991).

Genetic tools have applications in bear conservation that go well beyond taxonomy. Mitochondrial techniques have been published for distinguishing scat and hair from brown and black bears (Ursus americanus) on sympatric range (Waits and Ward 1995). Nuclear techniques are also available allowing the study of gene sequences from bear scat (Kohn et al. 1995). And recent nuclear microsatellite analysis has demonstrated multiple paternity in brown bears (Craighead et al. 1995). Applications such as these point to expanded future roles for genetics in census techniques for many wildlife species.

GENETIC GOALS OF THE 1993 GRIZZLY BEAR RECOVERY PLAN

Genetic diversity is discussed in the 1993 Grizzly Bear Recovery Plan(USFWS 1993) -- Management of Genetic Diversity (pp.27-28). This section demonstrates that the reduction in grizzly range has resulted in elimination of historic levels of gene flow. It cites work by Harris (1985) and Harris and Allendorf (1989) on the likelihood that effective population sizes (N_e) of existing populations are not large enough to avoid genetic impoverishment in the short term. Based on these concerns, the 1993 Recovery Plan suggested proactive genetic management of the isolated Yellowstone population through placement of one individual into the population each generation (10 years). Although not specifically stated in the 1993 Recovery Plan, the

concern of possible loss of genetic diversity is only one potential problem for the two isolated grizzly bear populations - the Yellowstone and North Cascades ecosystem populations.

The 1993 Plan does not specifically call for development of a continuing program to monitor genetic status of all 5 grizzly bear populations. Such a program, however, appears important to assure that the unique attributes and threats experienced by each population will be evaluated over time, and appropriate management actions initiated in a timely fashion.

METHODS FOR MONITORING THE GENETIC STATUS OF BEAR POPULATIONS

Methods for implementing genetic monitoring programs are not explicitly addressed in the expanding genetics literature. With this in mind, we elected to forward a brief questionnaire to individuals that have published articles dealing specifically with bear genetics, and who are familiar with small bear population genetics, and comparative genetics between bear populations from standpoints of conservation, taxonomy, or phylogeography.

Key points from responses from 6 individuals are summarized below:

1. Monitoring programs should focus on nuclear microsatellite markers.

Respondents emphasized the high sampling variance among genetic loci, and the consequent need for examination of multiple loci. Increasing the number of loci scored reduces sampling variance more than increasing sample size of individuals once approximately 30 individuals have been sampled. This factor may be especially important in analysis of small grizzly populations, such as those in the Cabinet Yaak and Selkirks. This need for sampling multiple loci reduces the value of mitochondrial DNA approaches, which in effect sample a single, fixed locus.

Other drawbacks of mitochondrial approaches are their high relative cost, and the difficulty of interpreting results from a maternally inherited gene in a species such as the grizzly where gene flow is male-biased. Finally, inbreeding depression and associated fitness loss -- primary concerns of a monitoring program -- are related to the expression of rare, deleterious alleles in nuclear, rather than mitochondrial, genes.

Given these attributes, and acknowledging the value of mitochondrial DNA techniques for phylogeographic studies, our respondents were in agreement that a genetic monitoring program should focus on nuclear DNA techniques -- specifically analysis of multiple DNA microsatellites. Nuclear microsatellites are inherited from both parents, are highly variable, and are independent. Statistical power for detecting bottlenecks improves as the number of loci scored increases; respondents advocated using a minimum of 6 to 8 loci, and optimally 20 to 40. PCR primer sequences derived from black bears (note: 12 new loci are from a European brown bear DNA library and work is underway to isolate additional loci from a Yellowstone grizzly bear DNA library, Waits and Ward, unpublished) are rapidly becoming available (one respondent indicated that 8 are presently available, while another indicated that 23 are available, demonstrating the rapid evolution of this field of research).

2. Blood and tissue remain the most reliable sources of genetic materials.

Respondents detailed the diversity of materials currently being investigated as sources of genetic material, including blood, tissue, hair, scat, saliva, and urine, and the decreasing DNA yield from each source (generally in the order listed, with the last 3 sources being similar). Genotyping errors may be experienced with low yield sources; for example, isolations using less than 10 hairs may have to be repeated 2 to 6 times to avoid errors. An advantage of tissue and blood samples is that they can provide enough material for archival purposes.

Respondents also pointed out the ancillary information that active versus passive sample acquisition may provide, such as confirmation of individual age, sex, and possible relatedness to others in the population -- all factors that assist interpretation of results. For example, a sample of anonymous hair snags biased toward adults might mask incipient loss of genetic variation for several years. Of course, passive sampling might be advantageous if a goal is to minimize animal handling.

3. Genetic status assessments should be conducted each decade.

Genetic assessments should be conducted at minimum once per generation (approximately 10 years in grizzlies), and ideally more often if adequate samples (>30) were available. Optimally, genotypes would be recorded by birth year, or samples could be pooled from 2-3 cohorts to increase sample size. Obvious trade-offs would be, on the one hand, the desirability to gather samples as seldom as possible and, on the other hand, the desirability of rapidly detecting loss of variation and/or population decline. Respondents pointed out that the more frequently samples are done, the less strong the associated genetic signal will be.

Thus, more frequent sampling would entail larger individual and loci sample size in order to achieve desired levels of statistical power.

4. Genetic monitoring programs should be tailored to individual population needs and status.

It will eventually be desirable to monitor all grizzly populations non-invasively using scat or hair, assuming that DNA yield from these methods will improve over time. In the near term, however, monitoring programs should take advantage of ongoing research activities providing samples of blood and tissue. For example, an adequate sample of juvenile bears (approximately 30) is currently being captured on an annual basis in the Yellowstone Grizzly Bear Ecosystem. (If a sample was inadequate, year groups could be pooled.) However, given the small number of individuals currently captured in the smaller grizzly populations (Cabinet-Yaak, Selkirk, Mission), non-invasive approaches may need to use existing, imperfect methods. The small sample sizes that are likely to be available in these populations necessitate careful study design and a clear understanding of data limitations (see 6).

Should additional funding become available, pedigree reconstruction could be undertaken for populations of approximately 200 or less. This approach would entail documentation of adult female-offspring relationships through direct observation, scat or hair collection, and

examination of 30-50 microsatellite loci. Pedigree maintenance would require sampling of nearly all new cubs.

5. Better understanding of genetic interchange between peninsular populations in the U.S. and adjacent Canadian populations is needed.

The present level of genetic interchange between U.S. peninsular populations (Cabinet-Yaak and Selkirk) and adjacent Canadian populations is not well documented. Because sample size of bear genetic materials that are likely to be collected from these populations will be small under any scenario, augmentation determinations are likely to rely heavily upon modeling techniques. Model reliability will rest upon correct assumptions regarding transborder interchange.

6. Power analyses and/or modeling techniques to better understand the relationship between observed and actual loss of genetic variability should be undertaken concurrently with acquisition of genetic samples.

Respondents listed similar factors suggesting loss of genetic variation that would call for increased management attention to a grizzly population, including demographic (increased cub mortality, observed sibling matings) and physiologic (declining sperm counts, low hormone levels, increased levels of infectious disease) abnormalities.

It was noted that "biologically significant" loss of variation is difficult to determine, as examples of populations with low genetic variation (e.g., Kodiak bears) and no resultant fitness loss are available. However, respondents still pointed out that rapid declines in effective population size, particularly those that persist for more than 1 generation, can be assumed to increase extinction risk.

A drawback of management decision making based on documented loss of genetic variability (versus decision making based on modeling) is that the difficulty of statistically detecting loss of variation may delay management actions until populations are already in jeopardy. (For example, in some situations, a loss of as much as 30% of genetic diversity may occur before the loss can be statistically proven.) Respondents mentioned the growing interest in power analysis in the biological sciences; power analysis attempts to define either prospectively or retrospectively a level of confidence that a failure to detect a decline is in fact not a decline.

Prospective power analysis is increasingly being advocated as an integral part of research design (Steidl et al. 1997; Reed and Blaustein 1997). In this case, power analyses could help in determining sample sizes and number of loci to be scored.

7. Recurring genetic assays would be relatively inexpensive.

Respondents suggest that costs per individual for monitoring 6-20 loci would be in the range of \$200. Thus total cost for a population sample of 30 would be approximately \$6,000. If protocols called for repeated genotyping (as is recommended for low yield DNA sources such as scat, hair, and urine), costs would be higher.

Respondents did not comment on the costs associated with simulation modeling.

SYNTHESIS

Of the 5 existing grizzly bear populations, only the Yellowstone and the North Cascades populations are genetically isolated from larger contiguous populations. Genetic isolation is the lack of natural movement of breeding animals into a population due to physical barriers or a lack of dispersal behavior to facilitate such movement. If bears were reintroduced into the Bitterroot ecosystem, these bears would be genetically isolated until and if they might eventually be joined with adjacent populations through movements. However, this linkage is questionable considering the lack of movement between populations to date. The NCDE, Cabinet-Yaak and Selkirk grizzly bear populations are all contiguous with larger populations in Canada. This larger contiguous Canadian population consists of thousands of grizzly bears in an unbroken population extending northward from the NCDE, Cabinet-Yaak and Selkirks in the U.S. through the Canadian Rockies and eventually joining the grizzly bear populations in the Yukon and Alaska. The U.S. portions of these populations are subsets of larger populations that extend southward across the border into the U.S. Because the NCDE, Cabinet-Yaak, and Selkirk populations are not genetically isolated, a loss of genetic diversity is not a threat to these populations. This alleviates the need to establish objective measurable criteria for genetics for these 3 contiguous populations.

The Yellowstone population has been isolated from contiguous populations to the north for perhaps 80 years. Perhaps because of this isolation, the Yellowstone population has less genetic diversity than the NCDE population (Table 1). However, to date there are no historic data on genetic diversity in places like Yellowstone. At this time there are no data to demonstrate any physical problems associated with a reduction in fitness in the Yellowstone grizzly bears that might be due to a loss of genetic diversity. In fact, the Yellowstone population shows every indication of a healthy population including high litter size (an average of 2.16 cubs per litter from 1991-1996), a high number of females seen with cubs (an average of 23 females with cubs seen each year from 1991-1996), high numbers of cubs seen (an average of 49 cubs seen each year from 1991-1996), almost no evidence of disease, high survivorship, an equal sex ratio, normal body size and physical characteristics, and a population increasing at between 4 and 7% per year for the past 8-10 years. These population fitness factors will continue to be monitored as part of normal research and monitoring activities to be sure and recognize any possible impacts on fitness related to changes in genetic diversity. Given the healthy nature of the Yellowstone population, the Service believes the current level of genetic diversity (Table 1) is adequate. Because the population is isolated, the Service believes that it is important that the genetic diversity not deteriorate by a significant amount.

As evidenced by Table 1, no information on the genetics of the North Cascades population is available. The North Cascades population is not a healthy population because it is low in numbers and the specific reasons for these low numbers such as low cub production and/or poor survival are as yet unknown. Also, the genetic heterozygosity of the North Cascades population is unknown and we cannot assume at this time that it is sufficient without genetic

sampling.

There is a need to monitor the change in genetic diversity over time in order to make sound decisions on the need for augmentation of new individuals to increase diversity if diversity is being lost. If genetic diversity is being lost in any of the isolated populations, this may be detected by the monitoring program and measurement protocol established in this recovery task.

Table. 1. Genetic variability within healthy North American brown bear populations based on nuclear DNA microsatellite analysis averaged over 8 loci (from Waits et al. 1998).

Population	Alleles	Diversity	Sample size
Kodiak Island, Alaska	2.1	26.5%	34
Kluane National Park, Canada	7.4	76.2%	24
East Slope, Alberta, Canada	6.4	65.6%	30
NCDE, Montana, USA	6.8	70.3%	35
Yellowstone, USA	4.4	55.5%	46

Diversity is calculated by $h = (1 - \sum x_i^2) / (n - 1)$, where x_i is the frequency of the i th lineage (allele) and n is the sample size.

This review highlights the need for a proactive strategy for assuring that there is no significant loss of genetic diversity in the isolated grizzly bear populations in the conterminous United States, and continued baseline monitoring of all populations and those contiguous populations in Canada. Isolation of the Yellowstone population makes this the population of most concern because it is the only isolated population, other than the North Cascades (where no data are currently available). Given that the data on population fitness indicates that current levels of genetic diversity are adequate, but concern that an ongoing loss below current levels could lead to detrimental conditions, maintenance of the existing levels of diversity is desirable. Table 1 shows current levels of genetic diversity in the NCDE and Yellowstone as compared to some other healthy North American brown bear populations (from Waits, et al. 1998).

Efforts in the near term should attempt to balance the need for prompt data acquisition and possible management action with recognition of the limitations and rapid evolution of current science. This calls for an adaptive, management-oriented approach to data gathering and evaluation. A reasonable approach for the next 10 years would include genotyping of available samples from all populations, and opportunistic acquisition of additional samples (in amounts suitable for archival purposes) from ongoing research and/or management captures. Comparisons of diversity change using microsatellite loci in each population should be made on

10-year intervals to assure adequate sample sizes for statistical comparison. Concurrently, modeling research should be continued to identify research designs offering optimum statistical power and effective non-invasive sampling techniques for future monitoring. This research could also weigh the relative advantages of modeling versus non-invasive genetic sampling approaches for the smaller populations. The results of these research projects could influence later decisions as to whether additional actual sampling will be required in the smaller populations.

Finally, the problems identified above point out the value of trying to enhance connectivity between populations if possible and that augmentation may have to be considered as a result of data confirming diversity loss but not necessarily confirming fitness loss. Given this potential problem, future revisions of the Grizzly Bear Recovery Plan will include expanded discussions of the challenges of maintaining genetic variation and will incorporate the findings of the monitoring program. This will allow the public to better understand future decisions regarding augmentation.

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APPENDIX V

IGBC Charter and the Form of the Yellowstone Ecosystem Management Subcommittee

This is the original charter of the IGBC that resulted in the formation of the Yellowstone Ecosystem Managers Committee. This IGBC-based management committee will continue as the Yellowstone Grizzly Management Committee after recovery and delisting to implement this Conservation Strategy in the Yellowstone Ecosystem.

**UNITED STATES DEPARTMENT OF AGRICULTURE, UNITED STATES DEPARTMENT OF THE INTERIOR AND STATES OF IDAHO, MONTANA, WYOMING, AND WASHINGTON
MEMORANDUM OF AGREEMENT TO REVISE AND EXPAND THE INTERAGENCY GRIZZLY BEAR COMMITTEE (1983)**

A. Need:

The grizzly bear is listed as a threatened species in the 48 conterminous States under provisions of the Endangered Species Act of 1973, as amended. To achieve the recovery of the grizzly bear, it is necessary that all Federal and State agencies with responsibilities for this species coordinate their management and research actions to the greatest extent possible to insure the best utilization of available resources and prevent duplication of effort.

To attain the objectives established by the Grizzly Bear Recovery Plan, the United States Department of Agriculture (U.S. Forest Service), the United States Department of the Interior (Fish and Wildlife Service, National Park Service, Bureau of Land Management, Bureau of Indian Affairs), and the States of Idaho, Montana, Wyoming, and Washington find it in the best interest of the grizzly bear to revise and expand the Interagency Grizzly Bear Committee (IGBC) established in April 1983).

B. Organization:

Members

- 3 Regional Foresters, USDA Forest Service
- 1 Regional Director, National Park Service
- 1 Regional Director, U.S. Fish and Wildlife Service
- 1 State Director, Montana, Bureau of Land Management
- 1 State of Idaho Representative)
- 1 State of Montana Representative) (Named by Appropriate
- 1 State of Wyoming Representative) Governor)
- 1 State of Washington Representative)

Advisor

Grizzly Bear Recovery Coordinator, U.S. Fish and Wildlife Service

Invitees

In addition to the members specified above, the following parties involved with the grizzly bear management and research in the State of Washington may participate in the committee and attend committee meetings: Regional Forester, National Park Service Regional Director, and the Fish and Wildlife Service Regional Director. The Bureau of Indian Affairs Area Directors from Portland, Oregon and Billings, Montana and representatives from the Canadian Provinces of British Columbia and Alberta also are invitees to committee and subcommittee meetings.

Subcommittees

Yellowstone Ecosystem

- National Park Superintendent (2)
- National Forest Supervisor (5)
- State Representatives from Wyoming, Montana and Idaho
- U.S. Fish and Wildlife Service Representatives (2)

Northern Continental Divide Ecosystem

- National Park Superintendent (1)
- National Forest Supervisor (5)
- State Representative from Montana
- U.S. Fish and Wildlife Service Representative (1)
- Bureau of Indian Affairs and/or Tribal Representative from each Indian Reservation (2)
- Canadian Representatives

Northwest Ecosystems

- National Park Superintendent (1)
- National Forest Supervisors (5-7)
- State Representatives from Montana, Idaho, and Washington
- U.S. Fish and Wildlife Service Representatives (2)
- Canadian Representative

Research

- U.S. Fish and Wildlife Service Representative
- U.S. Forest Service Representative
- National Park Service Representative
- States of Idaho, Montana, Washington, and Wyoming Representatives
- Bureau of Indian Affairs and/or Tribal Representative(s)
- Bureau of Land Management Representative
- Canadian Representatives
- (Existing Interagency Grizzly Bear Study Team to continue under Research Subcommittee.)

C. IGBC Operation:

1. Chairmanship of the IGBC shall rotate among representatives with the chairman serving a 2 year term, beginning with the representative of the U.S. Fish and Wildlife Service. Chairmen of the Research Subcommittee and Yellowstone, Northern Continental Divide and Northwest Ecosystems Subcommittees will be elected by Subcommittee members for 2 year terms.
2. Meet a minimum of twice per year, with additional meetings as needed and agreed to by majority of Committee.

D. IGBC Committee Responsibilities:

1. Implement the Grizzly Bear Recovery Plan, and all management and research activities necessary to provide for recovery of the grizzly bear.
2. Make provision for implementation of approved actions.
3. Guide and plan research direction.
4. Evaluate implementing activities to determine the effectiveness of achieving recovery plan objectives.
5. Take appropriate action under existing authority where necessary and make joint recommendations to Federal agency heads and States.
6. Review and approve or disapprove actions proposed by Subcommittees.

E. Northern Continental Divide Ecosystem, Yellowstone Ecosystem, and Northwest Ecosystems Subcommittee Responsibilities:

1. Implement management actions in a coordinated fashion.
2. Propose management policy to the IGBC.
3. Establish necessary task forces to implement approved actions when necessary (i.e., law enforcement, information and education, improvements).
4. Identify research needs and financial needs for management and submit to the IGBC.
5. Report to IGBC on progress concerning management actions necessary for grizzly bear recovery.

F. Research Subcommittee Responsibilities:

1. Identify and propose needed research programs to the IGBC as directed by the Grizzly Bear Recovery Plan.
2. Coordinate and direct needed research activities approved by IGBC.
3. Review and develop research plans to assure that they adequately address research needs and that the objectives, methods, analyses, timetables, and budgets are valid and realistic.
4. Establish ad hoc task forces to examine and report on special topics as approved by IGBC.
5. Review research findings and reports for scientific validity and make

recommendations to IGBC on their adequacy or relevance for assisting management decisions. Circulate these reports for peer review when necessary.

List of Signatories:

U.S. Department of Agriculture
Assistant Secretary for Natural Resources and Environment

U.S. Department of the Interior
Assistant Secretary for Fish and Wildlife and Parks

U.S. Department of the Interior
Assistant Secretary - Land and Water Resources

U.S. Department of the Interior
Assistant Secretary for Indian Affairs

Governor of the State of Idaho

Governor of the State of Montana

Governor of the State of Washington

Governor of the State of Wyoming

APPENDIX VI**Annual cost estimates by agency for implementing this Conservation Strategy.**

Task	YNP	USGS BRD - IGBST	Wyoming	Montana	Idaho	USFS	FWS LE	GTNP	TOTAL
• Annual GIS layer updates ⁵	5,000	10,000				70,000	-	1,000	86,000
• GIS run for annual Habitat Effectiveness calculation (CEM) ⁵	5,000	6,500	-	-	-	15,000	-	1,000	27,500
• GIS run for secure habitat/subunit ⁵	12,000	35,000	-	-	-	15,000	-	6,000	68,000
• GIS run for TMARD >1 mi/sq mi/subunit ⁵	In row 3	In row 3	-	-	-	In row 3	-	In row 3	In row 3
• GIS run for OMARD > 2 mi/sq mi/subunit ⁵	In row 3	In row 3	-	-		In row 3	-	In row 3	In row 3
• Cutthroat trout spawners (Kokanee – Idaho)	7,000	18,600	-	-	1,000	-	-	-	26,600
• Spring carcass surveys	6,500	12,000	-	-	-	4,000	-	-	22,500
• Whitebark cone transects	2,200	15,900	1,000	500	-	2,000	-	-	21,600
• Moth presence	-	19,100	3,500	1,000	-	-	-	2,000	25,600
• Private land status	-	-	1,500	5,000	1,000	-	-	-	7,500
• Monitoring unduplicated females w/cubs	15,000	16,500	29,150	15,000	2,000	-	-	3,000	80,650
• Mortality	1,000	9,600	11,000	15,000	1,000	-	20,000	1,000	58,600
• Distribution of family groups	7,500	49,700	7,500	5,000	2,000	-	-	-	71,700
• Maintaining 25 adult females w/radios	10,000	50,400	80,750	36,000	5,000	-	-	-	182,150
• Human/bear conflict mgt.	500,000 ¹	-	90,500 ¹	90,000 ⁴	5,000	400,000 ⁶	-	50,000 ¹	1,135,500
• Outreach and education	10,000	-	10,000	10,000	5,000	40,000 ¹	10,000	5,000	90,000
• Monitor genetic variation ²	-	-	-	-	-	-	-	-	-
Total per agency per year	581,200	243,300 ³	234,900 ¹	177,500	22,000	546,000	30,000	69,000	-
TOTAL COST PER YEAR									1,903,900
Total new cost per year	32,000	-	-	142,500	10,000	300,000	-	27,000	511,500

¹ This cost is a projected ongoing cost and is not specific to the Conservation Strategy.

² This cost will be covered through USFWS monitoring of possible changes in genetic variation in all lower 48 grizzly populations.

³ Much of this cost is in current IGBST operations.

⁴ \$35,000 is currently being spent.

⁵ These are new costs to manage habitat but are already required as per the Recovery Plan.

⁶ 50% currently funded; 50% currently needed but unfunded and are currently necessary to minimize bear-human conflicts as per the Recovery Plan.

APPENDIX VII

Lead agencies for actions under the Conservation Strategy.

AGENCY LEADS AND PARTICIPANT AGENCIES HABITAT AND POPULATION MONITORING				
	LEAD AGENCY	PARTICIPANT AGENCIES	TASK LEADER	ANNUAL REPORT LEADER
CEM layer updates for Habitat Effectiveness calculation	USFS	YNP,GTNP	USFS	USFS
GIS run for secure areas/ subunit	USFS	YNP,GTNP	USFS	USFS
GIS run for secure areas/ BMU	USFS	YNP,GTNP	USFS	USFS
GIS run for OMARD >1 mi/sq mi	USFS	YNP,GTNP	USFS	USFS
GIS run for TMARD > 2 mi/sq mi	USFS	YNP,GTNP	USFS	USFS
Cutthroat trout spawners	YNP	IGBST	YNP	YNP
Spring carcass surveys	YNP	IGBST	YNP	YNP
Whitebark cone transects	IGBST	YNP,USFS	IGBST	IGBST
Moth presence	WY	YNP, GTNP, IGBST	IGBST/WY	IGBST/WY
Mortality reduction	WY, MT, ID, NPS, USFS, FWS/LE	WY, MT, ID, NPS, USFS, FWS/LE	Cooperative	Cooperative

AGENCY LEADS AND PARTICIPANT AGENCIES HABITAT AND POPULATION MONITORING				
	LEAD AGENCY	PARTICIPANT AGENCIES	TASK LEADER	ANNUAL REPORT LEADER
Private land status	Private conservation groups in cooperation with states	WY, ID, MT	To be selected	To be selected
Unduplicated females w/cubs	IGBST	WY, YNP, MT, ID, GTNP	IGBST	IGBST
Mortality	IGBST	MT, WY, ID, YNP, GTNP, FWS/LE	IGBST	IGBST
Distribution	IGBST	WY, YNP, MT, ID, GTNP	IGBST	IGBST
Transects for mark/resight	IGBST	WY, YNP, MT, ID, GTNP	IGBST	IGBST
Maintaining 25 adult females with collars	IGBST	WY, YNP, MT, ID, GTNP	IGBST	IGBST
Monitoring genetic diversity	IGBST	IGBST and USFWS	IGBST	IGBST
Control action and conflict reporting	YNP	WY, YNP, MT, ID, GTNP	YNP	YNP/IGBST
Public outreach and information	All	WY, YNP, MT, ID, GTNP, USFS, FWS/LE	To be selected	To be selected

APPENDIX VIII

The Relationship Between the Five Factors in Section 4(a)(1) of the ESA and the Existing Laws and Authorities

The relationship between the five factors in Section 4(a)(1) of the Endangered Species Act and the existing State and Federal laws and regulations is important to assure that the existing laws and authorities can address all the factors necessary to assure recovery under the Endangered Species Act. This table presents the State and Federal laws and authorities and which of the five factors are addressed by that law or authority.

Sec. 4. (A) General. - (1) The Secretary shall by regulation promulgated in accordance with subsection (b) determine whether any species is an endangered species or a threatened species because of any of the following factors:

- (A) the present or threatened destruction, modification, or curtailment of its habitat or range;
- (B) overutilization for commercial, recreational, scientific, or educational purposes;
- (C) disease or predation;
- (D) the inadequacy of existing regulatory mechanisms;
- (E) other natural or manmade factors affecting its continued existence.

FEDERAL AND STATE LAWS AND REGULATIONS	Five Factors				
	A	B	C	D	E
The Act of Congress March 1, 1872 - Set Yellowstone National Park as a Public Park	X	X		X	X
National Park Service Organic Act of 1916, 16 U.S.C. 1, 39 Stat. 535	X	X		X	X
Lacey Act of 1900, as amended, 16 U.S.C. 701, 702; 31 Stat. 187, 32 Stat. 285; Criminal Code Provisions, as amended, 18 U.S.C. 42-44, 62 Stat. 87				X	
Fish & Wildlife Coordination Act of 1934, as amended, 16 U.S.C. 661-666c; 48 Stat.401	X	X		X	X
The Act of Congress September 14, 1950 - Expansion of Grand Teton National Park to include Jackson Hole National Monument	X			X	
Sikes Act, 1960, as amended, 16U.S.C. 670a-670o; 74 Stat. 1052, Pub. L. 86-797	X	X			X
Multiple-Use Sustained-Yield Act of 1960, 16 U.S.C. 528-531, 74 Stat. 215, P.L. 86-517	X	X			X
National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321, 83 Stat. 852, Pub. L. 91-190	X	X			X
The Act of Congress August 25, 1972 - Establish John D. Rockefeller, Jr. Memorial Parkway	X	X			
Endangered Species Act of 1973, as amended, 16 U.S.C. 1531-1543; 87 Stat. 884	X	X	X	X	X

FEDERAL AND STATE LAWS AND REGULATIONS	A	B	C	D	E
Forest and Rangeland Renewable Resources Planning Act, 1974, Pub. L. 93-378	X	X		X	X
National Forest Management Act of 1976, U.S.C. 1600 et. seq., Pub. L. 94-588	X	X			X
Federal Land Policy and Management Act of 1976, as amended, 43 U.S.C. 1701 et. seq., Pub. L. 94-579, 90 Stat. 2744		X			X
Fish & Wildlife Improvement Act of 1978, 16 U.S.C. 7421, 92 Stat. 3110				X	
Fish and Wildlife Conservation Act of 1980, 16 U.S.C. 2901-2904; 2905-2911; 94 Stat. 1322, Pub. L. 96-366	X	X		X	X
36 CFR 1.5 (a)(1)		X		X	
36 CFR 1.7(b) and 2.10(d)				X	X
36 CFR 1.7(b) and 7.13 (l)		X		X	X
36 CFR 2.2		X		X	X
36 CFR 2.10				X	X
36 CFR 219		X			X
36 CFR 219.19	X			X	
36 CFR 219.27 (a)(6)	X			X	X
36 CFR 261.50 (a), (b) and (c)				X	X
36 CFR 261.53 (a) and (e)				X	X
36 CFR 261.58 (e), (s) and (cc)				X	X
WYOMING STATE STATUTES					
23-1-101 (a)(xii)				X	
23-1-103		X		X	
23-1-302 (a)(ii)		X		X	
23-1-901					X
23-2-101 (e)				X	X
23-2-303 (d)				X	X
23-3-102 (b)		X		X	
23-3-103 (a) & (b)		X		X	X
23-3-106				X	X
23-3-107		X		X	X

FEDERAL AND STATE LAWS AND REGULATIONS	A	B	C	D	E
23-3-109		X		X	X
23-3-112		X		X	X
23-3-301				X	X
WYOMING GAME AND FISH COMMISSION REGULATIONS					
Chapter XLIII		X		X	X
Chapter XXVIII		X		X	X
Chapter III		X		X	X
IDAHO STATE STATUTES					
36-103 (a)		X		X	X
36-103 (b)				X	X
36-201				X	X
36-716		X		X	X
IDAHO FISH AND GAME COMMISSION REGULATIONS					
IDAPA 13 G 1.9		X		X	X
IDAPA 13 G 2.2				X	
MONTANA STATE STATUTES					
Section 87-1-301				X	
Section 87-5-301				X	
Section 87-5-302				X	
Section 87-2-101				X	
ADMINISTRATIVE RULES OF MONTANA					
MCA 12.9.103 GRIZZLY BEAR POLICY (1)	X	X	X	X	X
MONTANA DEPARTMENT OF STATE LANDS					
Title 75, Chapter 1 MCA - Montana Environmental Policy Act	X				
Title 76, Chapter 14, MCA - Montana Rangeland Resource Act	X				
Title 77, Chapter 1 MCA - Administration of State Lands	X				X
Title 87, Chapter 5, MCA - Nongame and Endangered Species Conservation Act	X			X	X
Montana Constitution. Article IX - Environment and Natural Resources. Section 1 - Protection and Improvement	X				

FEDERAL AND STATE LAWS AND REGULATIONS	A	B	C	D	E
Montana Constitution. Article X - Education and Public Lands. Section 4 - Board of Land Commissioners.	X				
FEDERAL PLANS AND GUIDELINES - NATIONAL PARK SERVICE					
NPS-77, Natural Resource Management Guidelines, May 16, 1991		X			X
Final Environmental Impact Statement, Grizzly Bear Management Program, Yellowstone National Park, July, 1983	X	X	X	X	X
Yellowstone National Park Annual Bear Management Plan		X			X
Grand Teton National Park Human/bear Management Plan, 1989	X	X	X	X	X
U.S. FOREST SERVICE (Regions 1,2, and 4)				X	
Beaverhead-Deerlodge NF Land Resource Management Plan (1986)	X			X	X
Bridger-Teton NF Land Resource Management Plan (1989)	X		X	X	X
Custer NF Land Resource Management Plan (1986)	X		X		
Gallatin NF Land Resource Management Plan (1987)	X		X	X	X
Shoshone NF Land Resource Management Plan (1986)	X		X	X	
Targhee NF Land Resource Management Plan revision (1998)	X		X	X	X
OTHER GUIDANCE					
Grizzly Bear Compendium. National Wildlife Federation, Washington, D.C. 1987					X
Interagency Grizzly Bear Committee Taskforce Report, Grizzly Bear/Motorized Access Management. 1994. Revised 1998.				X	
Yellowstone Grizzly Bear Investigations				X	X
Public Information and Involvement Strategy for IGBC.				X	X