APPENDIX 1. CHRONOLOGY OF GRIZZLY BEAR RECOVERY IN THE BITTERROOT ECOSYSTEM

Summary of Grizzly Bear Status and Recovery in the Bitterroot Ecosystem

1806 Grizzly bears were abundant in the Bitterroot Ecosystem (BE). Lewis and Clark killed at least 7 grizzly bears including 1 female and 2 cubs and numerous black bears while camped near present-day Kamiah, Idaho. With the assistance of the Nez Perce Indians, they correctly identified grizzly bears and black bears as 2 separate species.

1850 Extermination of ungulates and large predators began, including bison, wolves, and grizzly bears.

1900 Wild ungulate populations and large predators were decimated by unregulated harvest and settlement.

1920 For several years, as many as 25-40 grizzly bears per year were being killed in the BE by trappers and hunters.

1932 Last verified grizzly bear killed in BE.

1946 Last good evidence of grizzly bear track in the BE indicated by USFS District Ranger at Powell Ranger Station.

1950 Some scattered but unverified reports of potential grizzly bear sightings in the BE.

1975 Grizzly bear listed as threatened under the Endangered Species Act. Bitterroot Ecosystem recognized as one of the 3 recovery areas, along with the Bob Marshall and Yellowstone areas.

1979 Habitat research conducted to identify quantity and quality of grizzly bear foods in one study area in the Selway-Bitterroot Wilderness.

1982 Grizzly Bear Recovery Plan finalized. Bitterroot Ecosystem identified as an Evaluation Area to determine if grizzly bears still existed there, and if the habitat was of good enough quality to provide for grizzly bear population recovery.

1985 Research study to classify observation reports, and conduct ground searches for grizzly bears in the BE was finalized.

1985 Research study that evaluated grizzly bear habitat quality in the Selway-Bitterroot Wilderness was finalized.

1985 Further study initiated using landsat imagery and including all of the Bitterroot Evaluation Area (BEA), to better analyze quantity and quality of grizzly bear habitat.

1988 Continued efforts to verify grizzly bear presence in the BEA through quick response to observation reports and aerial verification efforts.

1990 Remote sensor camera study conducted to attempt to photograph and determine grizzly bear presence in the BEA.

1991 Continued attempts to photograph grizzly bears using remote cameras and to verify observation reports.

1991 Habitat study completed and researchers concluded the BEA was suitable habitat for grizzly bears.

1991 Technical Review Team of independent bear biologists was organized to review available habitat data. The Team determined that the BEA could support between 200-400 grizzly bears.

1992 The Interagency Grizzly Bear Committee (IGBC) reviewed the determination and recommendations of the Technical Review Team and authorized the preparation of a Recovery Plan for the Bitterroot Ecosystem to include as a chapter of the Grizzly Bear Recovery Plan. An interagency team of biologists was organized to develop the plan.

1992 A Citizens Involvement Group (CIG) was organized to help guide the development of the Bitterroot Ecosystem Grizzly Bear Recovery Chapter. The CIG began with 50 people and ended in 1993 with 30 members.

1993 Revised Grizzly Bear Recovery Plan completed.

1993 Bitterroot Ecosystem Subcommittee branched off from Northwest Ecosystem Subcommittee to allow decision makers more involvement in planning and local input.

1993 Several public meetings were held to obtain information for the BE Recovery Chapter.

1993 The Idaho Legislature authorized the formation of a Grizzly Bear Oversight Committee for Idaho, consisting of the chairs of the Idaho Senate and House Resource committees, and representatives each from timber, mining, livestock, recreation, and wildlife. Committee held public meetings in Grangeville and Orofino.

1993 An interagency task force, working with a citizen's involvement group drafted a chapter on grizzly bear recovery in the Bitterroot Ecosystem. In response to public comments from local communities of central Idaho and western Montana, several changes were made in the final chapter. The BE Recovery Plan final draft was appended as a chapter to the Revised Grizzly Bear Recovery Plan, and listed for comment in the Federal Register. It called for an Environmental Impact Statement (EIS) to evaluate a full range of recovery alternatives.

1994 Open houses to provide public information on the draft BE Recovery Plan Chapter were held by the USFWS, CIG, interagency team, and legislative oversight committee in Hamilton and Missoula, MT, Salt Lake City, UT, and Lewiston, Grangeville, and Orofino, ID. USFWS recommended using an "nonessential experimental population" designation as identified in Sec. 10(j) of the ESA and releasing 4-6 bears per year for 5 years.

1994 IGBC authorized development of an Environmental Impact Statement to identify alternatives and issues, recovery area boundaries, and environmental consequences of implementing the BE Recovery Chapter.

1995 The USFWS continued public involvement and assembled an interdisciplinary team to begin the EIS process. Team members include specialists from the USFWS, USFS, IDFG, MDFWP, and the Nez Perce Tribe. Dr. Chris Servheen of the Fish and Wildlife Service is the EIS team leader.

1996 Bitterroot Ecosystem Recovery Plan Chapter - Supplement to the Grizzly Bear Recovery Plan finalized. Chapter signed 9/11/96.

1996 Interagency EIS Team continues to prepare draft EIS, and coordinate with agency partners.

1997 Proposed Special Rule 10(j), Establishment of a Nonessential Experimental Population of Grizzly Bears in the Bitterroot Area of Idaho and Montana, is published in Federal Register for public review and comment.

1997 Draft EIS is released for public review and comment. Public comment period including 7

public hearing extended to 90 days.
1998 Content analysis of public comments on the DEIS, and preparation of Final EIS.
1999 Internal review of draft Final EIS, preparation of Final EIS, final surnaming of FEIS.
2000 Release FEIS and Record of Decision to public. Implement selected alternative.

Chronology of the Bitterroot Ecosystem Grizzly Bear EIS

See Chapter 5 "Consultation and Coordination in Development of the Proposal" for more information on the chronology of the EIS.

7/94 IGBC authorized the development of an EIS to identify issues and alternatives, recovery zone boundaries, environmental consequences, and other information necessary to recover grizzly bears.
1/95 Notice of Intent to prepare an EIS published in the Federal Register (Vol 60, No 5).
1/95 The USFWS assembled an interdisciplinary team to prepare the draft EIS. Team leader selected. Team members include specialists from the USFWS, USFS, IDFG, MDFWP, and the Nez Perce Tribe.
2/95 Core EIS team meeting. Develop initial EIS schedule.
5/95 BES meeting at USFS Powell Ranger District. Received 80 comments on NOI in Federal Register. Decide to contract with Responsive Management for survey of social attitudes regarding grizzly bear recovery in the BE.
5/95 Brochure developed by agencies, industry, and environmental groups reviewing questions and concerns about grizzly bear recovery in the BE.
5/95 Three preliminary alternatives were identified and published in a Scoping of Issues and Alternatives brochure, and mailed to 1100 people.
6/95 Formal scoping for issues and alternatives begins with notice in Federal Register for a 45-day comment period.
6/95 Citizens Involvement Group met to produce input on alternatives and issues.
7/95 Seven public open houses were held to identify issues and alternatives for the EIS, and over 300 people attended. Scoping sessions held in Grangeville, Orofino, Boise, ID, Hamilton, Missoula, Helena, MT, and Salt Lake City, UT.
7/95 Public survey to determine public attitudes toward grizzly bear recovery in the BE was finalized.
7/95 End 45-day public comment period on scoping of issues and alternatives.
7/95 Public comment period extended 30 days to August 21.
8/95 Issue scoping period closed. Written comments on the preliminary issues and alternatives were received from over 3,300 individuals, organizations, and government agencies.
9/95 Content analysis of public comments on scoping of issues and preliminary alternatives completed.
9/95 Scoping results summarized in the document, "Summary of public comments on the scoping of issues and alternatives for grizzly bear recovery in the Bitterroot Ecosystem" (FWS 1995). Document distributed.
11/95 EIS Team meeting to identify contract descriptions and assign remaining writing duties.
11/95 Two new team members added after resignation of team leader.
1-10/96 Preparation of draft EIS. Team meetings held in March, May, July, August, and October to prepare document.

8-12/96 Draft DEIS completed and released to USFWS and then to agency partners (USFS, IDFG, MDFWP, Nez Perce Tribe) for internal review and comment.

1-2/97 Comments from USFWS and agency partners reviewed and incorporated into draft EIS.

2/97 Final draft of DEIS sent to Region 6 and Washington Office, USFWS for final review and comment.

3/97 Comments from USFWS Region 6 and Washington Office incorporated into draft EIS.

7/97 DEIS completed, released, and public review requested during a 90-day public comment period Public comment period begins July 11 and ran through December 1, 1997.

7/97 Endangered Species Act, Proposed Rule 10(j) for Establishment of a Nonessential Experimental Population of Grizzly Bears in the Bitterroot Area of Idaho and Montana published in the Federal Register on July 2. Comment period July 11 through December 1.

9/97 9/30 - Comment period deadline extended from September 30 to November 1, based on numerous requests for more time to prepare comments.

10/97 Public hearings/open houses to gather public comments on the DEIS and Proposed Special Rule held in seven communities on the perimeter of the Bitterroot area. Approximately 1400 people attended these hearings and 293 individuals testified. The dates and locations for the public hearings were as follows: October 1, 1997: Challis, Idaho and Hamilton, Montana; October 2, 1997: Missoula, Montana and Lewiston, Idaho; October 3, 1997: Boise, Idaho and Helena, Montana; October 8, 1997: Salmon, Idaho.

11/97 Comment period deadline extended from November 1 to December 1, following a request from a member of the Idaho Congressional delegation

12/97 December 1 - Public Comment period ended.

12-3/98 Content Analysis of public comments on the Draft EIS and Proposed Special Rule. Report entitled, "Summary of Public Comments on the Draft EIS for Grizzly Bear Recovery in the Bitterroot Ecosystem" and Executive Summary Report released to public in April 1998.

4-12/98 EIS Team prepares draft Final EIS for internal review. EIS Team prepares draft Final EIS for internal review. Private contractor prepares Bitterroot Population Viability/Habitat Analysis for Congressionally-mandated study to be included in FEIS. Numerous EIS Team meetings occurred to write/review FEIS. EIS Team finalizes formal consultation with NMFS and internal review of USFWS Biological Assessment.

2/99 Internal USFWS review of draft Final EIS.

5/99 FWS internal review comments incorporated into FEIS.

6/99 Final internal review of final draft FEIS.

8-9/99 Comments received on final draft. Comments incorporated into final surname copy FEIS.

10/99 Final FEIS sent to Denver Region and Washington, D.C. offices for review and surname.

11/99 Final comments incorporated and FEIS sent to Denver Region and Washington Office for final review and surnaming process.

1-2/00 Final comments incorporated, and FEIS sent to printer.

3/00 Notice of Availability published in Federal Register, and FEIS released to public for 30-day final review period (March 24 through April 24). Comments will be reviewed, and a Record of Decision will be published and released to the public.

APPENDIX 2. TECHNICAL SUMMARY: GRIZZLY BEAR BIOLOGY AND ECOLOGY

Biology

***Taxonomy and Evolution*. --** The North American brown bears (*Ursus arctos*) include 2 subspecies; the grizzly bear (*Ursus arctos horribilis*) and the Kodiak bear (*Ursus arctos middendorfii*) (Rausch 1963). Recent taxonomic classifications consider the North American Brown Bears and the Eurasian Brown Bear to be the same species.

The evolutionary history of the family *Ursidae* encompasses a 20 million year period. The Etruscan bear (*Ursus etruscus*) which lived in the forests of Asia about 2 million years B.P. was ancestor to present day bears (Herrero 1972). Changes in environment from warm forest to a treeless landscape following repeated glacial periods gave rise to the cave bear (*Ursus spelaeus*) in Europe and the brown bear in Asia. Around 50,000 B.P. brown bears crossed the treeless Bering Land Bridge and spread across North America (Churcher and Morgan 1976). Brown bears occurred in North American south of the ice sheet during the late Wisconsinan (Kurten 1968). Archeological evidence suggests that the brown bear expanded its range into eastern North America by 11,000 B.P., however they were probably never abundant east of the Mississippi River.

A major trend in the early evolution of bears was the development of adaption that allowed a carnivore to feed relatively efficiently on vegetation (Kurten 1968). Bears began as small-bodied carnivores but eventually became large-bodied omnivores (Herrero 1985). The brown bear specifically evolved away from forest adaptations toward characteristics which allowed to bear to utilize a more open habitat. Brown bears developed morphological, physiological, and behavioral adaptations which enabled it to exploit the newly developed tundra-like habitat following glacial periods.

***Physical Characteristics.* --** Brown bears are large, plantigrade animals. There is considerable variation in size and color of local populations and individuals sometimes leading to problems in classification. Guard hairs are often silver-tipped to varying degree hence the name "grizzly." The muscle structure has developed for strength, quickness, and speed. Grizzly bears are often distinguished from black bears by their humped shoulders, longer and curved claws, smaller ears, and a concave face profile.

Grizzly bears are sexually dimorphic in body size with males considerably larger than females. In addition to variations between sexes, there is considerable variation in body size and weight between geographic regions. Weight data from various studies are available in IGBC (1987). There appears to be a clinal variation in weight with bears in coastal regions being heavier than bears in the more interior regions of the continent (Bunnell and Tait 1981). Rausch (1963) noted that the larger size of coastal bears appeared to be related with the distribution of salmon and the luxuriant coastal vegetation. In all brown bear populations males are heavier than females (Glenn 1980).

The remaining grizzly bears in the lower 48 states are found in the interior regions. Blanchard (1986) analyzing data from Yellowstone National Park found adult (5+ years) male bears weighed an average of 423 lbs. and adult females 298 lbs. In the NCDE adult (5+ years) males averaged 384 lbs. and adult females averaged 243 lbs. (Aune et. al. Unpub data). Whole carcass weights from throughout Montana were 463 lbs. for adult males and 284 lbs. for adult females (Aune et al. Unpub. data).

Grizzly bears undergo an annual cycle in weight, gaining in summer and losing during the winter during denning (Pearson 1975, Kingsley et al. 1983). Grizzly bears can gain weight at the rate of 0.79 to 2.2 lbs./day during the spring to fall season (Blanchard 1983, Bunnell and Hamilton 1983). Blanchard (1986) found that males gained weight faster than female bears during the forage season. Kingsley et al. (1983) reported that male bears loose 22% of their fall weight over winter while females loose 40%. Blanchard (1986) found that males lost a greater percent of body weight over winter than adult females (18% and 8% respectively). Mature females cycle more weight annually than males since they are liable for the energy cost of reproduction (Kingsley et al. 1983).

Reproduction. -- There is clear evidence that the female grizzly bear exhibits delayed implantation (Craighead and Mitchell 1982). Although mating occurs during spring (generally May and June), and estrous may last 30 days, blastocyst do not implant in the uterine wall until autumn. Implantation is affected by the physical condition of the female. Grizzly bears are polygamous; a female may mate with several males during a single breeding period. Female grizzly bears are not sexually mature until age 4 or 5 and exhibit prolonged care of their young. Generally, females attend to their litter for 2 years. Litter size may vary from 1-4 cubs although 2 cubs is most common. Grizzly bears may live to be 40 years old (Storer and Tevis 1955).

Mortality. -- Grizzly bear mortality is categorized as either natural or man-caused. The extent of natural mortality is difficult to document although parasites and disease do not appear to contribute significantly. On occasion, bears do kill each other. Human-caused mortality tends to occur in one of several categories including: (1) Control actions - A grizzly bear legally killed or removed by state or federal government officials to defend against damage to property or potential injury to humans; (2) Illegal - An illegally killed grizzly bear includes marauding bears killed illegally by private individuals, grizzly mistaken for a black bear, poaching, and deliberate vandal killing; (3) Vehicle Collision - A grizzly bear accidentally killed when struck by a train or motorized vehicle; (4) Unknown - A grizzly bear mortality caused by humans where the specific cause of death could not be determined; (5)Legal, Defense of Life - A grizzly bear legally killed by a citizen acting in self-defense or in the defense of others; (6) Legal, Hunting - A grizzly bear legally harvested during a legal grizzly bear hunting season.

In the absence of legal hunting, illegal mortality and control actions are the major sources of mortality in North America (Peek et al. 1987, Brannon et al. 1988). However, natural mortality in some areas may be higher than expected (Mace et al. 1996).

Ecology

General. -- The population sizes and distribution of grizzly bear are a product of historical and current factors. Before human settlement, continental and local populations were influenced solely by natural factors. The historical distribution of brown bears shows that this species was able to exploit a wide variety of niches; from open dry prairie or desert habitats to moist mountain habitats. Human occupation and settlement have added additional factors that limit population growth and have influenced the distribution of grizzly bears. Post human settlement, human-induced mortality coupled with conversion of habitat has most directly limited population size and distribution.

The biological needs of the grizzly bear are fairly well understood from historical records and current research activities. Factors that limit population size and distribution of grizzly bears by contributing to elevated natural or human-caused mortality are a consequence of the bears' need for space and habitat conversion.

Space. -- Grizzly bears are a wide-ranging species and mobility is an important aspect of grizzly bear biology (Compendium p. 31). As such grizzly bear populations require large tracts of suitable habitat wherein individuals can move freely and establish home ranges. The grizzly has been termed a "wilderness species", although the species lives in areas not legally designated as wilderness or national park.

Rate of movement per day varies among ecosystems, individuals, and seasons. Grizzly bears are known to make abrupt long-distance movements quickly such as a 33.5 mile foray in 62 hours (Craighead 1976).

The home range size of grizzly bears depends on many factors such as the juxtaposition of seasonal habitats, population density, presence or absence of ecocenters, age and reproductive status, and social relationship with other members of the population (IGBC 1987, Nagy and Haroldson 1989). Home range size may also vary among years in relation to food abundance and may enlarge as the animal ages (Blanchard and Knight 1991). Generally males have larger home ranges than females. It is advantageous for male ranges to include as many female ranges as possible, and it is advantageous for females to rear young in relatively small, areas with maximum security and food resources. Home range size also varies by habitat zone with larger ranges in the drier habitats relative to mesic habitats. The degree of home range overlap is a function of population density, social hierarchies, and distribution of food resources. Although range perimeters often overlap, use of core areas within ranges are often exclusive, especially for females (IGBC 1987, Mace and Waller 1997). Subadult males generally disperse from area of the maternal home range whereas females often establish ranges near their mother (IGBC 1987, Craighead and Mitchell 1982).

Habitat Conversion. -- There is very little overlap between occupied grizzly bear habitat and high human densities primarily because of niche differences and human intolerance (Mattson 1990). Humans have eliminated bears from many areas resulting in unoccupied but suitable habitat.

Grizzly bears are precluded by humans from using habitats in several ways. Large-scale habitat conversion to human settlement, hydroelectric development, and agriculture have reduced bear use of many inter-mountain valleys. Timber harvest and fire control policies have also contributed to a large-scale conversion of habitat by altering successional stages.

Forest roads affect grizzly bears in several ways (McLellan and Shackleton 1987, Mace et al. 1996). Bears may be either temporarily or permanently displaced from habitats near roads. Permanent displacement results in loss of habitat. Grizzly bears are also vulnerable to mortality in areas with roads.

Impacts to grizzly bear in areas where livestock are grazed include direct mortality through control actions and illegal kills, habitat loss or modification, displacement, or direct competition (IGBC 1987). Historically, conflict with livestock was a major cause of population decline or local extirpation throughout the bears former range (Storer and Trevis 1955). Depredation behavior is believed to be a learned process as not all bears in proximity to grazing allotments kill livestock.

Habitat Selection and Food Habits. -- Grizzly bear currently occupy coniferous forest habitats in the Rocky Mountain Cordillera. Aside from National Park and wilderness settings, grizzly bears are generally confined by human settlement to mountain and foothill habitats, and are not common in large inter-mountain valleys.

The grizzly bear is an omnivore, and as such displays great flexibility in its use of habitats and foods. Grizzly bears are opportunistic feeders and will scavenge or prey on most available prey species. Where prey is less abundant, vegetal matter, roots, and bulbs are important during spring (IGBC 1987). Depending on area, fish, fruit, insects, and nuts are important during summer and autumn. Some individual grizzly bears, especially females, may become habituated to human foods (Mattson 1990).

After leaving their dens during spring, bears may utilize relatively low elevation habitats although individual variation occurs. During spring, grizzly bears often forage in riparian areas, avalanche chutes, or winter ranges. As summer progresses, bears often move to higher elevations and shift to fruit or pine nuts.

Grizzly bears hibernate during winter months generally in high-elevation excavated dens. Bears generally enter their dens from late September to early November and remain in dens until early-March to early-May. During the denning period, body temperature is only slightly reduced while heart rate and respiration is more markedly depressed. Several weeks of lethargy occur prior to and subsequent to denning (Nelson 1973).

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APPENDIX 3. TECHNICAL SUMMARY: EVALUATION OF HABITAT QUALITY FOR GRIZZLY BEARS IN THE BITTERROOT ECOSYSTEM

A comprehensive review of pertinent literature and studies conducted in the Bitterroot Ecosystem (BE) provide the basis for this summary. Technical reviews of habitat information and research are included, as well as brief summaries of whitebark pine status (Keane and Arno 1996), and anadromous fish status (Brostrom 1996) in the BE.

Habitat Studies

Summary. -- The first study in the BE describing vegetation in relation to grizzly bear habitat was conducted by Scaggs in 1979. His study was conducted on a 40 square mile area within the Selway-Bitterroot Wilderness. Vegetation in ecological land types and forest habitat types of the subalpine and temperate zones were sampled to evaluate grizzly bear habitat. The evaluation was based on the abundance of grizzly bear food plants in relation to land area. The study area was rated as good grizzly bear habitat from the standpoint of vegetation and the vegetation was not a limiting factor affecting bear numbers according to the author. His study area however was small and represented only high elevational range. He indicated that further research was needed to better identify bear foods and relative nutritional values (Scaggs 1979).

Butterfield and Almack (1985) also evaluated grizzly bear habitat in the Selway-Bitterroot Wilderness Area. Their survey consisted of classifying floristically distinct plant communities identified in 5 sub-areas that represented the diversity of vegetation in the Selway-Bitterroot Wilderness Area. By intensive sampling, they described topographical and vegetal characteristics, and identified potential grizzly bear foods in each habitat class. They concluded that the, "area exhibits great environmental diversity", and identified 25 habitat classes that provided a wide range of grizzly bear life requisites including; denning sites, cover, and a rich, consistent supply of seasonally available foods. They felt the BE satisfied the habitat criteria essential to the maintenance of a viable grizzly bear population, and rated the BE as an "ecologically superior area for grizzly bear recovery". Based on the Craighead et al. (1982) essential criteria for grizzly bear habitat which consist of space, isolation, sanitation, denning, safety, vegetation types, and food, the authors stated "the BE more than satisfies these habitat criteria".

Davis and Butterfield (1991) conducted the most comprehensive review of grizzly bear habitat in the BE to date. Their 5-year study was conducted to evaluate habitat quality within the 1.4 million hectare (5,500 square mile) Bitterroot Evaluation Area (BEA) of the Bitterroot Mountains in Idaho and Montana (see Figure 3-6). They constructed a geographic information system (GIS) containing 13 map layers: 1) evaluation area boundaries; 2) USDA Forest Service administrative units; 3) wilderness areas; 4) land ownership; 5) roads; 6) trails; 7) hydrology; 8) elevation; 9) aspect; 10) slope; 11) watershed basins; 12) potential spring habitat; and 13) land cover. Ecodata plots using USDA Forest Service sampling techniques were conducted across the BEA. These plot data were analyzed to classify three major ecological zones and 15 land cover classes, resulting in 37 ecological land cover classes and associated structural and vegetal characteristics. They discussed the suitability of the BEA for grizzly bear habitat using the Craighead et al. (1982) criteria, and concluded that biological factors related to space, isolation, denning, vegetation types, and food were adequate for grizzly bear recovery. The Davis and Butterfield (1991) conclusions are summarized below:

Space and Isolation - Davis and Butterfield concluded that the, "BEA falls well within the space requirements for grizzly bears when compared to other ecosystems with known grizzly bear populations", and affords adequate isolation from human developments and activities from summer through winter. Because both humans and bears tend to use snow free, lower elevations during spring, however, the authors cautioned that spring grizzly bear range could present potential areas of bear-human conflicts. Davis and Butterfield estimated that the BEA contains substantial and adequate amounts (231,960 ha) of spring range mainly along the Selway, Lochsa, and North Fork of the Clearwater River valleys. Although access to the Selway River is restricted during spring, affording good isolation, spring range along the Lochsa River is bisected by U.S. Highway 12 presenting potential bear-human conflicts. The authors also recognized that substantial historic spring range exists adjacent to the BEA and caution that this area (i.e. Bitterroot and Clearwater Valleys) could also become areas of potential bear-human conflict in the future with a recovered grizzly bear population in the BE.

Vegetation types and foods - Davis and Butterfield, Butterfield and Almack, and Scaggs all identified a wide variety of vegetation types comparable to occupied habitat in other grizzly bear ecosystems, well distributed throughout the BEA. The authors concluded these habitats would support adequate sources of known grizzly bear foods including elk and deer, small mammals, herbaceous vegetation and tubers, and fruits and nuts. These studies showed that over 60% of known herbaceous, and nearly 80% of known fruit and nut food items consumed by grizzly bears still occur in the BEA.

Sanitation and safety - Davis and Butterfield identified three sources of artificial food for grizzly bears that would have to be addressed to reduce bear-human interactions: 1) recreational backcountry user camps; 2) hunting and outfitter camps; and 3) human habitations mainly along the Lochsa River.

Davis and Butterfield identified accidental killing of grizzly bears during the spring black bear and fall elk and deer hunting season, and direct poaching as potential mortality factors that could be detrimental to grizzly bear recovery. The authors identified the practice of hunting black bears over bait and chasing black bears with hounds could potentially lead to human-bear interaction, and represent a "major threat to grizzly bear recovery". The authors recommend a committed hunter education effort to gain the cooperation of local hunters and other resource users, and cautioned that changes in some hunting practices may be necessary for successful grizzly bear recovery.

Technical Review of Habitat Studies

In 1991, a Technical Review Team (Servheen et al. 1991) analyzed the Davis and Butterfield (1991) report and other available information. The team was comprised of experienced grizzly bear biologists and habitat specialists with no direct involvement in the evaluation process. They were charged with evaluating habitat and space values of the BEA. It was the opinion of the Technical Team that the BEA contained the physical attributes to sustain a viable grizzly population of between 200-400 bears.

Concerns Related to Habitat Suitability

Salmon. -- Despite the availability of diverse and abundant bear foods, some believe that one reason for the demise of the grizzly bear population in the Bitterroot Ecosystem may have been the elimination of historic salmon runs (Moore 1984, 1996). Based on genetic sampling of 2 samples of grizzly bear material supposedly collected in the north central portion of Idaho between 1840 and 1940, fish apparently constituted 54 and 90 percent of the carbon and nitrogen absorbed in their diet (Hilderbrand et al. 1996). Obviously a larger sample size of bear material collected in Idaho would be necessary to determine the importance of fish to grizzly bears in the BE. Where fish were available they probably supplied a large portion of the bears dietary protein needs. However, based on studies in Alaska, even where salmon are locally abundant along coastal areas, not all bears use the fisheries resource. Schoen et al. (1986) indicated that a large segment of the bears inhabiting upper elevations on Admiralty Island never fished for salmon. Similar resource partitioning was probably apparent in the BE. Moore (1984, 1996) indicated that bears existed in the BE fully 20 years after the salmon had been cut off due to dams on the Clearwater River. Wright (1909) indicated that although he observed grizzly bears in the Selkirk Mountains ravenously consuming a specific plant, they didn't feed on it in the Bitterroot Mountains although it was readily abundant. He noted that bears in different areas fed on different plants. Current research supports these observations, and the theory that feeding on specific items is a learned behavior.

Brostrom (1996) indicated that although salmon are no longer widely available in the BE, other fish species such as cutthroat trout and kokanee salmon may provide some supplemental food for grizzly bears (see attached paper). However, anadromous fish would not be readily available every year, and would only be supplemental at best as spawner carcasses. Many populations of grizzly bears exist today that have never used anadromous fish runs as a dietary supplement. Hilderbrand et al. (1996) found that where fish were not readily available in Montana and Wyoming, plant and animal matter constituted the majority of protein requirements of grizzly bears.

Whitebark Pine. -- Whitebark pine status and distribution has been studied fairly extensively in the last decade. Keane and Arno (1996) summarized the status and distribution of whitebark pine in the Bitterroot Ecosystem (see attached paper). They indicated that historically whitebark pine was a major species across 12-15 percent of the forest landscape and was considered an important nutritional and structural component of wildlife habitat. In the Yellowstone Ecosystem, whitebark pine is a very important food component of the grizzly bear's diet (Mattson and Reinhart 1994).

Whitebark pine has been reduced to about 20-40% of its original abundance in the BE and now is most prevalent in the southern half of the ecosystem. Due to whitebark pine blister rust, the authors felt that the species will probably continue to decline to about 5-10% of its historical abundance before leveling off and then increasing. Whitebark pine would become an increasingly insignificant food source for the grizzly bears in the BE for the next few decades in some areas, but would increase in abundance following proper fire management in other areas. Some researchers indicate that in areas like the BE that are strongly influenced by maritime climates, whitebark pine is not a significant food source for bears, and berry species are probably more valuable (Mattson and Rinehart 1994, Tisch 1961, and others).

Big Game. -- Big game numbers reached their peak through most of the BE during the late 1980's and have recently increased in the southern part of the Primary Analysis Area and decreased in the north (Kuck 1998). Based on historical accounts, elk and deer numbers in Idaho were considerably lower at the turn of the century than they are today. Game numbers have increased as a result of extensive fires, timber harvest, low snow winters, and controlled harvest. Because of the increased availability of game, grizzly bears may use protein provided by game carcasses during the spring and fall to constitute part of the necessary dietary nitrogen that may have been previously provided by anadromous fish during those critical periods. Big game winter range occurs within the boundaries of the wilderness, and early spring game die-offs that usually occur following average snow pack years would be available for bears upon den emergence. Hunter wounding losses during the fall hunting season may also provide some carrion, as would carcasses confiscated from other predators, and occasional animals predated upon by bears.

Other Research

Current habitat research continues and data are being collected and analyzed to more closely evaluate habitat quality in the BE. Merrill et al. (1999) are conducting research to rate habitat based on road densities, distance to population centers, and bear food quality and seasonal availability. Their mapping technique indicates suitable bear habitat exists within portions of the BE. Most of the identified suitable habitat is concentrated in the roadless central mountains. Their research indicates grizzly bears have the greatest chances of surviving and reproducing in western portions of the Bitterroot Evaluation Area (BEA) and in the area stretching from the Sawtooth Mountains Range to the South Fork of the Salmon River. They caution their results are dependent on protection of reintroduced grizzly bears from direct mortality comparable to that provided bears in other recovery areas. Intensive GIS mapping efforts and ground truthing have been conducted throughout the central Idaho area by the University of Montana. These data are available and are being further analyzed by several different scientists for grizzly bear habitat quality in the BE. Appendix 21 contains results of the most current research studies pertaining to habitat quality and suitability for grizzly bear recovery in the Bitterroot Ecosystem.

Summary
Most authors agree that although the habitat appears to provide ample requirements for grizzly bears, the only way to determine true habitat effectiveness is to monitor bears using the habitat. Grizzly bears are remarkably adaptive and occupy a variety of habitats ranging from the high quality habitat available along the Alaska and British Columbia coastal zones, to the Gobi desert of China. Habitats vary considerably even within ecosystems and bears learn to adapt to those foods and their availability. Approximately 12,000 black bears are estimated to live within the BE Primary Analysis Area, and the known diets of black and grizzly bears are not that different. Most authors also agree that successful bear recovery will be determined by the level of human caused mortality. Grizzly bears can live within the boundaries of the BE, but their densities will likely be less than what could have been supported when both salmon and whitebark pine were common.

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APPENDIX 3A. Anadromous and resident fisheries status in the Bitterroot Grizzly Bear Ecosystem, Idaho.

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Historical Overview

The two major drainages in the Bitterroot Ecosystem, the Clearwater River and Salmon River, once contained an abundant and diverse community of fish resources. Anadromous species of fish present were three races of chinook salmon (*Oncorhynchus tshawytsha* (Walbaum)), steelhead trout (*O. mykiss*), coho salmon (*O. kisutch)*, sockeye salmon (*O. nerka*) and Pacific lamprey (*Lampetra tridentata*). Resident native fish included cutthroat trout (*O. clarki*), rainbow trout (*O. mykiss*), bull trout (*Salvelinus confluentus*), mountain whitefish (*Prosopium williamsoni*), northern squawfish (*Ptychocheilus oregonensis*), redside shiner (*Richardsonius balteatus*), and several species of sculpin (*Cottus* spp.), dace (*Rhinichthys* spp.), and suckers (*Catostomus* spp.). All species still exist in the ecosystem, but many are at reduced or remnant levels, and chinook salmon, steelhead trout and bull trout have been eliminated from much of their historic range.

Idaho once produced an estimated 39% of the total spring chinook salmon, 45% of the total summer chinook salmon, 5% of the total fall chinook salmon, and 55% of the total summer steelhead in the Columbia River Basin (Mallet 1974). The Clearwater River drainage likely produced over 26% of Idaho's chinook salmon, and 28% of the summer steelhead entering Idaho. Chapman (1981) estimated that the number of adult spring chinook salmon entering the Clearwater River drainage in pristine conditions at 87,433.

The Nez Perce, primary inhabitants of the Clearwater River drainage prior to the arrival of European man, were predominantly a tribe of fisherman, and consequently the anadromous runs of chinook salmon and steelhead trout were able to support a large number of villages along the river corridor (Lane et al. 1981). Fish comprised 36-45% of the Nez Perce diet, and were also an important trade item. Salmon were the predominant species, but steelhead trout, salmon trout (probably large resident rainbow trout), other trout, lamprey and other fish were also used. As the influence of European man spread, the loss of other food sources such as camas root, big and small game occurred and fish became even more important for subsistence of the Nez Perce. Major fishing villages were along the mainstem Clearwater River corridor, but other important fishing sites were in headwater areas of the Selway, Lochsa and North Fork Clearwater rivers and used in conjunction with seasonal hunting and gathering trips (Lane et al. 1981).

The Salmon River drainage was inhabited or used for food gathering by the Nez Perce and the Shoshone tribes and the Bannock band of the Northern Paiute (Jones 1990). A Shoshone band known as the Sheepeaters were widely dispersed throughout the mountains surrounding the Salmon

River. While primarily hunters, they occasionally wintered at the confluence of the Snake and Salmon rivers with the Nez Perce to fish. The Whitebird band of the Nez Perce used the Little Salmon River and the lower Salmon River as their primary fishing grounds. In early summer, Shoshone from the Boise-Weiser country, along with other Idaho tribes, traveled to the Camas Prairie to collect and dry roots and bulbs. Fish were taken in the fall and big game was hunted in the surrounding mountains as far as the headwaters of the Salmon River (Murphy 1960, in Jones 1990).

Settlers and miners arriving in Idaho also took advantage of the abundant fishery resources, and tales of spearing hundreds of fish with pitchforks were not uncommon. Salmon and steelhead provided sustenance for miners from the headwaters of the Salmon River, downstream to the Snake River, and in the South Fork Clearwater drainage.

Recent Impacts and Restoration Efforts

Habitat changes through land use activities, hydropower development, fish passage problems, drought, ocean conditions, commercial fisheries and exotic species introductions have all had a negative effect on the size of salmon and steelhead runs returning to Idaho over at least the last thirty years (Figure 6-1). These impacts have reduced the size of chinook salmon runs in Idaho to a remnant of their historic levels. While steelhead trout numbers have been bolstered by hatchery production, the number of wild steelhead has also severely declined. Fish numbers have remained at low levels since the last two Snake River dams were completed in the late 1960's and early 1970's. Spring and summer chinook salmon in the Snake and Salmon River drainages are listed as threatened under the Endangered Species Act (ESA), as are fall chinook statewide. Sockeye salmon are listed as endangered. All Idaho wild steelhead trout are listed as threatened under the ESA, as are bull trout. Coho salmon were declared extinct in Idaho in 1986. All native trout are considered species of special concern by the State of Idaho.

Sportfishing in streams within the Idaho portion of the Bitterroot Ecosystem are currently managed under a variety of regulations, depending on what species are present and the protection needed to maintain populations. The most liberal limit is 6 trout, no size or gear restrictions, and occurs in waters where hatchery fish are stocked. Most wild steelhead trout waters have a 2 trout limit or are catch and release. There has been no general harvest of chinook salmon allowed Idaho since 1978, and only a few special seasons allowing harvest of hatchery salmon have occurred since then.

Clearwater Drainage -- Dams built at Harpster in 1910 (South Fork Clearwater) and at Lewiston in 1923 (mainstem Clearwater) eliminated the chinook salmon runs into the Clearwater drainage, and severely impacted or eliminated steelhead trout runs during low water years. Dworshak Dam, completed in 1971 on the North Fork Clearwater River, eliminated 627 miles of productive salmon and steelhead trout spawning and rearing habitat (Mallet 1974). After the removal of the Harpster Dam in 1963, and the Lewiston Dam in 1973, efforts were made to restore chinook salmon and

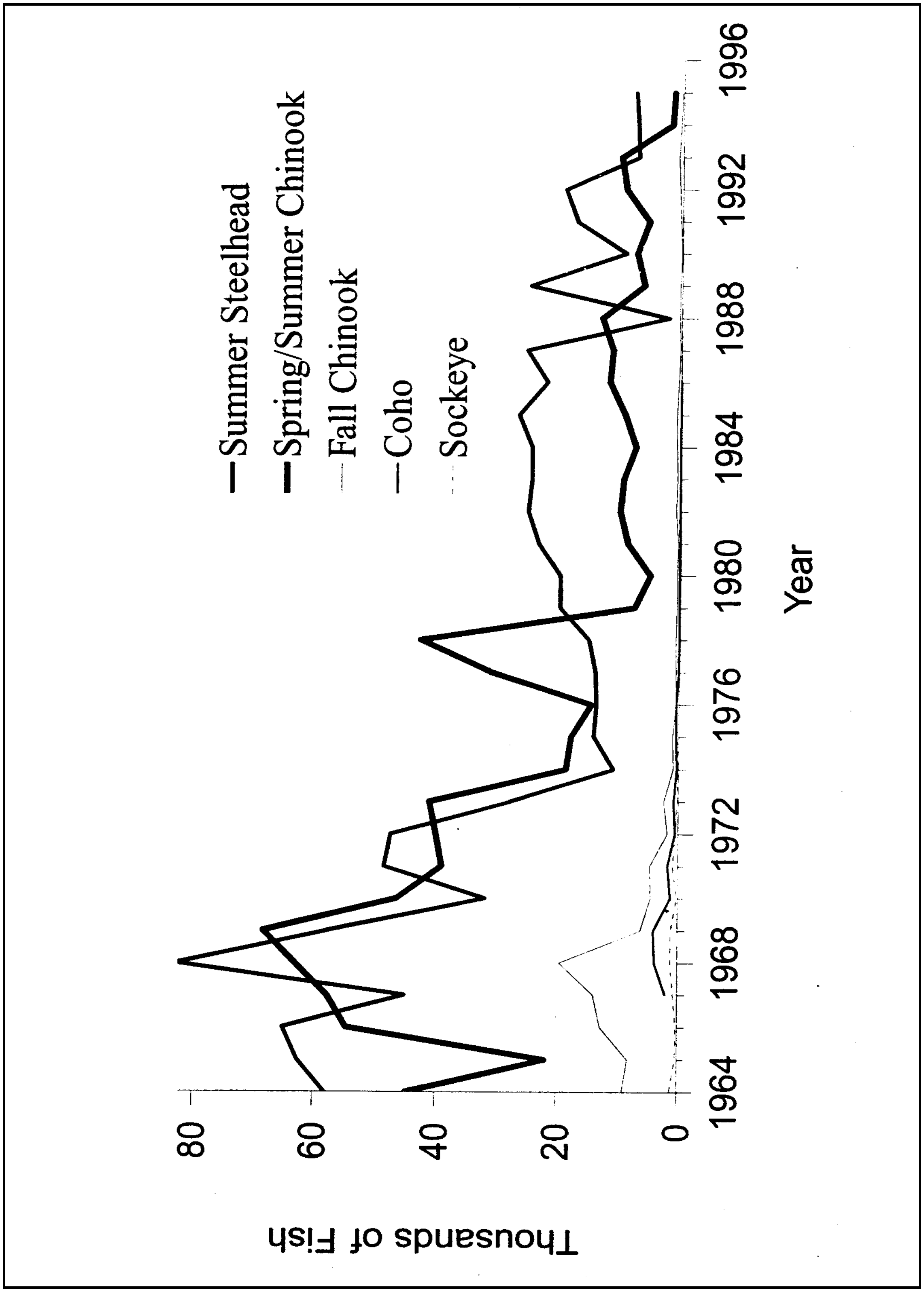

Figure 6-1. Adult returns of wild salmon and steelhead trout to the uppermost dam on the lower Snake River, 1964-1995. Uppermost dam was: Ice Harbor from 1964-68; Lower Monumental during 1969; Little Goose from 1970-74; and Lower Granite from 1975-95.

steelhead trout runs into the Clearwater Basin using hatchery stock. Presently, the Clearwater River drainage has 1,248 miles of stream available to anadromous fish, in various conditions of habitat quality (Mallet 1974). Two federally run hatcheries and one state run hatchery exist on the Clearwater River to help restore chinook salmon and steelhead trout numbers into the Clearwater drainage. The Nez Perce Tribe is actively trying to restore fall chinook and coho salmon into the lower portions of the Clearwater drainage.

After Dworshak Dam was completed, kokanee salmon (*O. nerka*) were stocked from 1971 - 1979 to provide a sport fishery in the reservoir. The population has fluctuated over the years due to changes in nutrient levels and hydroelectric power generation, but in some years spawner counts have totaled over 39,000 fish.

Salmon River Drainage -- The Salmon River drainage is the largest subbasin in the Columbia River drainage, excluding the Snake River, and has the most stream miles of habitat available to anadromous fish (IDFG et al. 1991). The total watershed is just over 14,000 square miles. With the exception of Sunbeam Mine Dam which blocked passage upstream of Yankee Fork from 1913-1934, the Salmon River has not been impacted by dams like the Clearwater River has. Although a majority of the habitat still available is high quality, logging, dredge mining, road building, intensive grazing and irrigation withdrawals have degraded many streams. Federal, state, tribal and private interests have recently come together in many areas to help restore the habitat quality through changes in agricultural practices, and instream and riparian enhancement. Several hatcheries raise both chinook salmon and steelhead trout for release into the Salmon River drainage to bolster natural populations.

Prospectus

Anadromous Fish -- Although habitat needs protection and improvement in localized areas, spawning and rearing habitat for natural production is of ample quantity and quality to allow for increased production. The Clearwater and Salmon drainage subbasin plans (1990) state that high juvenile mortality associated with eight downstream Snake and Columbia hydroelectric projects is a major factor inhibiting increased production of anadromous fish in Idaho. Until downstream migration problems are resolved, it is unlikely Idaho will ever have runs of historic size returning, and will continue to see numbers of fish at current or lower levels.

Resident Fish -- Resident fish populations have been impacted by the same land use activities as anadromous fish, with the exception of dams. State and federal management agencies continue to make efforts to restore and enhance habitat and prevent over harvest of populations. While native fish are not distributed as they once were historically, they are currently holding their own in most cases.

Food Potential For Grizzly Bears

Anadromous fish, particularly chinook salmon, likely once provided an abundant and important food source to grizzly bears in the Bitterroot Ecosystem. Concentrations of salmon adults at migration impediments and spawner carcasses throughout the ecosystem were ready sources of food during the summer and fall. Steelhead trout runs were probably of lesser values since their migration and spawning times coincided with high water levels. Runs of salmon at current levels would continue to provide a source of food through spawner carcasses, but these would be more on an incidental basis because spawners are widely distributed due to very low numbers. Anadromous fish would not be a readily available resource every year, and would only be supplemental at best.

It is unknown how large a role resident fish played in providing a food source. Bull trout and cutthroat spawners could be utilized by bears in the fall and late spring, respectively during their spawning runs. Distribution of these fish are mostly in the more pristine headwater areas of the ecosystem, and also would only be a supplemental part of the grizzly bear diet. Concentrations of kokanee salmon in the North Fork Clearwater River drainage may provide a more abundant food source if populations remain at current levels.

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APPENDIX 3B. Whitebark Pine (Pinus albicaulis) in the Selway Bitterroot Wilderness Complex: Ecology, Distribution and Health

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Introduction

Whitebark pine (Pinus albicaulis) is considered to be a keystone species of upper subalpine forests of the northern Rocky Mountains (Schmidt and McDonald 1990). It is an important nutritional and structural component of wildlife habitat (Arno and Hoff 1990; Schmidt and McDonald 1990). Its large, nut-like seeds are a major food source for many birds and mammals (around 105 species) including squirrels, black and grizzly bears, and Clark's nutcrackers (Hutchins and Lanner 1982). Whitebark pine protects watersheds by stabilizing soil and rock on the harshest sites and by catching and retaining snowpack. Historically whitebark pine was a major species on 10-15 percent of the forest landscape in western Montana and central Idaho (Arno 1986). Therefore its perpetuation is of concern for maintaining natural biodiversity and landscape structure. This paper will summarize the ecology, distribution, abundance for historical, present and future whitebark pine forests in the Selway-Bitterroot Wilderness Complex (SBWC) of central Idaho and west-central Montana. This summary will be in the context of reintroducing the grizzly bear into this diverse wilderness.

Ecology

Whitebark pine is typically a major seral species in the SBWC upper subalpine. In the absence of disturbance, whitebark pine is eventually replaced by the more shade-tolerant subalpine fir and Engelmann spruce in most of the area, but it can form nearly pure climax stands on many high, droughty ridgetops, especially above 8,000 feet elevation (Pfister and others 1977). The Clark's nutcracker (Nucifraga columbiana) plays a critical role in the whitebark pine regeneration process because this bird is essentially the only dispersal vector for the heavy, wingless, nut-like seed (Tomback 1982). A single nutcracker can store over 100,000 seeds in 8,000 to 15,000 caches of 1-22 seeds buried about 1-2 cm into the ground for distances up to 15 kilometers (Tomback 1982, Hutchins and Lanner 1982). The bird reclaims much of the seed but a large proportion are left to geminate. These seedlings eventually form the whitebark pine forests that were so prevalent on the landscape prior to 1960.

Large, stand-replacement fires are common in the SBWC. The great seed dispersal distances provided by the nutcracker allow whitebark pine a competitive advantage in colonizing the large areas burned by these fires (Tomback and others 1990). Also, Clark's nutcrackers prefer open, burned areas to cache whitebark pine seeds (Tomback and others 1990). Some whitebark pine stands in higher and drier areas contain evidence of less severe, more frequent surface fires (Arno 1986).

These low intensity fires tend to kill most competing conifer species, especially subalpine fir, thereby favoring the somewhat fire-resistant whitebark pine (Arno 1986). Whitebark pine is able to survive low severity fires better than its competitors because it has thicker bark, deeper roots and a high, open crown providing little fuel on the ground. Whitebark pine may also be more resistant to heat than fir or spruce.

Whitebark pine seeds are an important grizzly bear food where the two species coexist. Mattson and others (1991) found whitebark pine seed accounted for over 40% of the diet of Yellowstone grizzly bears. The size of the whitebark pine cone crop has been positively correlated to post-hibernation survival, number of twins, and pre-hibernation health of grizzly bears. Moreover, large whitebark pine cone crops have enticed the grizzly bear to spend the majority of the late summer in the high elevation areas away from the areas heavily used and occupied by humans. The bears obtain most whitebark pine seed from excavation of middens of whitebark pine cones cached by squirrels on the ground (Kendall 1980).

Distribution

Whitebark pine was the major component on the historical SBWC upper subalpine landscape. It was the principal forest component above 6800 feet elevation on most aspects and slopes. On this basis, it used to dominate 15-20 percent of the pre-1900 SBWC landscape. Today, whitebark pine occurrence has shrunk dramatically. It is rarely a major forest component north of 46°N latitude (north of Grangeville, ID and Darby, MT) in the SBWC. In the southern and eastern portions of the SBWC, blister rust-induced mortality is less severe, but successional replacement by subalpine fir and Engelmann spruce has generally pushed the lower elevational limit of the whitebark pine forest to 800 feet higher than it was in the early 1900's (Arno and others 1993).

Status and Health

Personal observations by the authors indicate whitebark pine is at approximately 20-40% of its pre-1900 abundance in the SBWC. A rapid decline in whitebark pine has occurred during the last 60 years as a result of three interrelated factors: 1) epidemics of mountain pine beetle (<u>Dendroctonus ponderosae</u>); 2) the introduced disease white pine blister rust (<u>Cronartium ribicola</u>); and 3) successional replacement by shade-tolerant conifers, specifically subalpine fir (<u>Abies lasiocarpa</u>) and Engelmann spruce (<u>Picea engelmannii</u>), as a result of fire exclusion policies of the last 60-80 years (Kendall and Arno 1990, Keane and Arno 1993, Ciesla and Furniss 1986).

An extensive beetle epidemic occurred during the late 1920's and early 1930's across the SBWC (Arno 1970, Arno 1976). This epidemic killed most of the mature whitebark pine trees over large areas. The result was accelerated succession to subalpine fir (Keane and Arno 1993). Beetles also seem to play the role of secondary colonizer, attacking and killing already stressed pines, especially those pines being killed by blister rust or other agents.

The exotic white pine blister rust, introduced to the western US around 1910, has killed most of the mature whitebark pine in the northern and western portions of the SBWC (Keane and Arno 1993, Keane et al. 1993, Kendall and Arno 1990). This disease requires an alternate host of gooseberry or currant (Ribes spp.) shrubs to complete its life cycle (Colley 1918, McDonald et al. 1981). Whitebark pine cone production is severely reduced by a rust epidemic because blister rust kills the top-most, cone-bearing branches first before ultimately killing the entire tree after 10-20 years.

The current prescribed natural fire program for the SBWC, covering most of the area since 1979, allows fire to return to a more natural role in maintaining SBWC ecosystem integrity (USDA Forest Service 1990). However, historical fire management policies from the 1930's through 1978 excluded fire from most of the SBWC landscape. Moreover, Brown and others (1994) found that the SBWC prescribed natural fire program has not burned enough area in the whitebark pine forests to mimic historical fire occurrences. Fire is essential for whitebark pine regeneration because nutcrackers do not like to cache seed under a thick forest canopy (Tomback 1982) and whitebark pine is not a shade tolerant species. Therefore, fire is vital to the maintenance of whitebark pine on the SBWC landscape (Keane and others 1990).

Prognosis

Based on field data, personal observations and simulation model results, it can be assumed that the whitebark pine population in the SBWC will continue to decline because of the blister rust to perhaps 5-10% of its original extent (Keane and Arno 1993, Keane and others 1990, Arno 1986, Arno and others 1993). The combination of the three damaging agents (beetles, rust and fire exclusion) has and will continue to accelerate this decline of whitebark pine. High elevation ridgetops, constituting about 5% of SBWC whitebark pine forests, will probably experience slow rates of rust mortality, presumably because the rust has a difficult time completing its life cycle in the most severe microclimates. There seems to be between 1-8% rust resistance in northern Rocky Mountain whitebark pine populations so it is doubtful that whitebark pine will ever be entirely eliminated by blister rust (Hoff and others 1980). However, the removal of whitebark pine as important ecosystem component and wildlife resource has already occurred in much of the northern, western and central SBWC, and this decline appears to be advancing southward and eastward at a perceptible rate (Keane and Arno 1993). The suppression of wildland fire from the SBWC landscape will exacerbate the decline by decreasing the potential for whitebark pine regeneration from rust-resistant trees.

In summary, whitebark pine populations will probably be reduced to approximately 5-10% of their historical numbers. This could be disastrous to subsequent whitebark pine regeneration because nutcrackers will eat much more than they will cache when there are limited cone-bearing individuals (Tomback 1982, Tomback and others 1990). This may mean that whitebark pine will be an increasingly insignificant food source for grizzly bears because squirrels probably will not harvest substantial amounts of cones, and what little that are harvested will be utilized immediately by the squirrels and not stored in middens.

In conclusion, it would seem that a program to restore whitebark pine on the SBWC landscape would be extremely beneficial to a grizzly bear restoration program. Techniques currently being studied for restoring damaged whitebark pine communities include cutting trees that compete with whitebark pine, prescribed burning and planting of rust resistant seedlings. These studies are being conducted in areas near and adjacent to the SBWC (Keane and Arno 1996). However, the single most important action we can do to maintain this species on the landscape is to return fire to the landscape. This will create ideal nutcracker caching habitat thus insuring future whitebark pine regeneration. The ensuing whitebark pine regeneration will most likely come from trees that have some degree of rust resistance. This is especially true when most overstory trees have already been killed by the rust and thus the surviving trees are likely to be rust-resistant.

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