Yellowstone Grizzly Bear Investigations 2008

Report of the Interagency Grizzly Bear Study Team

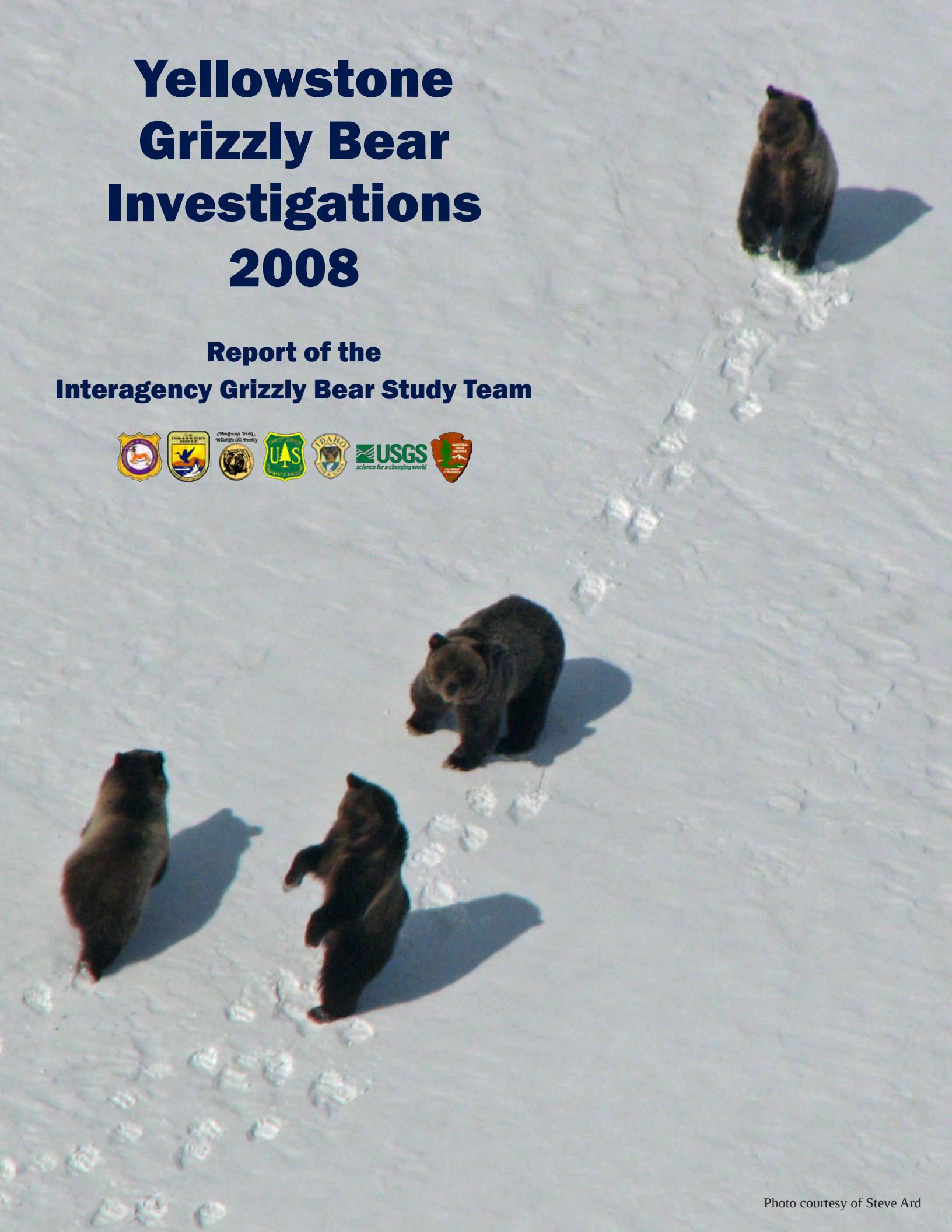

Photo courtesy of Steve Ard

Data contained in this report are preliminary and subject to change. Please obtain permission prior to citation. To give credit to authors, please cite the section within this report as a chapter in a book. Below is an example:

Moody, D.S., K. Frey, and D. Meints. 2009. Trends in elk hunter numbers within the Primary Conservation Area plus the 10-mile perimeter area. Page 39 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2008. U.S. Geological Survey, Bozeman, Montana, USA.

Cover: Female #533 with her 3 3-year-old offspring after den emergence, taken 1 May 2008 by Steve Ard.

YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

Annual Report of the Interagency Grizzly Bear Study Team

2008

U.S. Geological Survey
Wyoming Game and Fish Department
National Park Service
U.S. Fish and Wildlife Service
Montana Fish, Wildlife and Parks
U.S. Forest Service
Idaho Department of Fish and Game

Edited by Charles C. Schwartz, Mark A. Haroldson, and Karrie West

U.S. Department of the Interior
U.S. Geological Survey
2009

Table of Contents

INTRODUCTION 1
This Report 1
History and Purpose of the Study Team 2
Previous Research 2

RESULTS AND DISCUSSION 4
Bear Monitoring and Population Trend 4
Marked Animals 4
Assessing Trend and Estimating Population Size from Counts of Unduplicated Females 9
Occupancy of Bear Management Units by Females with Young 15
Observation Flights 16
Telemetry Relocation Flights 19
Estimating Sustainability of Annual Grizzly Bear Mortalities 20
Key Foods Monitoring 26
Spring Ungulate Availability and Use by Grizzly Bears in Yellowstone National Park 26
Spawning Cutthroat Trout 29
Grizzly Bear Use of Insect Aggregation Sites Documented from Aerial Telemetry and Observations 32
Whitebark Pine Cone Production 35
Habitat Monitoring 37
Grand Teton National Park Recreation Use 37
Yellowstone National Park Recreational Use 38
Trends in Elk Hunter Numbers within the Primary Conservation Area and 10-mile Perimeter Area 39
Grizzly Bear-Human Conflicts in the Greater Yellowstone Ecosystem 40

LITERATURE CITED 43

Appendix A: Assessing Habitat and Diet Selection for Grizzly and American Black Bears in Yellowstone National Park: 2008 annual progress report 48

Appendix B: 2008 Wyoming Bear Wise Community Project update 50

Appendix C: 2008 Wind River Indian Reservation Grizzly Bears grizzly bear camera study 56

Appendix D: Monitoring whitebark pine in the Greater Yellowstone Ecosystem: 2008 annual report 62

Appendix E: Grizzly bear habitat monitoring report: Greater Yellowstone Area National Forests and National Parks 69

Introduction

(Charles C. Schwartz, Interagency Grizzly Bear Study Team; and David S. Moody, Wyoming Game and Fish Department)

This Report

The contents of this Annual Report summarize results of monitoring and research from the 2008 field season. The report also contains a summary of nuisance grizzly bear (*Ursus arctos horribilis*) management actions.

The Interagency Grizzly Bear Study Team (IGBST) continues to work on issues associated with counts of unduplicated females with cubs-of-the-year (COY). These counts are used to estimate population size, which is then used to establish mortality thresholds. A recent review published in the Journal of Wildlife Management (Schwartz et al. 2008) suggest that the rule set of Knight et al. (1995) returns conservative estimates, but with minor improvements, counts of unduplicated females with COY can serve as a reasonable index of population size useful for establishing annual mortality limits. As a follow up to the findings of Schwartz et al. (2008), the IGBST held a workshop in October 2007 (IGBST 2008). The purpose of the workshop was to discuss the feasibility of developing new models that improve our ability to distinguish unique females with COY. The outcome of that workshop was a research proposal detailing methods to develop a hierarchical model that should improve the methods used to distinguish unique females with COY. Multiple agencies who are members of the Yellowstone Grizzly Bear Coordinating Committee are providing funding for this project and funds are currently being transferred. We anticipate starting this project in summer 2009, and we expect results to be available by winter 2009.

The grizzly bear was removed from protection under the Endangered Species Act on 30 April 2007 (U.S. Fish and Wildlife Service [USFWS] 2007*a*). Under the Revised Demographic Recovery Criteria (USFWS 2007*b*) and the demographic monitoring section of the Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area (USFWS 2007*c*), the IGBST is now tasked with reporting on an array of required monitoring programs. These include both population and habitat components. Annual population monitoring includes:

- Monitoring unduplicated females with COY for the entire Greater Yellowstone Area (GYA). The IGBST developed improved methods to estimate the annual number of females with COY and we detail them in this years report (see *Assessing trend and estimating population size from counts of unduplicated females*).
- Calculating a total population estimate for the entire GYA based on the model averaged Choa2 estimate of females with COY. Methods used to estimate the number of independent females and independent males (age ≥2 year) are also provided (see *Assessing trend and estimating population size from counts of unduplicated females*).
- Monitoring the distribution of females with young of all ages and having a target of at least 16 of 18 Bear Management Units (BMUs) within the Primary Conservation Area (PCA) occupied at least 1 year in every 6, and no 2 adjacent BMUs can be unoccupied over any 6-year period (see *Occupancy of Bear Management Units by females with young*).
- Monitoring all sources of mortality for independent (≥2 years old) females and males within the entire GYA. Mortality limits are set at ≤9% for independent females and ≤15% for independent males from all causes. Mortality limits for dependent young are ≤9% for known and probable human-caused mortalities (see *Estimating sustainability of annual grizzly bear mortalities*).

Habitat monitoring includes documenting the abundance of the 4 major foods throughout the GYA including winter ungulate carcasses, cutthroat trout (*Oncorhynchus clarkii*) spawning numbers, bear use of army cutworm moth (*Euxoa auxiliaris*) sites, and whitebark pine (*Pinus albicaulis*) cone production. These protocols have been monitored and reported by the IGBST for several years and are reported here. Additionally, we continued to monitor the health of whitebark pine in the ecosystem in cooperation with the Greater Yellowstone Whitebark Pine Monitoring Working Group. A summary of the 2008 monitoring is also presented (see Appendix D). The protocol has been modified to document mortality rate in whitebark pine from all causes, including mountain pine beetle (*Dendroctonus ponderosae*).

Also the Conservation Strategy (USFWS 2007*c*) requires maintenance of secure habitat, livestock allotments, and developed sites at 1998 levels in each BMU subunit. This year, the second report detailing this monitoring program is provided. This report documents 1) changes in secure habitat, open motorized access route density, total motorized route density inside the PCA, 2) changes in number and capacity of developed sites inside the PCA, 3) changes in number of commercial livestock allotments and changes in the number of permitted domestic sheep animal months inside the PCA, and livestock allotments with grizzly bear conflicts during the last 5 years (see Appendix E).

Results of DNA hair snaring work conducted on Yellowstone Lake (Haroldson et al. 2005) from 1997–2000 showed a decline in cutthroat trout use by grizzly bears when compared to earlier work conducted by Reinhardt (1990) in 1985–1987. As a consequence, the IGBST started a 3-year study to determine if spawning cutthroat trout continue to be an important food for bears, or if the trout population has declined to the level that bears no longer use this resource. If trout are no longer a useful food resource, we want to determine what geographical areas and foods the bears are using and if those foods are an adequate replacement to maintain a healthy population of grizzly bears. This project began in 2007. There are 2 graduate students and several field technicians working on the program. A summary of the 2008 field work can be found in Appendix A.

The state of Wyoming, following recommendations from the Yellowstone Ecosystem Subcommittee and the IGBST, launched the Bear Wise Community Effort in 2005. The focus is to minimize human/bear conflicts, minimize human-caused bear mortalities associated with conflicts, and safeguard the human community. Results of these efforts are detailed in Appendix B. Also, the state of Wyoming conducted a field study testing remote sensing cameras to count females with COY. Results of that study are reported in Appendix C.

The annual reports of the IGBST summarize annual data collection. Because additional information can be obtained after publication, <u>data summaries are subject to change</u>. For that reason, data analyses and summaries presented in this report supersede all previously published data. The study area and sampling techniques are reported by Blanchard (1985), Mattson et al. (1991*a*), and Haroldson et al. (1998).

History and Purpose of the Study Team

It was recognized as early as 1973, that in order to understand the dynamics of grizzly bears throughout the Greater Yellowstone Ecosystem (GYE), there was a need for a centralized research group responsible for collecting, managing, analyzing, and distributing information. To meet this need, agencies formed the IGBST, a cooperative effort among the National Park Service, U.S. Forest Service, USFWS, and the States of Idaho, Montana, and Wyoming. The U.S. Geological Survey (USGS) became part of IGBST in 1997. The responsibilities of the IGBST are to: (1) conduct both short- and long-term research projects addressing information needs for bear management; (2) monitor the bear population, including status and trend, numbers, reproduction, and mortality; (3) monitor grizzly bear habitats, foods, and impacts of humans; and (4) provide technical support to agencies and other groups responsible for the immediate and long-term management of grizzly bears in the GYE. Additional details can be obtained at our web site (http://www.nrmsc.usgs.gov/research/igbst-home.htm).

Quantitative data on grizzly bear abundance, distribution, survival, mortality, nuisance activity, and bear foods are critical to formulating management strategies and decisions. Moreover, this information is necessary to evaluate the recovery process. The IGBST coordinates data collection and analysis on an ecosystem scale, prevents overlap of effort, and pools limited economic and personnel resources.

Previous Research

Some of the earliest research on grizzlies within Yellowstone National Park (YNP) was conducted by John and Frank Craighead. The book, "The Grizzly Bears of Yellowstone" provides a detailed summary of this early research (Craighead et al. 1995). With the closing of open-pit garbage dumps and cessation of the ungulate reduction program in YNP in 1967, bear demographics (Knight and Eberhardt 1985), food habits (Mattson et al. 1991*a*), and growth patterns (Blanchard 1987) for grizzly bears changed. Since 1975, the IGBST has produced annual reports and numerous scientific publications (for a complete list visit our web page http://www.nrmsc.

usgs.gov/research/igbst-home.htm) summarizing monitoring and research efforts within the GYE. As a result, we know much about the historic distribution of grizzly bears within the GYE (Basile 1982, Blanchard et al. 1992), movement patterns (Blanchard and Knight 1991), food habits (Mattson et al. 1991*a*), habitat use (Knight et al. 1984), and population dynamics (Knight and Eberhardt 1985, Eberhardt et al. 1994, Eberhardt 1995). Nevertheless, monitoring and updating continues so that status can be reevaluated annually.

This report truly represents a "study team" approach. Many individuals contributed either directly or indirectly to its preparation. To that end, we have identified author(s). We also wish to thank the following individuals for their contributions to data collection, analysis, and other phases of the study. Without the collection efforts of many, the information contained within this report would not be available. USGS: J. Akins, J. Ball, J. Brown, H. Cardani, A. Ganick, J. Irving, P. Lendrum, J. Lewis, K. Quinton, G. Rasmussen, T. Rosen, C. Rumble, S. Schmitz, J. Teisberg, S. Thompson, B. Visaggi, C. Whitman; NPS: H. Bosserman, A. Bramblett, T. Coleman, C. Daigle-Berg, S. Dewey, L. Felicetti, L. Frattaroli, B. Gafney, S. Gunther, B. Hamblin, L. Haynes, D. Smith, D. Stahler, A. Tallian, P.J. White, S. Wolff, B. Wyman; MTFWP: N. Anderson, J. Smith, J. Smolczynski, S. Stewart; MSU; S. Cherry; WYGF: G. Anderson, T. Achterhof, D. Brimeyer, G. Brown, J. Clapp, D. Clause, B. DeBolt, D. Ditolla, L. Ellsbury, T. Fagan, G. Fralick, H. Haley, A. Johnson, N. Johnson, B. Kroger, M. Ladd, J. Longobardi, P. Luepke, D. McWhirter, B. Nesvik, C. Queen, R. Roemmich, C. Sax, Z. Turnbull; IDFG; C. Anderson, L. Hanauska-Brown, S. Grigg, T. Imthum, R. Knight, J. Koontz, G. Losinski, H. Miyasaki, S. Roberts, J. Rydalch; USFS: B. Davis, T. Hershey, M. Hinschberger, L. Otto, A. Pils, C. Pinegar; Pilots and Observers: C. Anderson, B. Ard, S. Ard, N. Cadwell, R. Danielson, D. Ford, K. Hamlin, H. Leech, T. Schell, D. Stinson, D. Stradley, R. Stradley; WS: G. McDougal, J. Rost; Shoshone and Arapaho Tribes: B. St. Clair, B. Makeshine; USFWS: P. Hnilicka, D. Skates.

Photo courtesy of Steve Ard, 31 Jul 2005

Results and Discussion

Bear Monitoring and Population Trend

Marked Animals *(Mark A. Haroldson and Chad Dickinson, Interagency Grizzly Bear Study Team; and Dan Bjornlie, Wyoming Game and Fish Department)*

During the 2008 field season, 66 individual grizzly bears were captured on 79 occasions (Table 1), including 19 females (11 adult) and 47 males (27 adult). Thirty-two individuals were new bears not previously marked.

We conducted research trapping efforts for 551 trap days (1 trap day = 1 trap set for 1 day) in the GYE. During research trapping operations we had 39 captures of 30 individual grizzly bears for a trapping success rate of 1 grizzly capture every 14 trap days.

There were 40 management captures of 36 individual bears in the GYE during 2008 (Tables 1 and 2), including 12 females (7 adult) and 24 males (12 adult). None of the bears captured at management settings were subsequently caught at research trap sites. Twenty-eight individual bears (10 females, 18 males), were relocated due to conflict situations (Table 1). Two subadult siblings (G133 and G134) were relocated twice. One bear (#582) was transported and subsequently removed. Eight other individuals (2 females, 6 males) were captured and removed due to conflicts (see *Estimating sustainability of annual grizzly bear mortalities*). Two of these bears (1 female, 1 male) were live removals to Washington State University.

We radio-monitored 87 individual grizzly bears during the 2008 field season, including 30 adult females (Tables 2 and 3). Fifty-one grizzly bears entered their winter dens wearing active transmitters. Two additional bear not located since September are considered missing (Table 3). Since 1975, 595 individual grizzly bears have been radiomarked in the GYE.

Table 1. Grizzly bears captured in the Greater Yellowstone Ecosystem during 2008.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site	Agency[b]
291	Male	Adult	04/19/08	E Fork Wind River, Pr-WY	Management	Removed	WYGF
579	Male	Subadult	04/21/08	Boulder River, Pr-MT	Management	Removed	MTFWP
G126	Female	Subadult	05/08/08	Wind River, Pr-WY	Management	Sunlight Creek, SNF	WYGF
G127	Male	Subadult	05/08/08	Wind River, Pr-WY	Management	Sunlight Creek, SNF	WYGF
525	Female	Adult	05/09/08	Wind River, Pr-WY	Management	Sunlight Creek, SNF	WYGF
580	Male	Adult	05/09/08	Long Creek, Pr-WY	Management	Mormon Creek, SNF	WYGF
581	Male	Adult	05/17/08	Crandall Creek, Pr-WY	Management	Mormon Creek, SNF	WYGF
582	Male	Subadult	06/08/08	Rattlesnake Creek, Pr-WY	Management	Pilot Creek, SNF	WYGF
			08/09/08	Beartooth Creek, SNF	Management	Removed	WYGF
583	Male	Subadult	06/12/08	Grass Creek, BLM-WY	Research	On site	WYGF
584	Male	Subadult	06/13/08	Rasberry Creek, State-WY	Research	On site	WYGF
448	Female	Adult	06/14/08	Bridge Creek, YNP	Research	On site	IGBST
			07/26/08	Bridge Creek, YNP	Research	On site	IGBST
			10/23/08	Arnica Creek, YNP	Research	On site	IGBST
585	Male	Adult	06/14/08	Yellowstone River, YNP	Research	On site	IGBST
149	Female	Adult	06/17/08	Yellowstone River, YNP	Research	On site	IGBST
586	Male	Subadult	06/19/08	Grass Creek, BLM-WY	Research	On site	WYGF
587	Male	Subadult	06/28/08	Pacific Creek, Pr-WY	Management	Glade Creek, CTNF	WYGF

Table 1. Continued.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site	Agency[b]
492	Female	Subadult	06/30/08	Flat Mountain Creek, YNP	Research	On site	IGBST
			07/18/08	Flat Mountain Creek, YNP	Research	On site	IGBST
434	Male	Adult	07/08/08	Horse Creek, SNF	Management	Sunlight Creek, SNF	WYGF
588	Male	Subadult	07/10/08	Standard Creek, BDNF	Research	On site	IGBST
360	Female	Adult	07/17/08	Papoose Creek, Pr-MT	Research	On site	IGBST
G128	Female	Subadult	07/18/08	S Fork Shoshone R., Pr-WY	Management	Lost Lake, BTNF	WYGF
541	Female	Adult	07/22/08	Flat Mountain Creek, YNP	Research	On site	IGBST
495	Female	Adult	07/22/08	Soda Butte Creek, GNF	Management	Removed	MTFWP
433	Male	Adult	07/24/08	Crow Creek, BTNF	Management	Removed	WYGF
504	Male	Adult	07/28/08	Gypsum Creek, BTNF	Management	Removed	WYGF
487	Male	Adult	07/27/08	Wood River, Pr-WY	Management	Boone Creek, CTNF	WYGF
589	Male	Adult	07/28/08	Bridge Creek, YNP	Research	On site	IGBST
464	Male	Adult	07/31/08	Trail Creek, BTNF	Management	Removed	WYGF
497	Female	Adult	08/04/08	Cow Creek, BTNF	Management	Sunlight Creek, BTNF	WYGF
565	Male	Subadult	08/09/08	Warm River, CTNF	Research	On site	IGBST
			08/26/08	Warm River, CTNF	Research	On site	IGBST
G129	Male	Subadult	08/09/08	Tepee Creek, BTNF	Management	Clark Fork, SNF	WYGF
373	Male	Adult	08/12/08	Warm River, CTNF	Research	On site	IGBST
590	Female	Subadult	08/13/08	Marston Creek, SNF	Research	On site	WYGF
545	Male	Adult	08/13/08	Sheridan Creek, SNF	Management	Removed	WYGF
556	Male	Adult	08/21/08	Warm River, CTNF	Research	On site	IGBST
			08/24/08	Warm River, CTNF	Research	On site	IGBST
591	Female	Subadult	08/21/08	Warm River, CTNF	Research	On site	IGBST
592	Male	Adult	08/21/08	Marston Creek, SNF	Research	On site	WYGF
593	Male	Subadult	08/22/08	Porcupine Creek, CTNF	Research	On site	IGBST
302	Male	Adult	08/23/08	Marston Creek, SNF	Research	On site	WYGF
594	Male	Subadult	08/23/08	Warm River, CTNF	Research	On site	IGBST
400	Male	Adult	08/23/08	Porcupine Creek, CTNF	Research	On site	IGBST
563	Male	Adult	08/24/08	Warm River, CTNF	Research	On site	IGBST
595	Male	Subadult	08/24/08	Bootjack Creek, CTNF	Research	On site	IGBST
279	Female	Adult	08/28/08	Sheridan Creek, SNF	Management	N Fork Shoshone R., SNF	WYGF
G130	Male	Subadult	09/12/08	Bennett Creek, Pr-WY	Management	Fox Creek, SNF	WYGF
G131	Male	Subadult	09/12/08	Bennett Creek, Pr-WY	Management	Fox Creek, SNF	WYGF
G132	Male	Subadult	09/12/08	Bennett Creek, Pr-WY	Management	Fox Creek, SNF	WYGF
596	Female	Adult	09/14/08	Bennett Creek, Pr-WY	Management	Mormon Creek, SNF	WYGF
363	Male	Adult	09/25/08	Monument Bay, YNP	Research	On site	IGBST
			10/19/08	Monument Bay, YNP	Research	On site	IGBST
597	Female	Subadult	09/26/08	Yellowstone River, Pr-MT	Management	Charcoal Bay, YNP	MTFWP
598	Male	Subadult	09/26/08	Yellowstone River, Pr-MT	Management	Charcoal Bay, YNP	MTFWP
458	Female	Adult	10/01/08	Buffalo Fork, Pr-WY	Management	Mormon Creek, SNF	WYGF
G133	Male	Subadult	10/01/08	Buffalo Fork, Pr-WY	Management	Mormon Creek, SNF	WYGF
			10/21/08	Clark Fork River, Pr-WY	Management	Mormon Creek, SNF	WYGF

Table 1. Continued.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site	Agency[b]
G134	Male	Subadult	10/01/08	Buffalo Fork, Pr-WY	Management	Mormon Creek, SNF	WYGF
			10/06/08	Sunlight Creek, Pr-WY	Management	On site	WYGF
			10/22/08	Clark Fork River, Pr-WY	Management	Mormon Creek, SNF	WYGF
443	Male	Adult	10/03/08	Coyote Creek, YNP	Research	On site	IGBST
567	Male	Adult	10/04/08	Monument Bay, YNP	Research	On site	IGBST
204	Male	Adult	10/07/08	Monument Bay, YNP	Research	On site	IGBST
			10/16/08	Alluvium Creek, YNP	Research	On site	IGBST
			10/19/08	Cub Creek, YNP	Research	On site	IGBST
450	Male	Adult	10/16/08	Crevice Creek, Pr-MT	Management	Arnica Creek, YNP	MTFWP
574	Male	Adult	10/16/08	Monument Bay, YNP	Research	On site	IGBST
599	Male	Adult	10/17/08	Pacific Creek, BTNF	Management	Mormon Creek, SNF	WYGF
520	Male	Adult	10/19/08	Antelope Creek, YNP	Research	On site	IGBST
			10/20/08	Antelope Creek, YNP	Research	On site	IGBST
211	Male	Adult	10/21/08	Antelope Creek, YNP	Research	On site	IGBST
600	Male	Subadult	10/22/08	Stephens Creek, YNP	Management	Arnica Creek, YNP	MTFWP/YNP
601	Female	Subadult	10/22/08	Stephens Creek, YNP	Management	Arnica Creek, YNP	MTFWP/YNP
602	Female	Subadult	10/22/08	Stephens Creek, YNP	Management	Arnica Creek, YNP	MTFWP/YNP
265[c]	Female	Adult	10/22/08	Stephens Creek, YNP	Management	Removed	MTFWP/YNP
514	Male	Adult	10/27/08	Pacific Creek, BTNF	Management	Mormon Creek, SNF	WYGF

[a] BDNF = Beaverhead-Deerlodge National Forest, BTNF = Bridger-Teton National Forest, CTNF = Caribou-Targhee National Forest, GNF = Gallatin National Forest, SNF = Shoshone National Forest, YNP = Yellowstone National Park, Pr = private.
[b] IGBST = Interagency Grizzly Bear Study Team, USGS; MTFWP = Montana Fish, Wildlife and Parks; WYGF = Wyoming Game and Fish; YNP = Yelowstone National Park.
[c] Conflict occurred along Yellowstone River at private residence. Capture operation by MTFWP was conducted at remote location in YNP due to human safety concerns.

Remote camera photo of Bear #588 at trap site in Standard Creek, Beaverhead-Deerlodge National Forest, 29 Jun 2008. Bear #588 was the first research capture of a grizzly bear in the Gravellys.

Table 2. Annual record of grizzly bears monitored, captured, and transported in the Greater Yellowstone Ecosystem since 1980.

Year	Number monitored	Individuals trapped	Total captures		
			Research	Management	Transports
1980	34	28	32	0	0
1981	43	36	30	35	31
1982	46	30	27	25	17
1983	26	14	0	18	13
1984	35	33	20	22	16
1985	21	4	0	5	2
1986	29	36	19	31	19
1987	30	21	15	10	8
1988	46	36	23	21	15
1989	40	15	14	3	3
1990	35	15	4	13	9
1991	42	27	28	3	4
1992	41	16	15	1	0
1993	43	21	13	8	6
1994	60	43	23	31	28
1995	71	39	26	28	22
1996	76	36	25	15	10
1997	70	24	20	8	6
1998	58	35	32	8	5
1999	65	42	31	16	13
2000	84	54	38	27	12
2001	82	63	41	32	15
2002	81	54	50	22	15
2003	80	44	40	14	11
2004	78	58	38	29	20
2005	91	63	47	27	20
2006	92	54	36	25	23
2007	86	65	54	19	8
2008	87	66	39	40	30

Table 3. Grizzly bears radio monitored in the Greater Yellowstone Ecosystem during 2008.

Bear	Sex	Age	Offspring[a]	Monitored		Current Status
				Out of den	Into den	
149	F	Adult	None	No	No	Dead
179	F	Adult	2 COY	Yes	Yes	Active
204	M	Adult		Yes	Yes	Active
205	F	Adult	1 2-year-old	Yes	Yes	Active
211	M	Adult		No	Yes	Active
246	F	Adult	3 yearlings	Yes	Yes	Active
279	F	Adult	None	No	Yes	Active
289	F	Adult	2 COY, lost 1	Yes	Yes	Active
295	F	Adult	3 COY	Yes	Yes	Active
302	M	Adult		No	Yes	Active
360	F	Adult	None	No	Yes	Active
363	M	Adult		No	Yes	Active
373	M	Adult		Yes	Yes	Active
379	M	Adult		Yes	Yes	Active
400	M	Adult		No	Yes	Active
407	M	Adult		Yes	No	Cast
428	F	Adult	Not seen	Yes	No	Failed battery
434	M	Adult		No	No	Cast
439	F	Adult	2 COY	Yes	No	Cast
443	M	Adult		No	Yes	Active
448	F	Adult	None	No	Yes	Active
450	M	Adult		No	Yes	Active
458	F	Adult	2 yearlings	No	No	Removed
459	M	Adult		Yes	No	Cast
472	F	Adult	1 2-year-old	Yes	No	Cast
487	M	Adult		No	No	Cast
489	F	Adult	3 yearlings	Yes	No	Cast
492	F	Subadult		Yes	Yes	Active
497	F	Adult	None	No	No	Cast
499	F	Adult	None	Yes	Yes	Active
500	F	Adult	2 COY	Yes	Yes	Active
503	F	Adult	Not seen	Yes	No	Cast
514	M	Adult		No	Yes	Active
520	M	Adult		No	Yes	Active
525	F	Adult	2 yearlings, both killed	No	Yes	Active
526	M	Subadult		Yes	No	Cast
529	M	Subadult		Yes	No	Cast
530	F	Adult	Not seen	Yes	No	Cast

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored: Out of den	Monitored: Into den	Current Status
531	F	Adult	None	Yes	Yes	Active
532	M	Adult		Yes	Yes	Active
533	F	Adult	3 3-year-olds	Yes	Yes	Active
537	F	Adult	None	Yes	Yes	Active
541	F	Adult	None	Yes	Yes	Active
547	M	Adult		Yes	No	Cast
550	M	Adult		Yes	No	Cast
551	F	Adult	Not seen	Yes	Yes	Active
554	F	Subadult		Yes	Yes	Active
556	M	Adult		Yes	Yes	Active
559	F	Adult	1 2-year-old	Yes	No	Cast
560	F	Subadult		Yes	No	Unresolved
561	F	Subadult		Yes	No	Dead
562	M	Adult		Yes	No	Dead
563	M	Adult		Yes	No	Dead
565	M	Subadult		Yes	Yes	Active
566	M	Subadult		Yes	No	Cast
567	M	Adult		Yes	Yes	Active
569	F	Adult	Not seen	Yes	Yes	Active
570	M	Adult		Yes	No	Cast
573	M	Adult		Yes	No	Cast
574	M	Adult		Yes	Yes	Active
576	F	Adult	None	Yes	Yes	Active
577	F	Adult	None	Yes	Yes	Active
578	M	Subadult		Yes	No	Cast

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored: Out of den	Monitored: Into den	Current Status
579	M	Subadult		No	No	Cast
580	M	Adult		No	No	Missing
581	M	Adult		No	Yes	Active
582	M	Subadult		No	No	Removed
583	M	Subadult		No	No	Dead
584	M	Subadult		No	Yes	Active
585	M	Adult		No	No	Dead
586	M	Subadult		No	No	Cast
587	M	Subadult		No	No	Cast
588	M	Subadult		No	Yes	Active
589	M	Adult		No	Yes	Active
590	F	Subadult		No	Yes	Active
591	F	Subadult		No	Yes	Active
592	M	Adult		No	Yes	Active
593	M	Subadult		No	Yes	Active
594	M	Subadult		No	Yes	Active
595	M	Subadult		No	No	Dead
596	F	Adult	3 yearlings	No	Yes	Active
597	F	Yearling		No	No	Missing
598	M	Yearling		No	No	Dead
599	M	Adult		No	Yes	Active
600	M	Yearling		No	Yes	Active
601	F	Yearling		No	Yes	Active
602	F	Yearling		No	Yes	Active

[a] COY = cub-of-the-year.

Assessing Trend and Estimating Population Size from Counts of Unduplicated Females *(Mark A. Haroldson, Interagency Grizzly Bear Study Team)*

Methods

Grizzly bears in the GYE were removed from protection under the Endangered Species Act (ESA 1975) as of 30 April 2007 (USFWS 2007*a*). Under the Revised Demographic Recovery Criteria (USFWS 2007*b*) and the demographic monitoring section of the Final Conservation Strategy for Grizzly Bear in the Greater Yellowstone Area (USFWS 2007*c*), IGBST is tasked with estimating the number of female with COY, determining trend in this segment of the population, and estimating size of specific population segments to assess sustainability of annual mortalities. Specific procedures used to accomplish these tasks are presented in IGBST (2005, 2006) and Harris et al. (2007). Briefly, the Knight et al. (1995) rule set is used to estimate the number of unique females with COY ($\hat{N}_{Obs}$) and tabulate sighting frequencies for each family. We then apply the Chao2 estimator (Chao 1989, Wilson and Collins 1992, Keating et al. 2002, Cherry et al. 2007)

$$\hat{N}_{Chao2} = m + \frac{f_1^2 - f_1}{2(f_2 - 1)},$$

where m is the number of unique females sighted randomly (i.e., without the aid of telemetry), f_1 is the number of families sighted once, and f_2 is the number families sighted twice. This estimator accounts for individual sighting heterogeneity and produces an estimate for the total number of female with COY present in the population annually.

Next, we estimate trend and rate of change (λ) for the number of unique females with COY in the population from the natural log (Ln) of the annual $\hat{N}_{Chao2}$ estimates using linear and quadratic regressions with model averaging (Burnham and Anderson 2002). The linear model for $Ln(\hat{N}_{Chao2})$ with year (y_i) is:

$$Ln(\hat{N}_{Chao2}) = \beta_0 + \beta_1 y_i + \varepsilon_i .$$

Thus the population size at time zero is estimated as $\hat{N}_0 = \exp(\hat{\beta}_0)$ and the rate of population change is estimated as $\hat{\lambda} = \exp(\hat{\beta}_1)$, giving $\hat{N}_i = \hat{N}_0 \hat{\lambda}^{y_i}$. The quadratic model:

$$Ln(\hat{N}_{Chao2}) = \beta_0 + \beta_1 y_i + \beta_2 y_i^2 + \varepsilon_i ,$$

is included to detect changes in tend. Model AIC (Akaike Information Criterion) will favor the quadratic model if the rate of change levels off or begins to decline (IGBST 2006, Harris et al. 2007). This process smoothes variation in annual estimates that result from sampling error or pulses in numbers of females producing cubs due to natural processes (i.e., process variation). Some changes in previous model-averaged estimates for unduplicated females with COY ($\hat{N}_{MAFC}$) are expected with each additional year of data. Retrospective adjustments to previous estimates are not done (IGBST 2006). Demographic Recovery Criterion 1 (USFWS 2007*b*) specifies a minimum requirement of 48 females with COY for the current year ($\hat{N}_{MAFC}$). Model-averaged estimates below 48 for 2 consecutive years will trigger a biology and management review, as will a shift in AIC that favors the quadratic model (i.e., AICc weight > 0.50, USFWS 2007*a*).

Given the assumption of a reasonably stable sex and age structure, trend for the females with COY represents the rate of change for the entire population (IGBST 2006, Harris et al. 2007). It follows that estimates for specific population segments can be derived from the $\hat{N}_{MAFC}$ and the estimated stable age structure for the population. Estimates for specific population segments and associated confidence intervals follow IGBST (2005, 2006). Thus, the total number of females ≥2 years old in the population is estimated by

$$\hat{N}_{females\ 2+} = \frac{\hat{N}_{MAFC}}{(0.289 * 0.77699)},$$

where 0.289 is the proportion of females ≥4 years old accompanied by COY from transition probabilities (IGBST 2005), and 0.77699 is the ratio of 4+ female to 2+ females in the population (IGBST 2006). Using the model averaged results in these calculations has the effect of putting the numerator ($\hat{N}_{MAFC}$) on the same temporal scale as the denominator (i.e., mean transition probability and ratio) which smoothes

estimates and alleviates extreme variation which are likely uncharacteristic of the true population (IGBST 2006, Harris et al. 2007). The number of independent aged males is given by

$$\hat{N}_{males\ 2+} = \frac{\hat{N}_{females\ 2+}}{(0.63513)},$$

where 0.63513 is the ratio of independent males:independent females (IGBST 2006). The number of dependent young is estimated by

$$\hat{N}_{dependent\ \ young} = \{\hat{N}_{MAFC,t} + [(\hat{N}_{MAFC,t-1})(0.638)]\}2.04$$

where 2.04 is the mean number of COY/litter (Schwartz et al. 2006*a*) and 0.638 is the mean survival rate for COY (Schwartz et al. 2006*b*). Estimates of uncertainty associated with parameters of interest were derived from the delta method (Seber 1982:7) as described in IGBST (2006).

Results

We documented 118 verified sightings of females with COY during 2008 (Fig. 1). This was a 65% decrease from the number of sightings obtained in 2007 (n = 335). Most (43%) sightings were obtained during observation flights (Table 4). Thirty-one percent of the observations occurred within the boundary of Yellowstone National Park. From the 118 sightings we were able to differentiate 44 unduplicated females using the rule set described by Knight et al. (1995). Total number of COY observed during initial sightings was 84 and mean litter size was 1.91 (Table 5). There were 10 single cub litters, 28 litters of twins, and 6 litters of triplets seen during initial observations (Table 5).

Forty-three families and 102 observations were obtained without telemetry (Table 6). Using these data and associated sighting frequencies $\hat{N}_{Chao2}$ = 53 (Table 6). Annual $\hat{N}_{Chao2}$ estimates for the period 1983–2008 (Table 6) were used to estimate the rate of population change (Fig. 2). Parameter estimates and AICc weights for the linear and quadratic models (Table 7) suggest that only the linear model is needed to model changes in the unduplicated female population for the period. The estimate of $\hat{\lambda}$ = 1.04513 with 95% confidence interval 1.03201 to 1.05841. The estimated quadratic effect (-0.00074, SE = 0.00092) was not significant (P = 0.427), with 74% of the AICc weight associated with the linear model. Therefore, the linear model is the best approximating model for the data. The $\hat{N}_{MAFC}$ = 56 (95% CI 46–68) for 2008. The model averaged point estimate exceeds the demographic objective of 48 specified in the demographic criteria for the GYE (USFWS 2007*a*, 2007*b*). Additionally, AICc weight continues to support the linear model (USFWS 2007*b*), indicating an increasing trend. Using $\hat{N}_{MAFC}$ = 56, the estimated population size for 2008 is 596 (Table 8).

Table 4. Method of observation for female grizzly bears with cubs-of-the-year sighted in the Greater Yellowstone Ecosystem during 2008.

Method of observation	Frequency	Percent	Cumulative percent
Fixed wing – other researcher	6	5.1	5.1
Fixed wing – observation	51	43.2	48.3
Fixed wing - telemetry	19	16.1	64.4
Ground sighting	42	35.6	35.6
Helicopter – other research	0	0	100.0
Trap	0	0	100.0
Total	118	100	

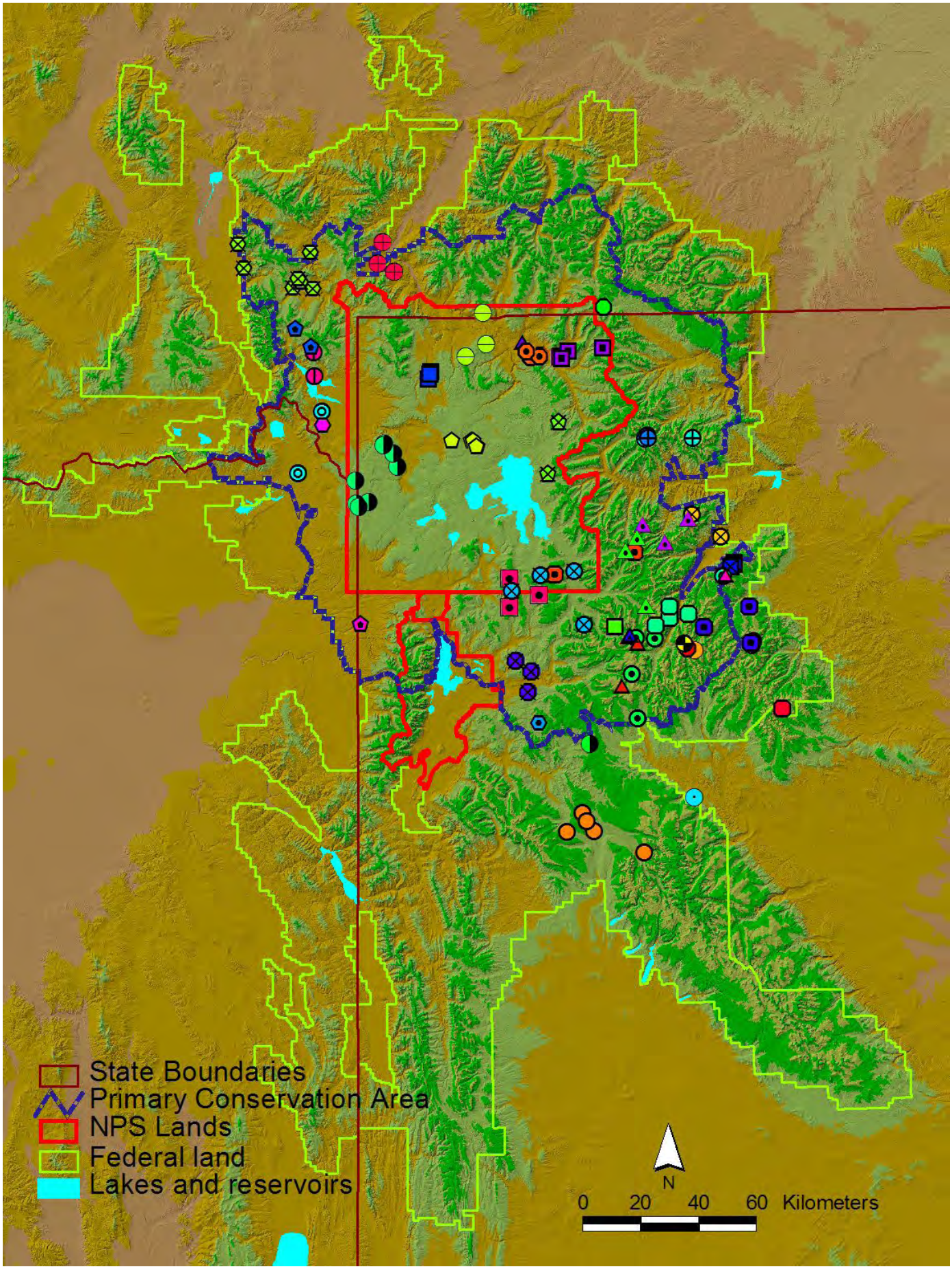

Fig. 1. Distribution of 118 observations of 44 (indicated by unique symbols) unduplicated female grizzly bears with cubs-of-the-year in the Greater Yellowstone Ecosystem during 2008.

Table 5. Number of unduplicated females with cubs-of-the-year ($\hat{N}_{Obs}$), litter frequencies, total number of cub, and average litter size at initial observation for the years 1973–2008 in the Greater Yellowstone Ecosystem.

Year	$\hat{N}_{Obs}$	Total sightings	Litter sizes: 1 cub	2 cubs	3 cubs	4 cubs	Total # cubs	Mean litter size
1973	14	14	4	8	2	0	26	1.86
1974	15	15	6	7	2	0	26	1.73
1975	4	9	2	2	0	0	6	1.50
1976	17	26	3	13	1	0	32	1.88
1977	13	19	3	8	2	0	25	1.92
1978	9	11	2	4	3	0	19	2.11
1979	13	14	2	6	5	0	29	2.23
1980	12	17	2	9	1	0	23	1.92
1981	13	22	4	7	2	0	24	1.85
1982	11	18	3	7	1	0	20	1.82
1983	13	15	6	5	2	0	22	1.69
1984	17	41	5	10	2	0	31	1.82
1985	9	17	3	5	1	0	16	1.78
1986	25	85	6	15	4	0	48	1.92
1987	13	21	1	8	4	0	29	2.23
1988	19	39	1	14	4	0	41	2.16
1989	16	33	7	5	4	0	29	1.81
1990	25	53	4	10	10	1	58	2.32
1991[a]	24	62	6	14	3	0	43	1.87
1992	25	39	2	12	10	1	60	2.40
1993	20	32	4	11	5	0	41	2.05
1994	20	34	1	11	8	0	47	2.35
1995	17	25	2	10	5	0	37	2.18
1996	33	56	6	15	12	0	72	2.18
1997	31	80	5	21	5	0	62	2.00
1998	35	86	9	17	9	0	70	2.00
1999	33	108	11	14	8	0	63	1.91
2000	37	100	9	21	7	0	72	1.95
2001	42	105	13	22	7	0	78	1.86
2002	52	153	14	26	12	0	102	1.96
2003	38	60	6	27	5	0	75	1.97
2004	49	223	14	23	12	0	96	1.96
2005	31	93	11	14	6	0	57	1.84
2006	47	172	12	21	14	0	96	2.04
2007	50	335	10	22	18	0	108	2.16
2008	44	118	10	28	6	0	84	1.91

[a] One female with unknown number of cubs. Average litter size was calculated using 23 females.

Table 6. Annual estimates for the numbers of females with cubs-of-the-year in the Greater Yellowstone Ecosystem grizzly bear population, 1983–2008. The number of unique females observed ($\hat{N}_{Obs}$) includes those located using radio-telemetry; *m* gives the number of unique females observed using random sightings only; and $\hat{N}_{Chao2}$ gives the nonparametric biased corrected estimate, per Chao (1989). Also included are f_1, the number of families sighted once, f_2, the number of families sighted twice, and an annual estimate of relative sample size ($n / \hat{N}_{Chao2}$), where *n* is the total number of observations obtained without the aid of telemetry.

Year	$\hat{N}_{Obs}$	m	f_1	f_2	$\hat{N}_{Chao2}$	n	$n / \hat{N}_{Chao2}$
1983	13	10	8	2	19	12	0.6
1984	17	17	7	3	22	40	1.8
1985	9	8	5	0	18	17	0.9
1986	25	24	7	5	28	82	3
1987	13	12	7	3	17	20	1.2
1988	19	17	7	4	21	36	1.7
1989	16	14	7	5	18	28	1.6
1990	25	22	7	6	25	49	2
1991	24	24	11	3	38	62	1.6
1992	25	23	15	5	41	37	0.9
1993	20	18	8	8	21	30	1.4
1994	20	18	9	7	23	29	1.3
1995	17	17	13	2	43	25	0.6
1996	33	28	15	10	38	45	1.2
1997	31	29	13	7	39	65	1.7
1998	35	33	11	13	37	75	2
1999	33	30	9	5	36	96	2.7
2000	37	34	18	8	51	76	1.5
2001	42	39	16	12	48	84	1.7
2002	52	49	17	14	58	145	2.5
2003	38	35	19	14	46	54	1.2
2004	49	48	15	10	58	202	3.5
2005	31	29	6	8	31	86	2.8
2006	47	43	8	16	45	140	3.3
2007	50	48	12	12	53	275	5.1
2008	44	43	16	8	56	102	1.8

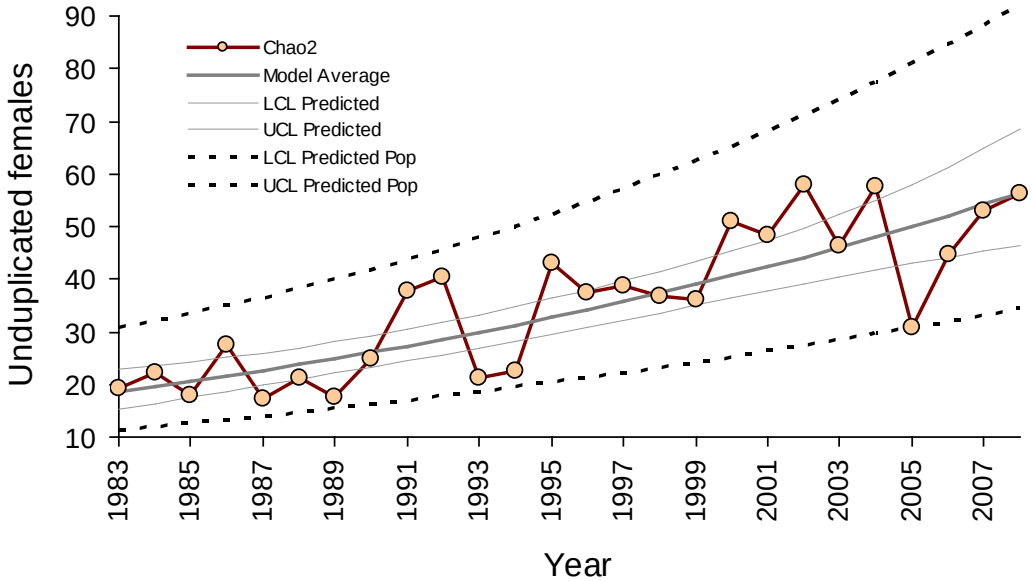

Fig. 2. Model-averaged estimates for the number of unduplicated female grizzly bears with cubs-of-the-year in the Greater Yellowstone Ecosystem for the period 1983–2008, where the linear and quadratic models of $Ln(\hat{N}_{Chao2})$ were fitted. The inner set of light solid lines represents a 95% confidence interval on the predicted population size for unduplicated female, whereas the outer set of dashed lines represents a 95% confidence interval for the individual population estimates for unduplicated females.

Table 7. Parameter estimates and model selection results from fitting the linear and quadratic models for $Ln(\hat{N}_{Chao2})$ with years for the period 1983–2008.

Model	Parameter	Estimate	Standard error	*t* value	Pr(>*t*)
Linear					
	β_0	2.90286	0.09450	30.71899	<0.0001
	β_1	0.04414	0.00611	7.21379	<0.0001
	SSE	1.31419			
	AICc	-70.51588			
	AICc weight	0.73933			
Quadratic					
	β_0	2.80904	0.15008	18.71745	<0.0001
	β_1	0.06425	0.02562	2.50805	0.01964
	β_2	-0.00074	0.00092	-0.80861	0.42702
	SSE	1.27786			
	AICc	-68.43085			
	AICc weight	0.26067			

Table 8. Estimates and 95% confidence intervals (CI) for population segments and total grizzly bear population size for 2008 in the Greater Yellowstone Ecosystem.

			95% CI	
	Estimate	Variance	Lower	Upper
Independent females	251	483.9	208	294
Independent males	159	349.5	123	196
Dependent young	185	107.5	165	206
Total	596	940.9	535	656

Bear #295 and her 3 cubs-of-the-year, 25 Jun 2008. Photo courtesy of Steve Ard.

Occupancy of Bear Management Units by Females with Young *(Shannon Podruzny, Interagency Grizzly Bear Study Team)*

Dispersion of reproductive females throughout the ecosystem is assessed by verified observation of female grizzly bears with young (COY, yearlings, 2-year-olds, and/or young of unknown age) by BMU. The requirements specified in the Conservation Strategy (USFWS 2007*c*) and the Revised Demographic Recovery Criteria (USFWS 2007*b*) state that 16 of the 18 BMUs must be occupied by young on a running 6-year sum with no 2 adjacent BMUs unoccupied. Eighteen of 18 BMUs had verified observations of female grizzly bears with young during 2008 (Table 9). Eighteen of 18 BMUs contained verified observations of females with young in at least 4 years of the last 6-year (2003–2008) period.

Table 9. Bear Management Units in the Greater Yellowstone Ecosystem occupied by females with young (cubs-of-the-year, yearlings, 2-year-olds, or young of unknown age), as determined by verified reports, 2003–2008.

Bear Management Unit	2003	2004	2005	2006	2007	2008	Years occupied
1) Hilgard	X	X	X	X	X	X	6
2) Gallatin	X	X	X	X	X	X	6
3) Hellroaring/Bear	X		X	X		X	4
4) Boulder/Slough	X	X	X		X	X	5
5) Lamar	X	X	X	X	X	X	6
6) Crandall/Sunlight	X	X	X	X	X	X	6
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	X	6
10) Firehole/Hayden	X	X	X	X	X	X	6
11) Madison			X	X	X	X	4
12) Henry's Lake		X	X	X	X	X	5
13) Plateau	X	X	X		X	X	5
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	X	6
Totals	16	16	18	16	17	18	

Observation Flights *(Karrie West, Interagency Grizzly Bear Study Team)*

Two rounds of observation flights were conducted during 2008. Forty-six Bear Observation Areas (BOAs; Fig. 3) were surveyed during Round 1 (12 Jun–26 Jul); 45 BOAs were flown during Round 2 (1 Jul–23 Aug). Observation time was 98 hours for Round 1 and 102 hours for Round 2; average duration of flights for both rounds combined was 2.2 hours (Table 10). Three hundred sixty-nine bear sightings, excluding dependent young, were recorded during observation flights. This included 8 radio-marked bears (4 solitary bears, a female with 1 COY seen during both rounds, a female with 3 COY, and a female with 1 2-year-old), 272 solitary unmarked bears, and 89 unmarked females with young (Table 10). Observation rate was 1.85 bears/hour for all bears. One hundred fifty-eight young (83 COY, 58 yearlings, and 17 2-year-olds) were observed (Table 11). Observation rates were 0.47 females with young/hour and 0.23 females with COY/hour (Table 11).

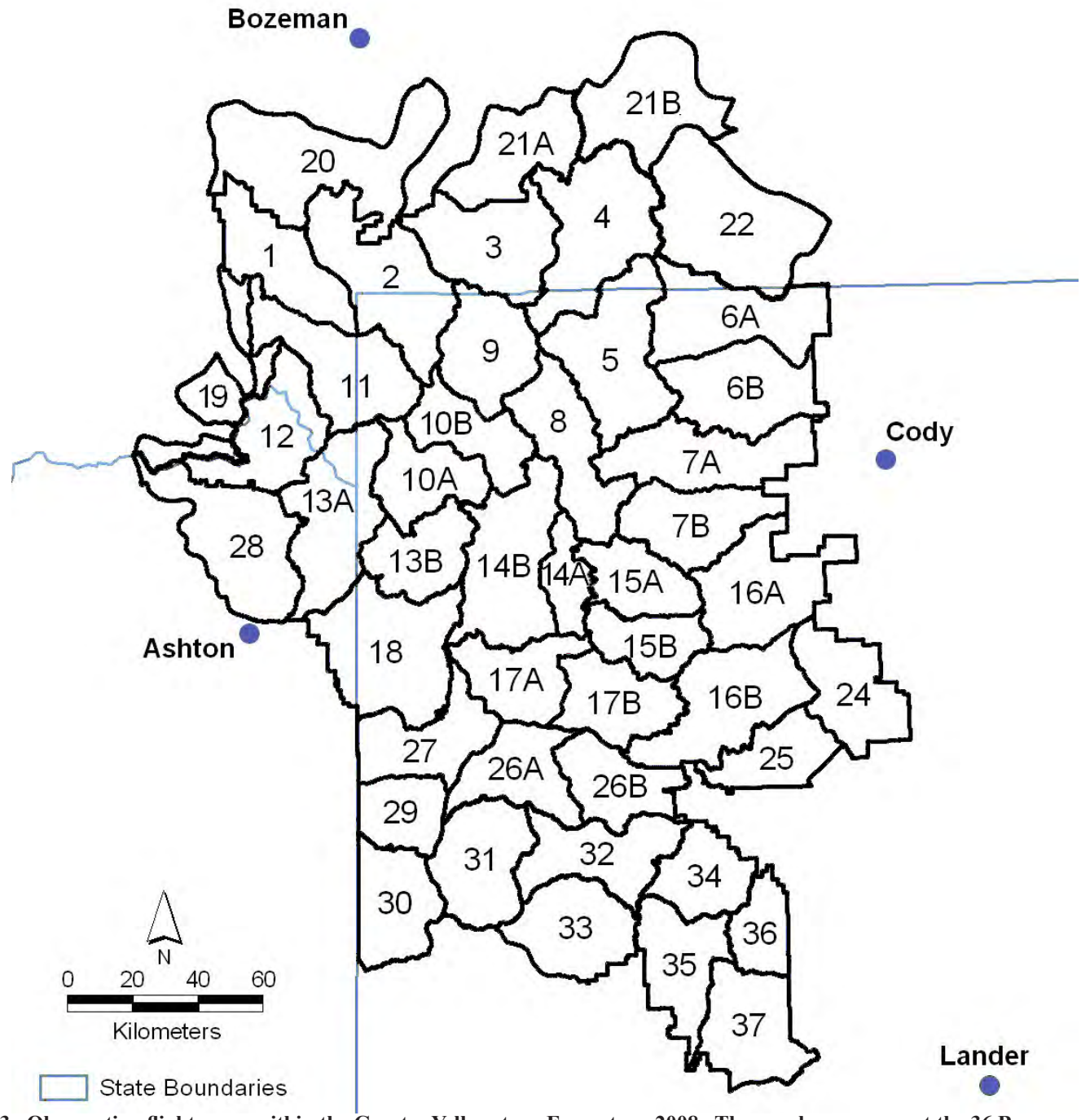

Fig. 3. Observation flight areas within the Greater Yellowstone Ecosystem, 2008. The numbers represent the 36 Bear Observation Areas. Those units too large to search during a single flight were further subdivided into 2 units. Consequently, there were 46 search areas.

Table 10. Annual summary statistics for observation flights conducted in the Greater Yellowstone Ecosystem, 1997–2008.

Date	Observation period	Total hours	Number of flights	Average hours/ flight	Bears seen: Marked: Lone	Bears seen: Marked: With young	Bears seen: Unmarked: Lone	Bears seen: Unmarked: With young	Bears seen: Total number of groups	Observation rate (bears/hour): All groups	Observation rate (bears/hour): With young	Observation rate (bears/hour): With COY[a]
1997[b]	Round 1	55.5	26	2.1	1	1	38	19	59	1.08		
	Round 2	59.3	24	2.5	1	1	30	17	49	0.83		
	Total	114.8	50	2.3	2	2	68	36	108	0.94	0.33	0.16
1998[b]	Round 1	73.6	37	2.0	1	2	54	26	83	1.13		
	Round 2	75.4	37	2.0	2	0	68	18	88	1.17		
	Total	149.0	74	2.0	3	2	122	44	171	1.15	0.31	0.19
1999[b]	Round 1	79.7	37	2.2	0	0	13	8	21	0.26		
	Round 2	74.1	37	2.0	0	1	21	8	30	0.39		
	Total	153.8	74	2.1	0	1	34	16	51	0.33	0.11	0.05
2000[b]	Round 1	48.7	23	2.1	0	0	8	2	10	0.21		
	Round 2	83.6	36	2.3	3	0	51	20	74	0.89		
	Total	132.3	59	2.2	3	0	59	22	84	0.63	0.17	0.12
2001[b]	Round 1	72.3	32	2.3	0	0	37	12	49	0.68		
	Round 2	72.4	32	2.3	2	4	85	29	120	1.66		
	Total	144.7	64	2.3	2	4	122	41	169	1.17	0.31	0.25
2002[b]	Round 1	84.0	36	2.3	3	0	88	34	125	1.49		
	Round 2	79.3	35	2.3	6	0	117	46	169	2.13		
	Total	163.3	71	2.3	9	0	205	80	294	1.80	0.49	0.40
2003[b]	Round 1	78.2	36	2.2	2	0	75	32	109	1.39		
	Round 2	75.8	36	2.1	1	1	72	19	93	1.23		
	Total	154.0	72	2.1	3	1	147	51	202	1.31	0.34	0.17
2004[b]	Round 1	84.1	37	2.3	0	0	43	12	55	0.65		
	Round 2	76.6	37	2.1	1	2	94	38	135	1.76		
	Total	160.8	74	2.2	1	2	137	50	190	1.18	0.32	0.23
2005[b]	Round 1	86.3	37	2.3	1	0	70	20	91	1.05		
	Round 2	86.2	37	2.3	0	0	72	28	100	1.16		
	Total	172.5	74	2.3	1	0	142	48	191	1.11	0.28	0.13
2006[b]	Round 1	89.3	37	2.4	2	1	106	35	144	1.61		
	Round 2	77.0	33	2.3	3	1	76	24	104	1.35		
	Total	166.3	70	2.3	5	2	182	59	248	1.49	0.37	0.27
2007[b]	Round 1	99.0	44	2.3	2	1	125	53	181	1.83		
	Round 2	75.1	30	2.5	0	4	96	20	120	1.60		
	Total	174.1	74	2.4	2	5	221	73	301	1.73	0.45	0.29
2008[b]	Round 1	97.6	46	2.1	2	1	87	36	126	1.29		
	Round 2	101.5	45	2.3	2	3	185	53	243	2.39		
	Total	199.1	91	2.2	4	4	272	89	369	1.85	0.47	0.23

[a] COY = cub-of-the-year.

[b] Dates of flights (Round 1, Round 2): 1997 (24 Jul–17 Aug, 25 Aug–13 Sep); 1998 (15 Jul–6 Aug, 3–27 Aug); 1999 (7–28 Jun, 8 Jul–4 Aug); 2000 (5–26 Jun, 17 Jul–4 Aug); 2001 (19 Jun–11 Jul, 16 Jul–5 Aug); 2002 (12 Jun–22 Jul, 13 Jul–28 Aug); 2003 (12 Jun–28 Jul, 11 Jul–13 Sep); 2004 (12 Jun–26 Jul, 3 Jul–28 Aug); 2005 (4 Jun–26 Jul, 1 Jul–31 Aug); 2006 (5 Jun–9 Aug, 30 Jun–28 Aug); 2007 (24 May–2 Aug, 21 Jun–14 Aug); 2008 (12 Jun–26Jul, 1 Jul–23 Aug).

Table 11. Size and age composition of family groups seen during observation flights in the Greater Yellowstone Ecosystem, 1998–2008.

	Females with cubs-of-the-year (number of cubs)			Females with yearlings (number of yearlings)			Females with 2-year-olds or young of unknown age (number of young)		
Date	1	2	3	1	2	3	1	2	3
1998[a]									
Round 1	4	10	4	0	4	2	1	2	1
Round 2	0	7	3	2	4	1	0	1	0
Total	4	17	7	2	8	3	1	3	1
1999[a]									
Round 1	2	1	1	0	1	2	1	0	0
Round 2	2	2	0	0	3	1	0	1	0
Total	4	3	1	0	4	3	1	1	0
2000[a]									
Round 1	1	0	0	0	0	0	0	1	0
Round 2	3	11	1	1	2	0	0	2	0
Total	4	11	1	1	2	0	0	3	0
2001[a]									
Round 1	1	8	1	1	0	0	0	0	1
Round 2	14	10	2	4	2	1	0	0	0
Total	15	18	3	5	2	1	0	0	1
2002[a]									
Round 1	8	15	5	3	2	0	0	0	1
Round 2	9	19	9	2	4	2	0	1	0
Total	17	34	14	5	6	2	0	1	1
2003[a]									
Round 1	2	12	2	2	6	2	3	3	0
Round 2	2	5	3	2	5	0	2	0	1
Total	4	17	5	4	11	2	5	3	1
2004[a]									
Round 1	4	1	3	1	1	0	2	0	0
Round 2	6	16	7	4	7	0	0	0	0
Total	10	17	10	5	8	0	2	0	0
2005[a]									
Round 1	5	5	3	2	3	1	0	1	0
Round 2	4	4	1	3	6	3	5	2	0
Total	9	9	4	5	9	4	5	3	0
2006[a]									
Round 1	8	12	7	4	2	2	1	0	0
Round 2	5	11	2	2	1	0	2	2	0
Total	13	23	9	6	3	2	3	2	0
2007[a]									
Round 1	7	21	9	8	6	0	2	1	0
Round 2	2	6	6	3	2	3	0	2	0
Total	9	27	15	11	8	3	2	3	0
2008[a]									
Round 1	3	10	0	9	5	2[b]	6	2	0
Round 2	9	21	3	7	8	3	3	2	0
Total	12	31	3	16	13	5	9	4	0

[a] Dates of flights (Round 1, Round 2): 1998 (15 Jul–6 Aug, 3–27 Aug); 1999 (7–28 Jun, 8 Jul–4 Aug); 2000 (5–26 Jun, 17 Jul–4 Aug); 2001 (19 Jun–11 Jul, 16 Jul–5 Aug); 2002 (12 Jun–22 Jul, 13 Jul–28 Aug); 2003 (12 Jun–28 Jul, 11 Jul–13 Sep); 2004 (12 Jun–26 Jul, 3 Jul–28 Aug); 2005 (4 Jun–26 Jul, 1 Jul–31 Aug); 2006 (5 Jun–9 Aug, 30 Jun–28 Aug); 2007 (24 May–2 Aug, 21 Jun–14 Aug); 2008 (12 Jun–26Jul, 1 Jul–23 Aug).
[b] Includes 1 female with 4 yearlings.

Telemetry Relocation Flights *(Karrie West, Interagency Grizzly Bear Study Team)*

One hundred thirteen telemetry relocation flights were conducted during 2008, resulting in 370.7 hours of search time (ferry time to and from airports excluded) (Table 12). Flights were conducted at least once during all months, with 84% occurring May–November. During telemetry flights, 942 locations of bears equipped with radio transmitters were collected, 120 (13%) of which included a visual sighting. Thirty-one sightings of unmarked bears were also obtained during telemetry flights, including 26 solitary bears, 2 females with COY, 1 female with yearlings, and 2 females with 2-year-olds. Rate of observation for all unmarked bears during telemetry flights was 0.08 bears/hour. Rate of observing females with COY was 0.005/hour, which was considerably less than during observation flights (0.23/hour) in 2008.

Bear #575 on an elk carcass, 11 Aug 2008. Photo courtesy of Steve Ard.

Table 12. Summary statistics for radio-telemetry relocation flights in the Greater Yellowstone Ecosystem, 2008.

				Radioed bears			Unmarked bears observed					
								Females			Observation rate (groups/hour)	
Month	Hours	Number of flights	Mean hours per flight	Number of locations	Number seen	Observation rate (groups/hr)	Lone bears	With COY[a]	With yearlings	With young	All groups	Females with COY
January	6.04	2	3.02	28	0	0.00	0	0	0	0	---	---
February	13.42	4	3.36	35	0	0.00	0	0	0	0	---	---
March	24.94	6	4.16	81	1	0.04	3	0	0	0	0.12	0.000
April	10.95	4	2.74	36	2	0.18	0	0	0	0	---	---
May	66.87	16	4.18	151	42	0.63	8	0	0	0	0.12	0.000
June	39.57	14	2.83	78	14	0.35	3	0	0	0	0.08	0.000
July	35.71	13	2.75	92	22	0.62	4	2	0	1	0.20	0.056
August	40.80	14	2.91	95	16	0.39	5	0	1	1	0.17	0.000
September	38.15	12	3.18	97	9	0.24	1	0	0	0	0.03	0.000
October	48.32	14	3.45	132	10	0.21	1	0	0	0	0.02	0.000
November	39.98	12	3.33	95	4	0.10	1	0	0	0	0.02	0.000
December	5.90	2	2.95	22	0	0.00	0	0	0	0	---	---
Total	370.65	113	3.28	942	120	0.32	26	2	1	2	0.08	0.005

[a] COY = cub-of-the-year.

Estimating sustainability of annual grizzly bear mortalities *(Mark A. Haroldson, Interagency Grizzly Bear Study Team; and Kevin Frey, Montana Fish, Wildlife and Parks)*

Grizzly bears in the GYE were removed from protection under the Endangered Species Act (ESA 1975) as of 30 April 2007 (USFWS 2007*a*). Under the Revised Demographic Recovery Criteria (USFWS 2007*b*) and the demographic monitoring section of the Final Conservation Strategy for Grizzly Bear in the Greater Yellowstone Area (USFWS 2007*c*), IGBST is tasked with evaluating the sustainability of annual mortalities. Specific procedures used to accomplish these tasked are presented in IGBST (2005, 2006). Briefly, estimates for specific population segments are derived from the modeled-averaged annual Choa2 estimate for females with COY (see *Assessing trend and estimating population size from counts of unduplicated females*).

Sustainable mortality for independent aged (≥2 years) females is considered 9% of the estimated size for this segment of the population (IGBST 2005, 2006; USFWS 2007*b*). Thus, female mortalities are within sustainable limits if,

$$\hat{D}_F \leq \hat{N}_F * 0.09 ,$$

where, $\hat{N}_F$ is the estimated population size for independent aged females and $\hat{D}_F$ is the estimated total mortality for independent aged females. All sources of mortality are used to evaluate sustainability for independent aged bears, which included an estimate of the unreported loss (Cherry et al. 2002, IGBST 2005). Thus,

$$\hat{D}_F = A_F + R_F + \hat{B}_F , \quad (1)$$

where A_F is the number of sanctioned agency removals of independent females (including radio-marked individuals), R_F is the number of radio-marked bears lost (excluding sanctioned removals), and B_F is the median of the creditable interval for the estimated reported and unreported loss (Cherry et al. 2002). Exceeding independent female mortality limits for 2 consecutive years triggers a biology and management review (USFWS 2007*a*).

Sustainability for independent aged males is 15% of the estimated male population (IGBST 2005, 2006; USFWS 2007*b*). Male mortality is considered sustainable if,

$$\hat{D}_M \leq \hat{N}_M * 0.15 ,$$

where $\hat{N}_M$ is the estimated population size for independent aged males and $\hat{D}_M$ is the estimated total mortality for independent males obtained by,

$$\hat{D}_M = A_M + R_M + \hat{B}_M , \quad (2)$$

where A_M is the number of sanctioned agency removals of independent males (including radio-marked individuals), R_M is the number of radio-marked bears lost (excluding sanctioned removals), and B_M is the median of the creditable interval for the estimated reported and unreported loss (Cherry et al. 2002). Exceeding independent male mortality limits for 3 consecutive years triggers a biology and management review (USFWS 2007*a*).

Sustainability for dependent young (i.e., COY and yearlings) is set at 9% of the estimate for this population segment. Only human-caused deaths are assessed against this threshold (USFWS 2007*a*). Exceeding the dependent young mortality limit for 3 consecutive years triggers a biology and management review (USFWS 2007*a*).

We continue to use the definitions provided in Craighead et al. (1988) to classify grizzly bear mortalities in the GYE relative to the degree of certainty regarding each event. Those cases in which a carcass is physically inspected or when a management removal occurs are classified as "known" mortalities. Those instances where evidence strongly suggests a mortality has occurred but no carcass is recovered are classified as "probable." When evidence is circumstantial, with no prospect for additional information, a "possible" mortality is designated. Possible mortalities are excluded from assessments of sustainability. We continue to tabulate possible mortalities because at the least they provide an additional source of location information for grizzly bears in the GYE.

2008 Mortality Results

We documented 48 known and probable, and 4 possible mortalities in the GYE during 2008 (Table 13). We also documented 2 mortalities that evidence indicated occurred prior to 2008. The remains on an old adult male bear believed to have died from natural causes during the fall of 2007 were found during July in Trout Creek, YNP. The skull of a yearling bear found during the fall of 2006 by a park visitor was turned in to YNP officials. There was no indication as to the cause of death for this bear. The 4 possible mortalities were hunting related incidents. In 3 of these events bears were known to have been wounded but no substantive evidence developed that mortalities had occurred.

Of the 48 known and probable mortalities occurring during 2008, 37 were attributable to human causes (Table 13). Twenty (54%) of the human-caused losses were hunting related; including 5 mistaken identity kills by spring black bear (*Ursus americanus*) hunters and 8 self-defense kills, 4 of which were adult females. Three of the adult females were accompanied by 5 COY, which are considered probable losses. Other hunter related losses included 1 COY shot when its mother charged hunters (evidence indicated the female was not wounded), and 1 adult female killed when an outfitter attempted to haze the bear away from a backcountry camp (Table 1). The remaining human-caused losses were management removals (n = 10), malicious killings (n = 2), self-defense at residences (n = 2), handling related (n = 2), and a road kill (n = 1). We also documented 7 natural mortalities and 4 from undetermined causes (Table 13).

The 2 handling related deaths both occurred after research captures by IGBST personnel in Idaho. Both bears (males #563 and #595) were captured in culvert traps and handled on 24 August. In both instances standard protocols were followed and characteristics of the anesthesia, handling events, and recoveries were unremarkable. Bear #595 was found dead by a hunter on 31 August. Necropsy and subsequent laboratory analysis completed by the Wildlife Health Laboratory, Idaho Department of Fish and Game, attributed cause of death to a clostridial (*Clostridium* spp.) infection at the anesthesia injection site. A similar pathology was suspected but specific cause of death could not be confirmed for bear #563 because the carcass was not discovered until 4 September and the state of decomposition was advanced. Clostridial infections are known to cycle with weather and moisture conditions and incidents of complication from the bacteria were high in ruminates in the general vicinity of these captures during 2008 (P. Mamer, Idaho Department of Fish and Game, personal communication). As a result of these mortalities, handling protocols were reviewed and amended to included application of a prophylactic antibiotic that is affective for Clostridium.

Among known and probable losses for independent aged female bears there were 3 management removals, 1 death of radio-marked bear, and 10 other reported losses for a total of 14 (Table 14). We documented 7 management removals, 5 radio-marked losses, and 11 reported losses for independent aged males (Table 14). Human-caused losses of dependent young totaled 8 (Table 14). Using the criteria specified under the Revised Demographic Recovery Criteria (USFWS 2007*b*) and methodology presented by IGBST (2005, 2006), mortality thresholds for independent females and males were exceeded during 2008 (Table 14). This is the first year these thresholds have been exceeded. The mortality threshold for dependent young was not exceeded (Table 14).

An additional mortality occurred during 2008 that was not included in the list for 2008. Sometime during the fall (Oct–Nov) an instrumented yearling male was maliciously killed and dumped in Ashton Reservoir, Idaho. This individual was a COY during fall of 2007 when its mother was killed by a hunter north of Gardiner, Montana. This bear was considered a probable mortality during 2007 and as such was not included in 2008.

Table 13. Grizzly bear mortalities documented in the Greater Yellowstone Ecosystem during 2008.

Bear[a]	Sex	Age[b]	Date	Location[c]	Certainty	Cause
Unm	U	Yearling	Fall/2006	Bear Creek, YNP	Known	Undetermined cause. Remains (skull) of a yearling (by tooth eruption) found November 2006, and report to YNP on 9/30/2008.
Unm	M	Adult	Fall/2007	Trout Creek, YNP	Known	Natural, specific cause undetermined. Likely due to maladies associated with old age.
291	M	Adult	4/19/2008	E Fork Wind River, Pr-WY	Known	Human-caused, management removal of bear #291 for repeated property damage. Bear was not collared.
579	M	Subadult	4/21/2008	Boulder River, Pr-MT	Known	Human-caused, management removal (live to WSU) of bear #579 for repeated nuiscane activity, unnatural foods and property damage. Bear was not collared.
Unm	M	Adult	5/7/2008	North Fork Shoshone, SNF	Known	Human-caused, mistaken identity kill by black bear hunter.
Unm	M	Subadult	5/10/2008	Meadow Creek, GNF	Known	Human-caused, mistaken identity kill by black bear hunter.
G109	M	Adult	5/25/2008	Cliff Creek, BTNF	Known	Human-caused, bear #G109 mistaken identity kill by black bear hunter.
Unm	M	Adult	5/27/2008	Clark Fork River, SNF	Known	Human-caused, mistaken identity kill by black bear hunter.
Unm	M	Subadult	6/1/2008	Crooked Creek, Pr-WY	Known	Natural, parts of hide and skull found, hole in skull from bite indicates bear killed by wolf or bear. Mortality date is approximate. Samples collected, DNA determined male.
Unm	F	Subadult	6/1/2008	Yellowstone River, YNP	Known	Undetermined, remains of a carcass found in the Yellowstone River near confluence with Gardner River on 9/14. Sex determination from DNA was female. Date is approximate.
Unm	F	Yearling	6/9/2008	Middle Creek, YNP	Known	Natural, apparent malnutrition.
561	F	Subadult	6/10/2008	Soda Fork, BTNF	Known	Undetermined cause, 2-year-old female #561 found dead by outfitter on 7/8/2008. Failed (battery life) ear transmitter recovered at site.
Unm	M	Adult	6/14/2008	Reef Creek, SNF	Known	Human-caused, bear was wounded due to mistaken identity by a black bear hunter, wounded bear charged the hunter and was killed.
Unm	U	COY	6/14/2008	Bear Creek, State-MT	Probable	Natural, female grizzly bear #289 lost 1 COY between 6/3 and 6/25. Approximate mortality date.
Unm	M	COY	6/15/2008	Greybull River, State-WY	Known	Undetermined cause, male COY found dead on Phelps Mountain Road, did not appear to be human-caused.
583	M	Subadult	7/19/2008	Slaughter Creek, SNF	Known	Natural, bear #583 possibly killed by wolves. Bear was collared.
495	F	Adult	7/22/2008	Soda Butte Creek, GNF	Known	Human-caused, management removal of bear #495 (live to WSU) for human-injury and property damage at campground. Failed collar (battery life) on bear.
433	M	Adult	7/24/2008	Crow Creek, BTNF	Known	Human-caused, management removal of bear #433 for repeated livestock depredations. Bear was not collared when captured.
504	M	Adult	7/28/2008	Gypsum Creek, BTNF	Known	Human-caused, management removal of bear #504 for repeated livestock depredations. Bear was not collared when captured.

Table 13. Continued.

Bear[a]	Sex	Age[b]	Date	Location[c]	Certainty	Cause
464	M	Adult	7/31/2008	Trail Creek, BTNF	Known	Human-caused, management removal of bear #464 for repeated cattle depredation. Bear was not collared at time of removal.
582	M	Subadult	8/11/2008	Beartooth Creek, SNF	Known	Human-caused, management removal of bear #582 for numerous food rewards and habituated behaviors in campgrounds. Was wearing active collar when removed.
585	M	Adult	8/12/2008	Pelican Creek, YNP	Known	Natural, bear #585 died of maladies associated with old age. Bear was collared.
412	F	Adult	8/13/2008	Glade Creek, GTNP	Known	Undetermined, bear #412 was found dead by agency personnel, had been cached and fed on by bear(s) and wolves. Bear was not collared.
545	M	Adult	8/13/2008	Sheridan Creek, SNF	Known	Human-caused, management removal of bear #545 for repeated cattle depredation. Bear was not collared at time of removal.
453	M	Adult	8/24/2008	Soda Butte Creek, Pr-MT	Known	Human-caused, DLP kill of bear #453 as it broke into home. Bear was not collared when killed.
595	M	Subadult	8/31/2008	Rock Creek, CTNF	Known	Human-caused, bear #595 was found dead by hunter. Bear had been handled on 8/24/2008. Capture related, significant infection at the injection site. Bear was collared.
563	M	Adult	9/2/2008	Thirsty Creek, CTNF	Known	Human-caused, bear #563 was found dead via telemetry. Bear had been handled on 8/24/2008. Likely capture related, similar to #595. Bear was collared.
432	M	Adult	9/12/2008	Castle Creek, SNF	Known	Human-caused, hunting related, bear #432 charged archery hunter calling elk. Shot with bow, human injuries. Not collared at time of death.
Unm	F	Adult	9/19/2008	Castle Creek, SNF	Possible	Human-caused, hunting related, female with 2-3 yearlings charged archery hunters calling elk, 1 pistol shot at female at close range, small blood trail for short distance, no carcass found.
Unm	U	Yearling	9/19/2008	Castle Creek, SNF	Possible	Human-caused, hunting related, yearling with mother and 1–2 siblings charged archery hunters calling elk, 2 shots at yearling at close range, small blood trail for short distance, no carcass found.
562	M	Adult	9/28/2008	N Fork Fish Creek, BTNF	Known	Human-caused, hunting related, self defense kill of bear #562. Bear was collared.
303	F	Adult	10/1/2008	Long Creek, SNF	Known	Human-caused, hunting related, self defense kill of bear #303. Female was accompanied by 2 COY. Bear was not collared when killed.
Unm	U	COY	10/1/2008	Long Creek, SNF	Probable	Human-caused, hunting related, COY of female #303 killed by hunters.
Unm	U	COY	10/1/2008	Long Creek, SNF	Probable	Human-caused, hunting related, COY of female #303 killed by hunters.
Unm	F	Adult	10/2/2008	Yellowstone River, BTNF	Known	Human-caused, hunting related, female with 2 COY was killed when she was charged hunter at elk carcass.
Unm	U	COY	10/2/2008	Yellowstone River, BTNF	Probable	Human-caused, hunting related, COY of female killed by hunter.
Unm	U	COY	10/2/2008	Yellowstone River, BTNF	Probable	Human-caused, hunting related, COY of female killed by hunter.
Unm	F	Adult	10/7/2008	Cartridge Creek, SNF	Known	Human-caused, hunting related, female with 2 yearlings was killed when she charged elk hunter.

Table 13. Continued.

Bear[a]	Sex	Age[b]	Date	Location[c]	Certainty	Cause
Unm	F	Adult	10/7/2008	Hoodoo Creek, SNF	Known	Human-caused, hunting related, female with 1 COY killed when she charged guide near meat pole.
Unm	U	COY	10/7/2008	Hoodoo Creek, SNF	Probable	Human-caused, hunting related, COY of female killed by hunter.
Unm	F	Adult	10/13/2008	Crystal Creek, YNP	Known	Natural, specific cause undetermined. Likely due to predation attempt on bison or conflict with wolves.
G129	M	Adult	10/15/2008	Little Rock Creek, SNF	Known	Human-caused, human injuries, bear #G129 was killed when he charged. Bear was not collared.
149	F	Adult	10/18/2008	Cottongrass Creek, YNP	Known	Natural, bear #149 died of maladies associated with old age. Bear was collared.
G126	F	Yearling	10/19/2008	Warm Springs Creek, SNF	Known	Human-caused, malicous killing of yearling #G126.
G127	M	Yearling	10/19/2008	Warm Springs Creek, SNF	Known	Human-caused, malicous killing of yearling #G127.
458	F	Adult	10/22/2008	Clark Fork River, PR-WY	Known	Human-caused, management removal (shot) of bear #458 for repeated property damage and food rewards. Two yearlings (G133 and G134) were relocated. Bear was collared when removed.
265	F	Adult	10/22/2008	Stephens Creek, YNP	Known	Human-caused, management removal of adult female #265 (possible ID). Three yearlings relocated to Arnica Creek, YNP. Bear was not collared when removed. MTFWP removed #265 for conflicts at private residence in MT. The capture operation was conducted at a remote location in YNP for reasons of human safety.
318	M	Adult	10/25/2008	Crevice Creek, PR-MT	Known	Human-caused, DLP kill of bear #318, aggressive behavior at residence. Bear was not collared when killed.
Unm	M	Adult	10/28/2008	Ishawooa Creek, SNF	Known	Human-caused, DL kill while hunting.
Unm	F	COY	10/30/2008	Cinnabar Creek, GNF	Known	Human-caused, DL kill while hunting. Female with COY charged hunter, COY was killed, no evidence that female was wounded.
Unm	F	Adult	10/30/2008	Cinnabar Creek, GNF	Possible	Human-caused, DL kill while hunting. Female with COY charged hunter, COY was killed, no evidence that female was wounded.
Unm	F	Subadult	11/1/2008	South Fork Madison, GNF	Known	Human-caused. Female was apparently hit by vehicle and was paralyzed in rear legs. Bear was dispatched by warden.
447	F	Adult	11/4/2008	Wolverine Creek, BTNF	Known	Human-caused, hunting related. Bear #447 shot in camp. Bear was not collared.
Unm	U	Adult	11/18/2008	Middle Creek, GNF	Possible	Human-caused, hunting related. Elk hunter shot bear at site of 2 hunter killed elk carcasses. Bear was hit but ran away from site. No evidence of mortality found at site.

[a] Unm = unmarked bear, number indicates bear number.
[b] COY = cub-of-the-year.
[c] BTNF = Bridger-Teton National Forest, CTNF = Caribou-Targhee National Forest, GNF = Gallatin National Forest, GTNP = Grand Teton National Park, MTFWP = Montana Fish, Wildlife and Parks, SNF = Shoshone National Forest, WWR = Wind River Reservation, YNP = Yellowstone National Park, Pr = private.

Table 14. Annual size estimates ($\hat{N}$) for population segments and evaluation of sustainability for known and probable mortalities documented during 2008 in the Greater Yellowstone Ecosystem. Established mortality thresholds (USFWS 2007*b*) are 9%, 9%, and 15% for dependent young and independent (≥2) females and males, respectively. Only human-caused losses are counted against the mortality threshold for dependent young.

Population segment	$\hat{N}$	Human-caused loss	Sanctioned removals (A[a])	Radio-marked loss (R[b])	Reported loss	Estimated reported and unreported loss (B[c])	Estimated total mortality (D[d])	Annual mortality limit	Mortality threshold year result
Dependent young	185	8						17	Under
Independent females[e]	251	9	3	1	10	26	30	23	Exceeded
Independent males[f]	159	20	7	5	11	29	41	24	Exceeded

[a] Term A in equations 1 and 2 is the annual count of agency sanctioned management removals of independent aged bears including those involving radio-marked individual.
[b] Term R in equations 1 and 2 is the annual count of loss for independent aged bears wearing active telemetry except those removed through management actions.
[c] Term B in equations 1 and 2 is the median of the credible interval for estimated reported and unreported loss calculated using methods described in Cherry et al. (2002) from the annual reported loss.
[d] Term D in equations 1 and 2 is estimated total mortality which is the sum of the sanctioned removals, the radioed-marked loss, and the estimated reported and unreported loss.
[e] Mortality counts and estimates for independent aged female bears are indicated by subscript F in equation 1.
[f] Mortality counts and estimates for independent aged male bears are indicated by subscript M in equation 2.

The carcass of an adult female grizzly bear was found during a telemetry flight 13 Oct 2008 (Table 13) in Crystal Creek, YNP. It was unknown if the bison was involved in the bear's death or merely at the scene. Photo courtesy of Steve Ard.

Key Foods Monitoring

Spring Ungulate Availability and Use by Grizzly Bears in Yellowstone National Park. *(Shannon Podruzny, Interagency Grizzly Bear Study Team; and Kerry A. Gunther and Travis Wyman, Yellowstone National Park)*

It is well documented that grizzly bear use ungulates as carrion (Mealey 1980, Henry and Mattson 1988, Green 1994, Blanchard and Knight 1996, Mattson 1997) in YNP. Competition with recently reintroduced wolves (*Canis lupus*) for carrion and changes in bison (*Bison bison*) and elk (*Cervus elaphus*) management policies in the GYE have the potential to affect carcass availability and use by grizzly bears. For these and other reasons, we continue to survey historic carcass transects in YNP. In 2008, we surveyed routes in ungulate winter ranges to monitor the relative abundance of spring ungulate carcasses (Fig. 4).

We surveyed each route once for carcasses between April and early-May. At each carcass, we collected a site description (i.e., location, aspect, slope, elevation, distance to road, distance to forest edge), carcass data (i.e., species, age, sex, cause of death), and information about animals using the carcasses (i.e., species, percent of carcass consumed, scats present). We were unable to calculate the biomass consumed by bears, wolves, or other unknown large scavengers with our survey methodology.

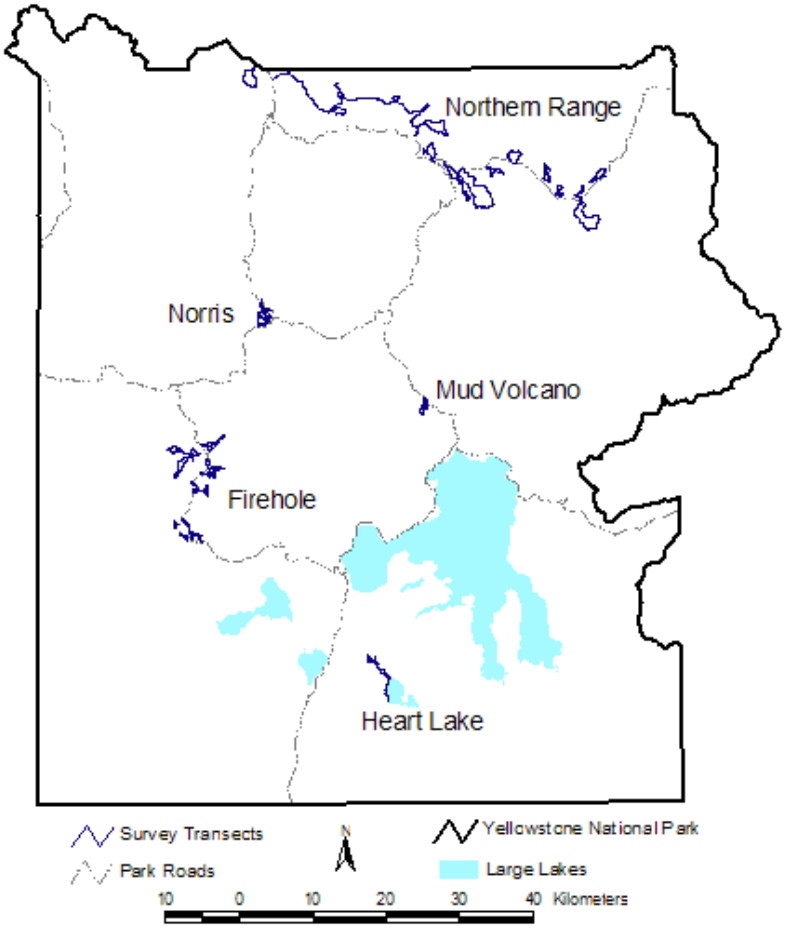

Fig. 4. Spring ungulate carcass survey transects in 5 areas of Yellowstone National Park.

In 2008, we recorded 116 ungulate carcasses for a total of 0.45 carcasses/km surveyed (Fig. 5).

Northern Range

We surveyed 12 routes on Yellowstone's Northern Range totaling 151.6 km traveled. One route was not surveyed to avoid disturbing an active wolf den. We used a Global Positioning System to more accurately measure the actual distance traveled on most of the routes. We counted 76 carcasses, including 2 mule deer, 71 elk, 2 bison, and 1 pronghorn, which equated to 0.50 carcasses/km (Table 15). Sex and age of carcasses found are shown in Table 16. All carcasses were almost completely consumed by scavengers. Evidence of use by grizzly bears was found at 4 elk carcasses. Evidence of use by wolves was found at 4 elk carcasses. Grizzly bear sign (e.g., tracks, scats, daybeds, or feeding activity) was observed along 8 of the routes and 1 grizzly was seen during the surveys. Black bear tracks were found along 1 survey route and 4 individuals were seen. The carcasses of 2 coyotes were also found.

Firehole River Area

We surveyed 8 routes in the Firehole drainage totaling 72.3 km. We found the remains of 33 bison and 2 elk, which equated to 0.48 carcasses/km traveled (Table 15). Definitive evidence of use by grizzly bears was found at 3 bison and 1 elk carcass. Grizzly bear sign was also found along 7 of the routes. We observed a mountain lion (*Felis concolor*) on 1 survey route, and lion tracks were seen on another survey route.

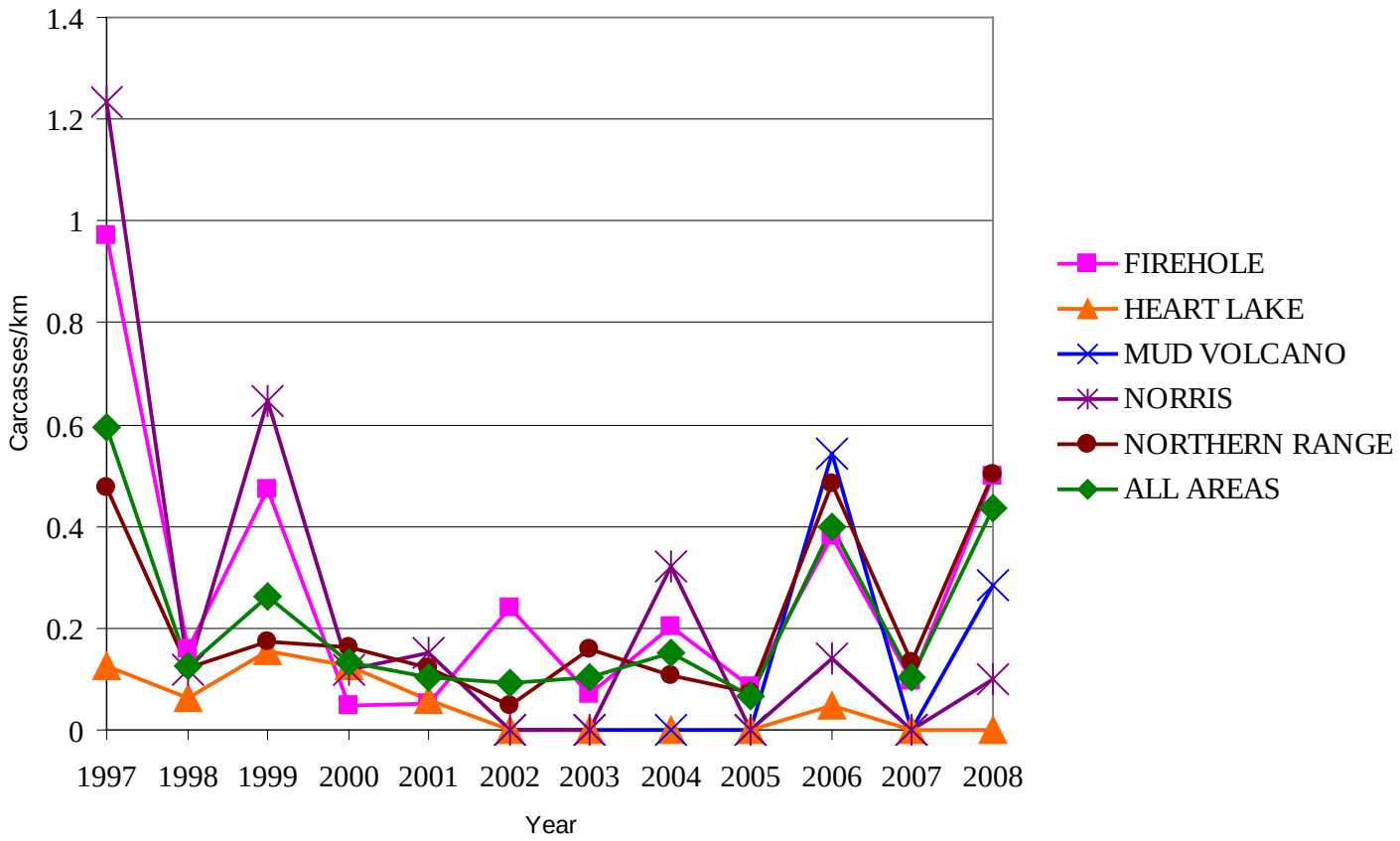

Fig. 5. Annual ungulate carcasses/km found on spring survey routes in winter ranges of Yellowstone National Park, Wyoming, 1997–2008.

Norris Geyser Basin

We surveyed 4 routes in the Norris Geyser Basin totaling 19.9 km traveled. We observed 2 bison carcasses on these transects, and grizzly bear sign was observed along all 3 of the 4 routes.

Heart Lake

We surveyed 3 routes in the Heart Lake thermal basin covering 14.9 km. We observed no carcasses. Grizzly bear sign, including tracks, scats, and other feeding activities, was observed on all 3 routes.

Mud Volcano

We surveyed a single route in the Mud Volcano area covering 7 km. Two bison carcasses were observed this spring, and tracks and evidence of feeding by at least 1 grizzly bear was found at 1 carcass. Consumption of mineral soil by grizzly bears was also documented along the route.

National Park Service

Table 15. Ungulage carcasses found and visitation of carcasses by bears, wolves, and unknown large scavengers along surveyed routes in Yellowstone National Park during spring 2008.

Survey area (# routes)	Elk				Bison				Total carcasses/km
	Number of carcasses	# Visited by species			Number of carcasses	# Visited by species			
		Bear	Wolf	Unknown		Bear	Wolf	Unknown	
Northern Range (12)	71	6	4	52	2	0	0	2	0.50[a]
Firehole (8)	2	0	0	1	33	11	2	5	0.48
Norris (4)	0	0	0	0	2	1	1	0	0.10
Heart Lake (3)	0	0	0	0	0	0	0	0	0.00
Mud Volcano (1)	0	0	0	0	2	1	0	1	0.29

[a] Included 1 pronghorn and 2 mule deer carcasses.

Table 16. Age classes and sex of elk and bison carcasses found, by area, along surveyed routes in Yellowstone National Park during spring 2008.

	Elk (n = 73)						Bison (n = 39)					
	Northern Range	Firehole	Norris	Heart Lake	Mud Volcano	Total	Northern Range	Firehole	Norris	Heart Lake	Mud Volcano	Total
Age												
Adult	57	1	0	0	0	58	2	18	0	0	2	22
Yearling	1	0	0	0	0	1	0	13	0	0	0	13
Calf	2	0	0	0	0	2	0	1	2	0	0	3
Unknown	11	1	0	0	0	12	0	1	0	0	0	1
Sex												
Male	19	0	0	0	0	19	0	13	1	0	1	15
Female	30	1	0	0	0	31	2	15	0	0	1	18
Unknown	22	1	0	0	0	23	0	5	1	0	0	6

Spawning Cutthroat Trout (*Kerry A. Gunther, Todd M. Koel, Patrick Perrotti, Eric Reinertson, Phil Doepke, Brian Ertel, and Travis Wyman, Yellowstone National Park)*

Spawning cutthroat trout are a high quality, calorically dense food source for grizzly bears in YNP (Mealey 1975, Pritchard and Robbins 1990), and influence the distribution of bears over a large geographic area (Mattson and Reinhart 1995). In past years, grizzly bears were known to prey on cutthroat trout in at least 36 different tributary streams of Yellowstone Lake (Hoskins 1975, Reinhart and Mattson 1990). Haroldson et al. (2005) estimated that approximately 68 grizzly bears likely fished Yellowstone Lake tributary streams annually. Bears also occasionally prey on cutthroat trout in other areas of the park, including the cutthroat trout (and/or cutthroat x rainbow trout [*Oncorhynchus mykiss*] hybrids) of the inlet creek to Trout Lake located in the northeast section of YNP.

The cutthroat trout population in Yellowstone Lake is now threatened by the introduction of nonnative lake trout (*Salvelinus namaycush*) and the exotic parasite (*Myxobolus cerebralis*) that causes whirling disease (Koel et al. 2005*a*, Koel et al. 2006). Lake trout and whirling disease have depressed the native cutthroat trout population and associated bear fishing activity. In addition to lake trout and whirling disease, drought may also be contributing to the decline of the Yellowstone Lake cutthroat trout population (Koel et al. 2005*b*). Due to the importance of cutthroat trout to grizzly bears and the potential threats from lake trout, whirling disease, and drought, monitoring of the cutthroat trout population is specified under the Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area (USFWS 2007*c*). The cutthroat trout population is currently monitored annually using counts at a fish trap located on a tributary along the east shore of Yellowstone Lake, and through visual stream surveys conducted along North Shore and West Thumb tributaries to Yellowstone Lake (Koel et al. 2005*a*, USFWS 2007*c*). Visual stream surveys are also conducted along the inlet creek at Trout Lake in the northeast section of the park.

Yellowstone Lake

Fish trap surveys.—The number of spawning cutthroat trout migrating upstream are counted annually from a weir with a fish trap at the mouth of Clear Creek on the east side of Yellowstone Lake (Koel et al. 2005*a*). The fish trap is generally installed in May, the exact date depending on winter snow accumulation, weather conditions, and spring snow melt. Fish are counted by dip netting trout that enter the upstream trap box and/or visually counting trout as they swim through wooden chutes attached to the trap. An electronic fish counter is also periodically used. A weir and fish trap on Bridge Creek, monitored for spawning cutthroat trout 1999–2005, has not been operated since due to the extremely low number of trout; only 1 cutthroat was counted there in 2004 and none were found in 2005.

In 2008, unusually high spring run-off damaged the Clear Creek weir and necessitated its removal prior to completing a count of spawning cutthroat trout ascending that creek. Two hundred-fifty-four cutthroat trout were counted before the weir was removed on 17 June. The cutthroat trout spawning run was still in progress when the weir was pulled. Since the fish count for 2008 was not completed, it cannot be compared to data from previous years (Fig. 6).

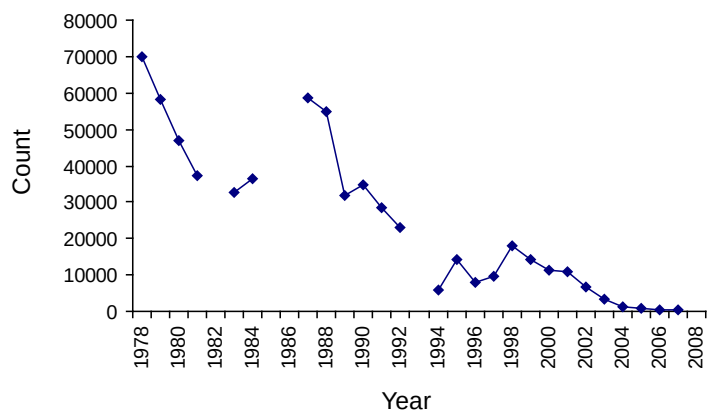

Fig. 6. Number of spawning cutthroat trout counted at the Clear Creek fish trap on the east shore of Yellowstone Lake, Yellowstone National Park, 1977–2008.

Spawning stream surveys.--Beginning 1 May each year, several streams including Lodge, Hotel, Hatchery, Incinerator, Wells, Bridge, Weasel, and Sand Point Creeks on the North Shore of Yellowstone Lake; and Sandy, Sewer, Little Thumb, and 1167 Creeks in the West Thumb area 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 in these streams are conducted. Sample methods follow Reinhart (1990), as modified by Andrascik (1992) and Olliff (1992). In each stream on each sample day, 2 people walk upstream from the stream mouth and record the number of adult trout observed. Sampling continues 1 day/week until most adult trout return to the lake (i.e., end of spawning). The length of the spawn is calculated by counting the number of days from the first day spawners are observed through the last day spawners are observed. The average number of spawning cutthroat trout counted per stream survey conducted during the spawning season is used to identify annual trends in the number of cutthroat trout spawning in Yellowstone Lake tributaries.

Data collected in 2008 continued to show low numbers of spawning cutthroat trout in North Shore and West Thumb streams (Table 17). In North Shore streams, only 3 spawning cutthroat trout were counted. All were in Bridge Creek. No spawning cutthroat trout were observed in Lodge, Hatchery, Incinerator, or Wells Creeks. On West Thumb streams, only 20 spawning cutthroat trout were counted including 13 in Little Thumb Creek, 3 in 1167 Creek, 2 in Sandy Creek, and 2 in Sewer Creek. The number of spawners counted in the North Shore and West Thumb streams have decreased significantly since 1989 (Fig. 7). No evidence of grizzly bear or black bear fishing activity was observed along any of the 9 Yellowstone Lake tributaries surveyed in 2008.

Trout Lake

Spawning stream surveys.--Beginning in mid-May of each year, the Trout Lake inlet creek is checked once per week for the presence of spawning cutthroat trout (and/or cutthroat x rainbow trout hybrids). Once spawning trout are detected (i.e., onset of spawning), weekly surveys of adult trout in the inlet creek are conducted. On each sample day, 2 people

Table 17. Start of spawn, end of spawn, duration of spawn, and average number of spawning cutthroat trout counted per survey in North Shore and West Thumb spawning tributaries to Yellowstone Lake, Yellowstone National Park, 2008.

Stream	Start of spawn	End of spawn	Duration of spawn (days)	Number of surveys during spawning period	Number of fish counted	Average fish/survey
North Shore Streams						
Lodge Creek			No Spawn		0	
Hotel Creek			Not Surveyed			
Hatchery Creek			No Spawn		0	
Incinerator Creek			No Spawn		0	
Wells Creek			No Spawn		0	
Bridge Creek	6/16	6/16	1	1	3	3
Weasel Creek			Not Surveyed			
Sand Point Creek			Not Surveyed			
West Thumb Streams						
1167 Creek	6/2	6/2	1	1	3	3
Sandy Creek	6/9	6/9	1	1	2	2
Sewer Creek	6/9	6/9	1	1	2	2
Little Thumb Creek	6/23	6/23	1	1	13	13
Northern Range Stream						
Trout Lake Inlet	6/21	7/14	24	4	966	242

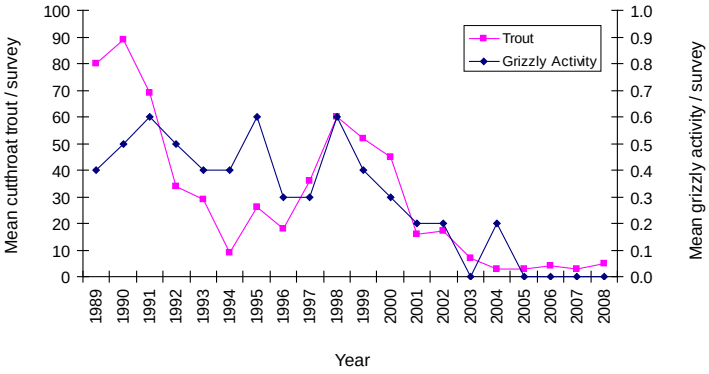

Fig. 7. Mean number of spawning cutthroat trout and mean activity by grizzly bears observed during weekly visual surveys of 8 North Shore and 4 West Thumb spawning streams tributary to Yellowstone Lake, Yellowstone National Park, 1989–2008.

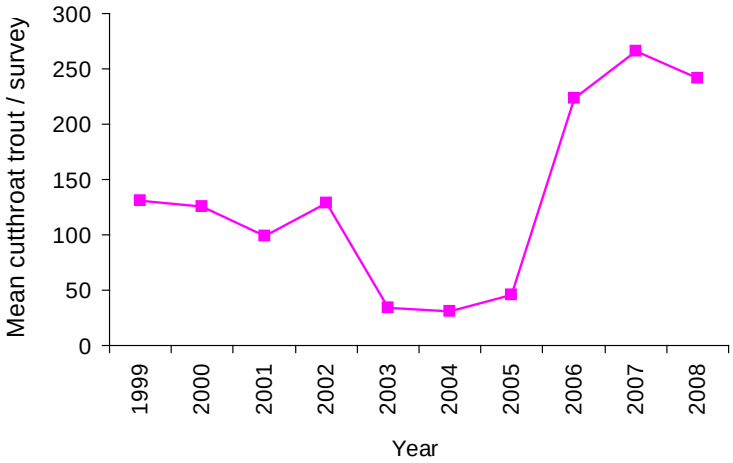

Fig. 8. Mean number of spawning cutthroat (and/or cutthroat x rainbow trout hybrids) observed during weekly visual spawning surveys of the Trout Lake inlet, Yellowstone National Park, 1999–2008.

walk upstream from the stream mouth and record the number of adult trout observed. Sampling continues 1 day/week until 2 consecutive weeks when no trout are observed in the creek and all trout have returned to Trout Lake (i.e., end of spawn). The length of the spawn is calculated by counting the number of days from the first day spawning trout are observed through the last day spawning trout are observed. The mean number of spawning trout observed per visit is calculated by dividing the total number of adult trout counted by the number of surveys conducted during the spawning period.

In 2008, the first movement of spawning trout from Trout Lake into the inlet creek was observed on 21 June. The spawn lasted approximately 24 days with the last spawning trout being observed in the inlet creek on 14 July. During the once per week visual surveys, 966 spawning cutthroat (and/or cutthroat trout x rainbow trout hybrids) were counted, an average of 242 per visit (Table 17). The number of fish observed per survey has ranged from a low of 31 in 2004 to a high of 266 in 2007 (Fig. 8).

No evidence of grizzly bear or black bear fishing activity was observed along the inlet creek during the surveys. A bear scat containing dandelion (*Taraxacum* spp.) was found next to the inlet creek on 26 June, during the spawning run.

Cutthroat trout outlook.--Using gill-nets, park fisheries biologists caught and removed 76,136 lake trout from Yellowstone Lake in 2008 as part of management efforts to protect the native cutthroat trout population (Koel et al. In press). Electro-shocking of spawning grounds was not conducted in 2008. The catch per effort of cutthroat trout (unintentional by-catch) in smaller mesh size gillnets used to target juvenile lake trout increased in 2008, indicating an increase in cutthroat trout recruitment in recent years. During the fall cutthroat trout netting assessment on Yellowstone Lake, fisheries biologists noticed a slightly higher average catch of cutthroat trout per net than previous years, another indication that the cutthroat trout population may be rebounding.

Lake trout removed from Yellowstone Lake, 3 Oct 2007. Photo courtesy of Audrey Squires/NPS.

Grizzly Bear Use of Insect Aggregation Sites Documented from Aerial Telemetry and Observations
(Dan Bjornlie, Wyoming Game and Fish Department; and Mark Haroldson, Interagency Grizzly Bear Study Team)

Army cutworm moths were first recognized as an important food source for grizzly bears in the GYE during the mid 1980s (Mattson et al. 1991*b*, French et al. 1994). Early observations indicated that moths, and subsequently bears, showed specific site fidelity. These sites are generally high alpine areas dominated by talus and scree adjacent to areas with abundant alpine flowers. Such areas are referred to as "insect aggregation sites." Since their discovery, numerous bears have been counted on or near these aggregation sites due to excellent sightability from a lack of trees and simultaneous use by multiple bears.

Complete tabulation of grizzly presence at insect sites is extremely difficult. Only a few sites have been investigated by ground reconnaissance and the boundaries of sites are not clearly known. In addition, it is likely that the size and location of insect aggregation sites fluctuate annually with moth abundance and variation in environmental factors such as snow cover.

Since 1986, when insect aggregation sites were initially included in aerial observation surveys, our knowledge of these sites has increased annually. Our techniques for monitoring grizzly bear use of these sites have changed in response to this increase in knowledge. Prior to 1997, we delineated insect aggregation sites with convex polygons drawn around locations of bears seen feeding on moths and buffered these polygons by 500 m. The problem with this technique was that small sites were overlooked due to the inability to create polygons around sites with fewer than 3 locations. From 1997–1999, the method for defining insect aggregation sites was to inscribe a 1-km circle around the center of clusters of observations in which bears were seen feeding on insects in talus/scree habitats (Ternent and Haroldson 2000). This method allowed trend in bear use of sites to be annually monitored by recording the number of bears documented in each circle (i.e., site).

A new technique was developed in 2000 (D. Bjornlie, Wyoming Game and Fish Department, personal communication). Using this technique, sites were delineated by buffering only the locations of bears observed actively feeding at insect aggregation sites by 500 m to account for error in aerial telemetry locations. The borders of the overlapping buffers at individual insect sites were dissolved to produce a single polygon for each site. These sites are identified as "confirmed" sites. Because these polygons are only created around feeding locations, the resulting site conforms to the topography of the mountain or ridge top where bears feed and does not include large areas of non-talus habitat that are not suitable for cutworm moths. Locations from the grizzly bear location database from 1 July through 30 September of each year were then overlaid on these polygons and enumerated. The technique to delineate confirmed sites developed in 2000 substantially decreased the number of sites described compared to past years in which locations from both feeding and non-feeding bears were used. Therefore, annual analysis for this report is completed for all years using this technique. Areas suspected as insect aggregation sites but dropped from the confirmed sites list using this technique, as well as sites with only 1 observation of an actively feeding bear or multiple observations in a single year, are termed "possible" sites and will be monitored in subsequent years for additional observations of actively feeding bears. These sites may then be added to the confirmed sites list. When possible sites are changed to confirmed sites, analysis is done on all data back to 1986 to determine the historic use of that site. Therefore, the number of bears using insect aggregation sites in past years may change as new sites are added, and data from this annual report may not match that of past reports. In addition, as new actively feeding bear observations are added to existing sites, the polygons defining these sites increase in size and, thus, more overlaid locations fall within the site. This retrospective analysis brings us closer each year to the "true" number of bears using insect aggregation sites in past years.

In 2008, actively feeding grizzly bears were observed on 4 sites classified as possible in past years. Therefore, these sites were reclassified as confirmed and analysis was done back to 1986. An observation of a grizzly bear actively feeding in 1 new area resulted in the identification of a new possible insect aggregation site. The reclassification of sites and a new possible site produced 35 confirmed sites and 17 possible sites for 2008.

The percentage of confirmed sites with documented use by bears varies annually, suggesting that some years have higher moth activity than others

(Fig. 9). For example, the years 1993–1995 were probably poor moth years because the percentage of confirmed sites used by bears (Fig. 9) and the number of observations recorded at insect sites (Table 18) were low. Overall, the percent of insect aggregation site use by grizzly bears increased by 6% in 2008 (Fig. 9). The number of observations or telemetry relocations at sites increased slightly from 2007, as well (Table 18). The number of insect aggregation sites used by bears in 2008 increased to 26 from 24 in 2007 (Table 18) and was slightly higher than the 5-year average of 22.0 sites/year from 2003–2007.

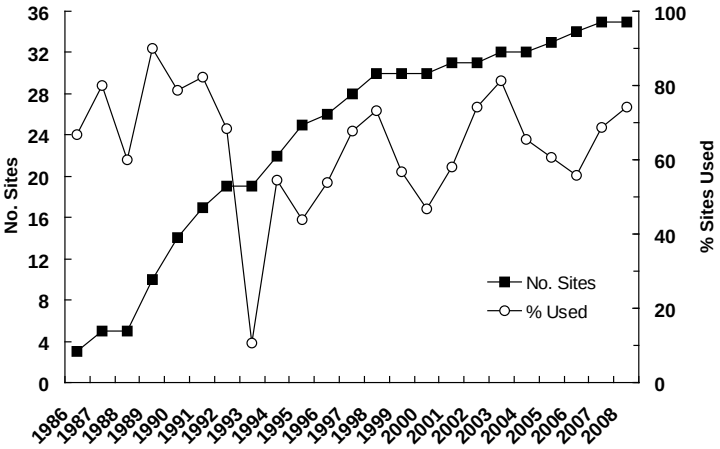

Fig. 9. Annual number of confirmed insect aggregation sites and percent of those sites at which either telemetry relocations of marked bears or visual observations of unmarked bears were recorded, Greater Yellowstone Ecosystem, 1986–2008.

The IGBST maintains an annual list of unduplicated females observed with COY (see Table 5). Since 1986, 726 initial sightings of unduplicated females with COY have been recorded, of which 207 (29%) have occurred at (within 500 m, n = 181) or near (within 1,500 m, n = 26) insect aggregation sites (Table 19). In 2008, 11 of the 44 (25.0%) initial sightings of unduplicated females with COY were observed at insect aggregation sites, a decrease of 6 from 2007 (Table 19). This is lower than the 5-year average of 34.3% from 2003–2007.

Survey flights at insect aggregation sites contribute to the count of unduplicated females with COY; however, it is typically low, ranging from 0 to 20 initial sightings/year since 1986 (Table 19). If these sightings are excluded, an increasing trend in the annual number of unduplicated sightings of females with COY is still evident (Fig. 10), suggesting that some other factor besides observation effort at insect aggregation sites is responsible for the increase in sightings of females with cubs.

Table 18. The number of confirmed insect aggregation sites in the Greater Yellowstone Ecosystem annually, the number used by bears, and the total number of aerial telemetry relocations and ground or aerial observations of bears recorded at each site during 1986–2008.

Year	Number of confirmed moth sites[a]	Number of sites used[b]	Number of aerial telemetry relocations	Number of ground or aerial observations
1986	3	2	5	5
1987	5	4	4	11
1988	5	3	10	33
1989	10	9	10	41
1990	14	11	9	75
1991	17	14	11	165
1992	19	13	5	102
1993	19	2	1	1
1994	22	12	1	28
1995	25	11	7	35
1996	26	14	21	65
1997	28	19	15	80
1998	30	22	8	174
1999	30	17	25	152
2000	30	14	37	90
2001	31	18	22	119
2002	31	23	26	246
2003	32	26	9	158
2004	32	21	2	130
2005	33	20	15	175
2006	34	19	13	174
2007	35	24	11	174
2008	35	26	16	213
Total			283	2233

[a] The year of discovery was considered the first year a telemetry location or aerial observation was documented at a site. Sites were considered confirmed after additional locations or observations in a subsequent year and every year thereafter regardless of whether or not additional locations were documented.

[b] A site was considered used if ≥1 location or observation was documented within the site that year.

Table 19. Number of initial sightings of unduplicated females with cubs-of-the-year (COY) that occurred on or near insect aggregation sites, number of sites where such sightings were documented, and the mean number of sightings per site in the Greater Yellowstone Ecosystem, 1986–2008.

Year	Unduplicated females with COY[a]	Number of moths sites with an initial sighting	Initial sightings: Within 500 m[b] *N*	Within 500 m[b] %	Within 1,500 m[c] *N*	Within 1,500 m[c] %
1986	25	0	0	0.0	0	0.0
1987	13	0	0	0.0	0	0.0
1988	19	1	2	10.5	2	10.5
1989	16	1	1	6.3	1	6.3
1990	25	3	3	12.0	4	16.0
1991	24	7	11	45.8	14	58.3
1992	25	4	6	24.0	9	36.0
1993	20	1	1	5.0	1	5.0
1994	20	3	5	25.0	5	25.0
1995	17	2	2	11.8	2	11.8
1996	33	4	4	12.1	7	21.2
1997	31	8	11	35.5	11	35.5
1998	35	11	13	37.1	13	37.1
1999	33	3	6	18.2	7	21.2
2000	37	6	7	18.9	10	27.0
2001	42	6	11	26.2	13	31.0
2002	52	10	14	26.9	17	32.7
2003	38	11	19	50.0	20	52.6
2004	49	10	15	30.6	16	32.7
2005	31	8	9	29.0	9	29.0
2006	47	11	13	27.7	15	31.9
2007	50	10	17	34.0	17	34.0
2008	44	7	11	25.0	14	31.8
Total	726		181		207	
Mean	31.6	5.5	7.9	22.2	9.0	25.5

[a] Initial sightings of unduplicated females with COY; see Table 5.
[b] Insect aggregation site is defined as a 500-m buffer drawn around a cluster of observations of bears actively feeding.
[c] This distance is 3 times what is defined as a insect aggregation site for this analysis, since some observations could be made of bears traveling to and from insect aggregation sites.

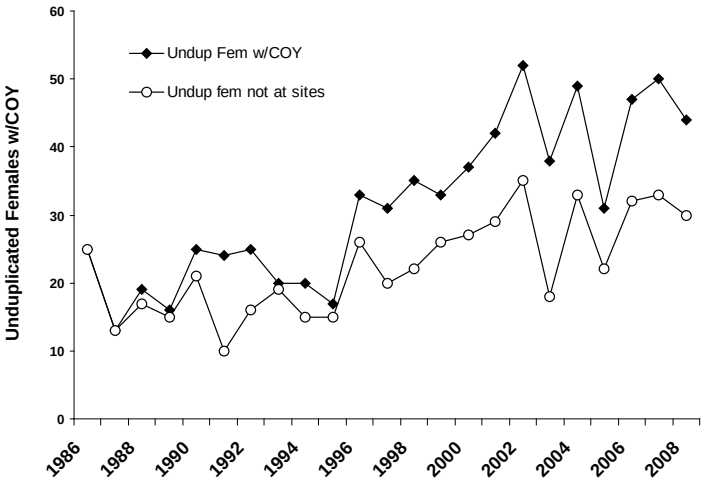

Fig. 10. The total number of unduplicated females with cubs-of-the-year (COY) observed annually in the Greater Yellowstone Ecosystem and the number of unduplicated females with COY not found within 1,500 m of known insect aggregation sites, 1986–2008.

Grizzly bear feeding on moths, 11 Jul 2008. Photo courtesy of Dale C. Ditolla.

Whitebark Pine Cone Production *(Mark A. Haroldson and Shannon Podruzny, Interagency Grizzly Bear Study Team)*

Whitebark pine surveys showed generally poor cone production during 2008. Twenty-six transects (Fig. 11) were read, including 1 new transect (CSG, Fig. 11). All trees on 3 transects (F1, H, and T) were dead and suitable replacement trees could not be found within the stands; these transects will be retired. Overall, mean cones/tree was 8.6 (Table 20). The best cone production occurred on transects in the northwest portion of the ecosystem (Fig. 11); poorest was on transects J and CSA (Fig. 11 and Table 21). This is the first year since 2004 that cone production has been below average (Fig. 12).

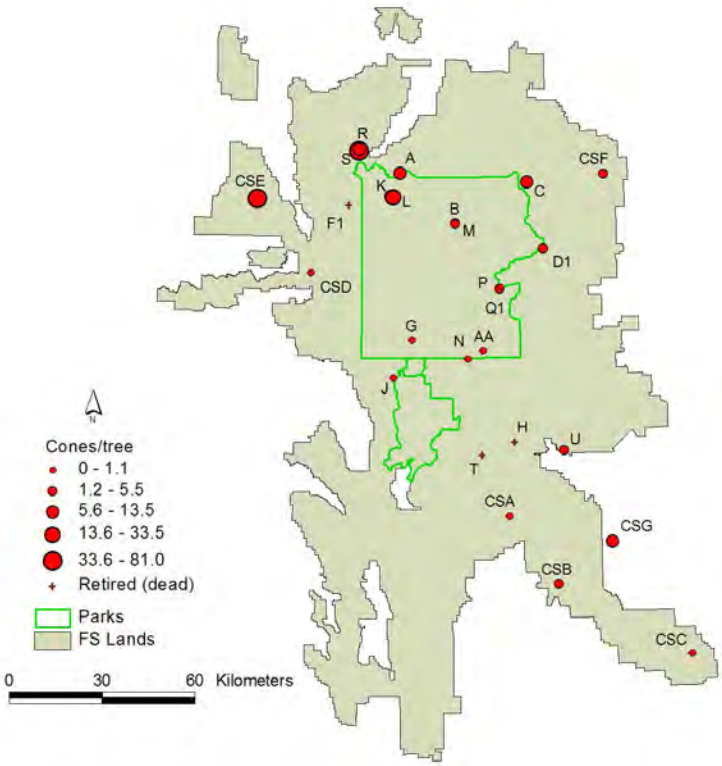

Fig. 11. Locations and mean cones/tree for 26 whitebark pine (*Pinus albicaulis*) cone production transects surveyed in the Greater Yellowstone Ecosystem during 2008.

Table 21. Whitebark pine (*Pinus albicaulis*) cone production transect results for 2008.

Transect	Cones	Trees	Mean	SD
A	56	10	5.6	14.6
B	34	10	3.4	3.3
C	71	9	7.9	7.0
D1	14	5	2.8	4.4
F1	Dead (retired)			
G	4	7	0.6	1.5
H	Dead (retired)			
J	0	10	0.0	0.0
K	85	10	8.5	7.1
L	139	10	13.9	12.4
M	19	10	1.9	2.6
N	2	9	0.2	0.7
P	18	10	1.8	3.2
Q1	7	10	0.7	1.2
R	304	9	33.8	53.1
S	89	9	9.9	17.3
T	Dead (retired)			
U	2	1	2.0	
AA	10	10	1.0	1.6
CSA	0	10	0.0	0.0
CSB	26	10	2.6	4.7
CSC	7	10	0.7	1.6
CSD	8	10	0.8	1.5
CSE	801	10	80.1	55.2
CSF	22	10	2.2	3.3
CSG	71	10	7.1	7.1

Table 20. Summary statistics for whitebark pine (*Pinus albicaulis*) cone production transects surveyed during 2008 in the Greater Yellowstone Ecosystem.

Total			Trees				Transect			
Cones	Trees	Transects	Mean cones	SD	Min	Max	Mean cones	SD	Min	Max
1,789	209	23	8.6	24.2	0	161	77.8	167.6	0	801

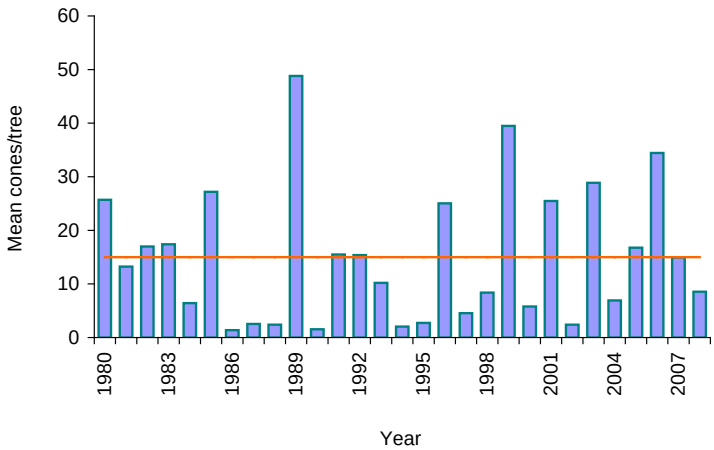

Fig. 12. Annual mean cones/tree on whitebark pine (*Pinus albicaulis*) cone production transects surveyed in the Greater Yellowstone Ecosystem during 1980–2008. The overall average for the period of 15 cones/tree is indicated by the horizontal line.

Mountain pine beetle activity continues at high levels on our original 19 transects. We observed an additional 24.1% (26/108) mortality among the live trees surveyed since 2002. Annual tree mortality during the last 6 years has ranged from 6.9% to 24.1%. Total tree mortality since 2002 is 56.8% (108/190) and 94.7% (18/19) of our original transects contain beetle-killed trees. Five (71.4%) of the 7 new transects exhibited beetle activity.

Near exclusive use of whitebark pine seeds by grizzly bears has been associated with falls in which mean cone production on transects exceeds 20 cones/tree (Blanchard 1990, Mattson et al. 1992). Typically, there is a reduction in numbers of management actions during fall months with abundant cone availability. During August–October of 2008, 11 management captures of bears 2 years of age or older (independent) resulted in 8 transports and 3 removals. This result was near the overall average of 9 management actions for August–October 1980–2007. However, the number of bear mortalities from self-defense kill by hunters (see *Estimating sustainability of annual grizzly bear mortalities*) was high (n = 8, for independent aged bears) during August–October.

Whitebark pine stand on Windy Peak, Shoshone National Forest, showing evidence of blister rust, beetle kill, and fire, 9 Aug 2008. Photo courtesy of Jonathan Ball.

Habitat Monitoring

Grand Teton National Park Recreational Use *(Steve Cain, Grand Teton National Park)*

In 2008, total visitation in Grand Teton National Park was 3,832,016 people, including recreational, commercial (e.g. Jackson Hole Airport), and incidental (e.g. traveling through the Park on U.S. Highway 191 but not recreating) use. Recreational visits alone totaled 2,485,987. Backcountry user nights totaled 27,521. Long- and short-term trends of recreational visitation and backcountry user nights are shown in Table 22 and Fig. 13.

Table 22. Average annual visitation and average annual backcountry use nights in Grand Teton National Park by decade from 1951 through 2008.

Decade	Average annual parkwide visitation[a]	Average annual backcountry use nights
1950s	1,104,357	Not available
1960s	2,326,584	Not available
1970s	3,357,718	25,267
1980s	2,659,852	23,420
1990s	2,662,940	20,663
2000s[b]	2,488,710	29,973

[a] In 1983 a change in the method of calculation for parkwide visitation resulted in decreased numbers. Another change in 1992 increased numbers. Thus, parkwide visitation data for the 1980s and 1990s are not strictly comparable.

[b] Data for 2000–2008 only.

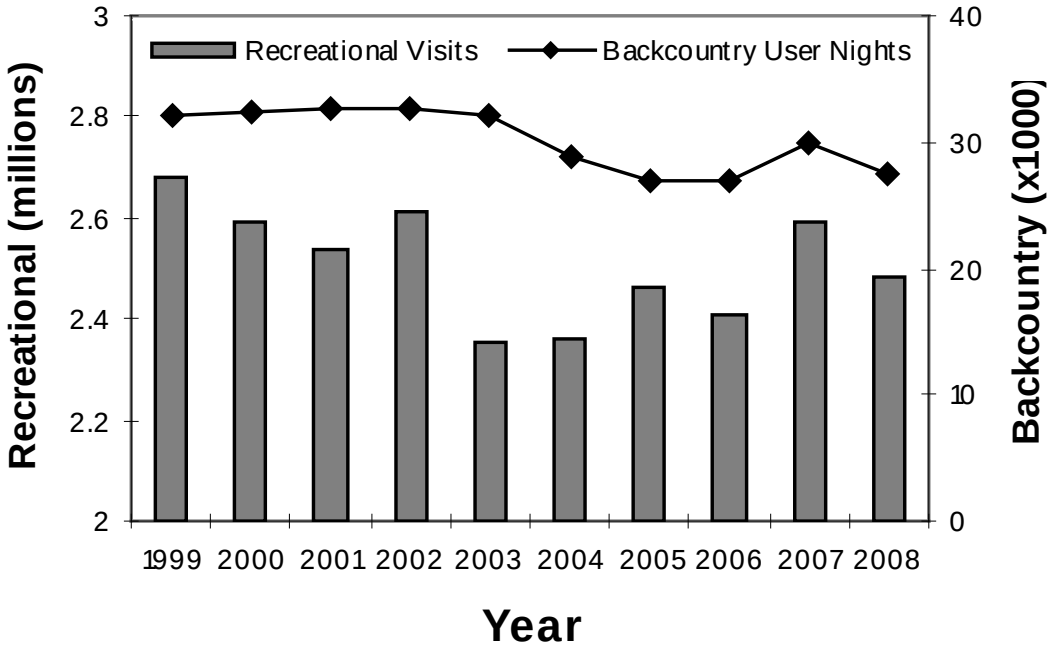

Fig. 13. Trends in recreational visitation and backcountry user nights in Grand Teton National Park during 1999–2008.

Yellowstone National Park Recreational Use *(Kerry A. Gunther, Yellowstone National Park)*

In 2008, total visitation to Yellowstone National Park was 3,945,130 people including recreational and non-recreational (e.g. traveling through the Park on U.S. Highway 191 but not recreating) use. Recreational visits alone totaled 3,066,578. These visitors spent 694,315 user nights camping in developed area roadside campgrounds and 39,302 user nights camping in backcountry campsites. The bulk of YNP's visitation occurs from May through September. Total recreational visits to the park in 2008 during that time were 2,797,250, an average of 18,283 visitors/day.

Average annual recreational visitation increased each decade from an average of 7,378 visitors/year during the late 1890s to 3,012,653 visitors/year in the 1990s (Table 23). Average annual recreational visitation has decreased slightly the first 9 years (2000–2008) of the current decade, to an average of 2,931,687 visitors/year. Average annual backcountry user nights have been less variable between decades than total park visitation, ranging from 39,280 to 45,615 user nights/year (Table 23). The number of backcountry user nights is limited by both the number and capacity of designated backcountry campsites in the park.

Table 23. Average annual visitation, auto campground user nights, and backcountry user nights in Yellowstone National Park by decade from 1895 through 2008.

Decade	Average annual parkwide total recreational visitation	Average annual auto campground user nights	Average annual backcountry user nights
1890s	7,378[a]	Not available	Not available
1900s	17,110	Not available	Not available
1910s	31,746	Not available	Not available
1920s	157,676	Not available	Not available
1930s	300,564	82,331[b]	Not available
1940s	552,227	139,659[c]	Not available
1950s	1,355,559	331,360	Not available
1960s	1,955,373	681,303[d]	Not available
1970s	2,240,698	686,594[e]	45,615[f]
1980s	2,344,485	656,093	39,280
1990s	3,012,653	647,083	43,605
2000s	2,931,687[g]	631,584[g]	40,434[g]

[a]Data from 1895–1899. From 1872–1894 visitation was estimated to be not less than 1,000 nor more than 5,000 each year.
[b] Data from 1930–1934
[c] Average does not include data from 1940 and 1942.
[d] Data from 1960–1964.
[e]Data from 1975–1979.
[f] Backcountry use data available for the years 1972–1979.
[g]Data for the years 2000–2008.

Trends in Elk Hunter Numbers within the Primary Conservation Area Plus the 10-mile Perimeter Area *(David S. Moody, Wyoming Game and Fish Department; Kevin Frey, Montana Department of Fish, Wildlife and Parks; and Daryl Meints, Idaho Department of Fish and Game)*

State wildlife agencies in Idaho, Montana, and Wyoming annually estimate the number of people hunting most major game species. We used state estimates for the number of elk hunters by hunt area as an index of hunter numbers for the PCA plus the 10-mile perimeter area. Because some hunt area boundaries do not conform exactly to the PCA and 10-mile perimeter area, regional biologists familiar with each hunt area were queried to estimate hunter numbers within the PCA plus the 10-mile perimeter area. Elk hunters were used because they represent the largest cohort of hunters for an individual species. While there are sheep, moose, and deer hunters using the PCA and 10-mile perimeter area, their numbers are fairly small and many hunt in conjunction with elk, especially in Wyoming, where seasons overlap. Elk hunter numbers represent a reasonably accurate index of total hunter numbers within areas occupied by grizzly bears in the GYE.

We generated a data set from all states from 1998 to 2008 (Table 24, Fig. 14). Complete data do not exist for all years. Idaho and Montana do not calculate these numbers annually or, in some cases the estimates are not available in time for completing this report. As data become available it will be added in the future.

Overall, hunter numbers have decreased since 1998, with the exception of 2002 when hunter numbers increased in Wyoming, Idaho, and Montana. Until 2008, most of the decrease occurred in Wyoming and Montana. Idaho drastically reduced harvest objectives for females in 2008, which accounts for the decrease in hunter numbers this year. Hunter numbers in Wyoming have decreased from the peak of 15,439 in 1998 to 8,792 in 2008. It is anticipated that hunter numbers in Wyoming will probably stabilize at 2007 and 2008 levels into the future as harvest objectives have been realized. Hunter numbers also decreased in Montana since 2002 but at reduced levels compared to Wyoming. All 3 states liberalized elk seasons in the early 1990s through 2002 to reduce elk herds towards respective population objectives. The majority of the increased harvest was focused on females. Elk populations began approaching population objective around 2004. As a result, elk hunter numbers have stabilized.

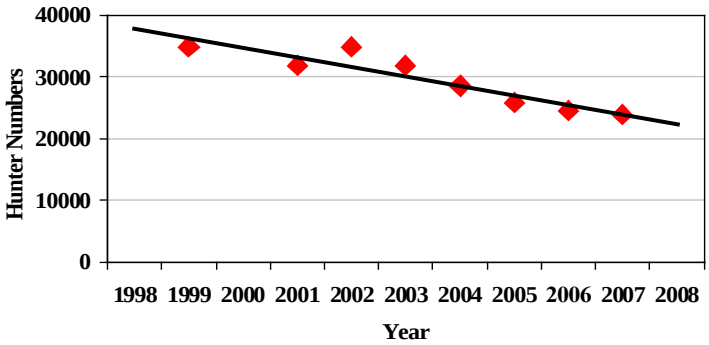

Fig. 14. Trend in elk hunter numbers within the Primary Conservation Area plus a 10-mile perimeter in Idaho, Montana, and Wyoming, 1998-2008.

Table 24. Estimated numbers of elk hunters within the Primary Conservation Area plus a 10-mile perimeter in Idaho, Montana, and Wyoming, for the years 1998–2008.

	Year										
State	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Idaho	2,785	2,883	[a]	2,914	3,262	3,285	3,454	3,619	3,016	2,592	1,763
Montana	[a]	16,254	17,329	15,407	17,908	16,489	14,320	12,365	12,211	12,635	[a]
Wyoming	15,439	15,727	12,812	13,591	13,709	11,771	10,828	9,888	9,346	8,716	8,792
Total		34,864		31,912	34,879	31,905	28,602	25,872	24,573	23,943	

[a] Hunter number estimates not currently available.

Grizzly Bear-Human Conflicts in the Greater Yellowstone Ecosystem *(Kerry A. Gunther, Yellowstone National Park; Bryan Aber, Idaho Department of Fish and Game; Mark T. Bruscino, Wyoming Game and Fish Department; Steve L. Cain, Grand Teton National Park; Kevin Frey, Montana Fish, Wildlife and Parks; and Mark A. Haroldson and Charles C. Schwartz, Interagency Grizzly Bear Study Team)*

Conservation of grizzly bears in the GYE requires providing sufficient habitat (Schwartz et al. 2003) and keeping human-caused bear mortality at sustainable levels (IGBST 2005, 2006). Most human-caused grizzly bear mortalities are directly related to grizzly bear-human conflicts (Gunther et al. 2004). Grizzly bear-human conflicts may also erode public support for grizzly bear conservation. To effectively allocate resources for implementing management actions designed to prevent grizzly bear-human conflicts from occurring, land and wildlife managers need baseline information as to the types, causes, locations, and trends of conflict incidents. To address this need, we record all grizzly bear-human conflicts reported in the GYE annually. We group conflicts into 6 broad categories using standard definitions described by Gunther et al. (2000, 2001). To identify trends in areas with concentrations of conflicts, we calculated the 80% isopleth for the distribution of conflicts from the most recent 3-year period (2006–2008), using the fixed kernel estimator in the Animal Movements (Hooge and Eichenlaub 1997) extension for ArcView GIS (Environmental Systems Research Institute 2002).

The frequency of grizzly bear-human conflicts is inversely associated with the abundance of natural bear foods (Gunther et al. 2004). When native bear foods are of average or above average abundance there tend to be few grizzly bear-human conflicts involving property damage and anthropogenic foods. When the abundance of native bear foods is below average, incidents of grizzly bears damaging property and obtaining human foods and garbage increase, especially during late summer and fall when bears are hyperphagic (Gunther et al. 2004). Livestock depredations tend to occur independent of the availability of natural bear foods (Gunther et al. 2004). In 2008, the number of winter-killed ungulate carcasses were above average in both thermally influenced ungulate winter ranges and on the Northern Ungulate Winter Range (see Spring Ungulate Availability) during early spring. Unusually persistent snow cover delayed spring green-up resulting in low abundance of vegetal bear foods during late spring, estrus and early-hyperphagia. In addition, very few spawning cutthroat trout were observed in monitored tributary streams of Yellowstone Lake (see Spawning Cutthroat Trout) during estrous. Many grizzly bears were observed at high elevation army cutworm moth aggregation sites (see Grizzly Bear Use of Insect Aggregation Sites) once snow had melted off of the talus slopes. During late hyperphagia, whitebark pine seed production was poor throughout most of the ecosystem (see Whitebark Pine Cone Production). However, berry production was noticeably good for the GYE during September. The high number of bear-human conflicts and human-caused bear mortalities in October suggest that preferred high quality bear foods were scarce at that time.

There were 190 grizzly bear-human conflicts reported in the GYE in 2008 (Table 25, Fig. 15). These incidents included bears obtaining anthropogenic foods (38%, n = 72), killing livestock (35%, n = 67), damaging property (20%, n = 38), obtaining vegetables and fruit from gardens and orchards (4%, n = 7), and injuring people (3%, n = 6). Most (58%, n = 111) conflicts occurred on private land in the states of Wyoming (30%, n = 57), Montana (21%, n = 42), and Idaho (6%, n = 12). Forty-two percent (n = 79) of the conflicts occurred on public land administered by the U.S. Forest Service (36%, n = 68) and National Park Service (6%, n = 11). Most (74%, n = 140) of the bear-human conflicts in 2008 occurred inside of the PCA. Twenty-five percent (n = 48) of the bear-human conflicts occurred outside of the PCA. The number of incidents of grizzly bear-human conflict in 2008 were similar to the long-term averages recorded from 1992–2007 (Table 26).

The conflict distribution map constructed using the fixed kernel 80% conflict distribution isopleths, identified 5 areas where most grizzly bear-human conflicts in the GYE occurred over the last 3 years (Fig. 16). These 5 areas contained 406 (75%) of the 539 conflicts that occurred from 2006–2008. The 5 areas where most conflicts occurred included: 1) the Gardiner Basin area; 2) the area encompassing the Clarks Fork River, Crandall Creek, Sunlight Creek, and the North and South Forks of the Shoshone River; 3) the Wood River/Cottonwood Creek/Grass Creek drainages, 4) the Green River/Dunoir Creek drainages, and 5) the area encompassing West Yellowstone

and Island Park. These 5 areas should receive consideration when allocating state, federal, and private resources available for reducing grizzly bear-human conflicts in the GYE.

Grizzly bear habitat under different ownership and land management mandates exhibited different types of bear-human conflicts in 2008. On private land, incidents of property damage and bears obtaining anthropogenic foods (garbage, grain, bird seed) were the most common (80%, 89 of 111) type of grizzly conflict reported. On lands managed by the U.S. Forest Service, cattle depredations were the most common (77%, 52 of 68) type of conflict. On lands under National Park Service jurisdiction, there were very few grizzly bear-human conflicts of any type (n = 11), but habituation of bears to people was a significant management challenge. In Grand Teton National Park (GTNP), the number of incidents where habituated bears frequented roadside meadows and the outskirts of developments continued to increase in 2008. GTNP staff managed visitors and bears at 122 grizzly bear-jams in 2008. In YNP, the number of bear-jams was among the highest recorded since major changes in bear management were implemented in 1970. There were 298 grizzly bear-jams reported in YNP in 2008. In both parks, a significant amount of staff time was spent managing habituated bears and the visitors that want to view and photograph habituated bears that feed on native foods in roadside meadows.

Table 25. Number of incidents of grizzly bear-human conflicts reported within different land ownership areas in the Greater Yellowstone Ecosystem, 2008.

Land owner[a]	Property damages	Anthropogenic foods	Human injury	Gardens/ Orchards	Beehives	Livestock depredations	Total Conflicts
ID-private	0	12	0	0	0	0	12
ID-state	0	0	0	0	0	0	0
MT-private	12	24	0	5	0	1	42
MT-state	0	0	0	0	0	0	0
WY-private	14	28	0	2	0	13	57
WY-state	0	0	0	0	0	0	0
BLM	0	0	0	0	0	0	0
BDNF	0	0	0	0	0	0	0
BTNF	1	2	0	0	0	24	27
CNF	0	0	0	0	0	0	0
CTNF	0	0	0	0	0	1	1
GNF	2	1	2	0	0	0	5
SNF	3	2	2	0	0	28	35
GTNP/JDR	1	0	0	0	0	0	1
YNP	5	3	2	0	0	0	10
Total	38	72	6	7	0	67	190

[a] BLM = Bureau of Land Management, BDNF = Beaverhead-Deerlodge National Forest, BTNF = Bridger-Teton National Forest, CNF = Custer National Forest, CTNF = Caribou-Targhee National Forest, GNF = Gallatin National Forest, GTNP/JDR = Grand Teton National Park/John D. Rockefeller, Jr. Memorial Parkway, ID = Idaho, MT = Montana, SNF = Shoshone National Forest, WY = Wyoming, YNP = Yellowstone National Park.

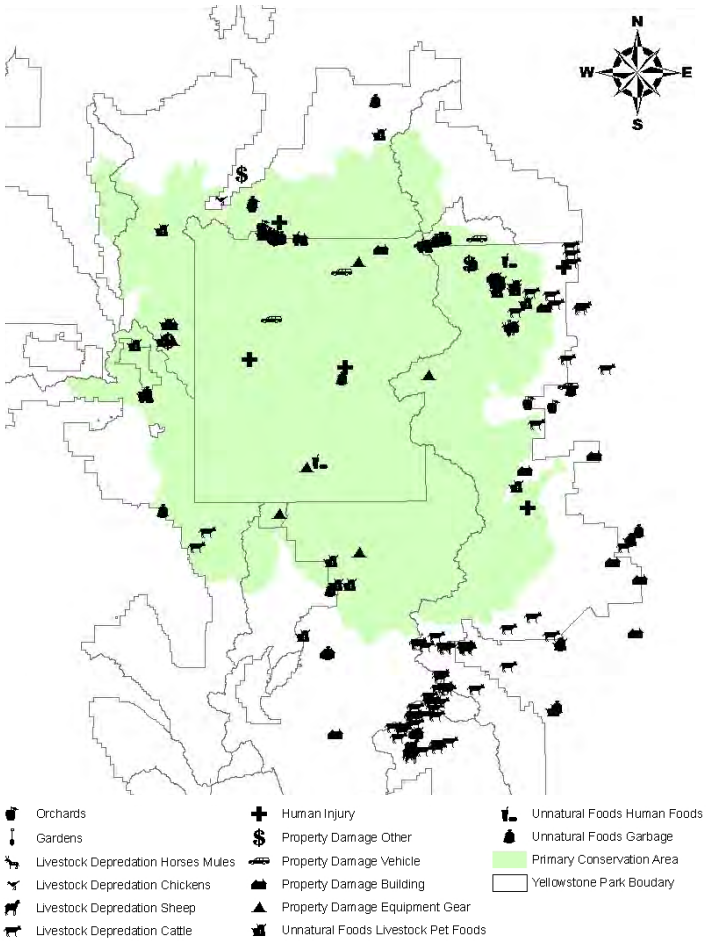

Fig. 15. Locations of different types of grizzly bear-human conflicts reported in the Greater Yellowstone Ecosystem in 2008. The shaded area represents the Greater Yellowstone Grizzly Bear Primary Conservation Area.

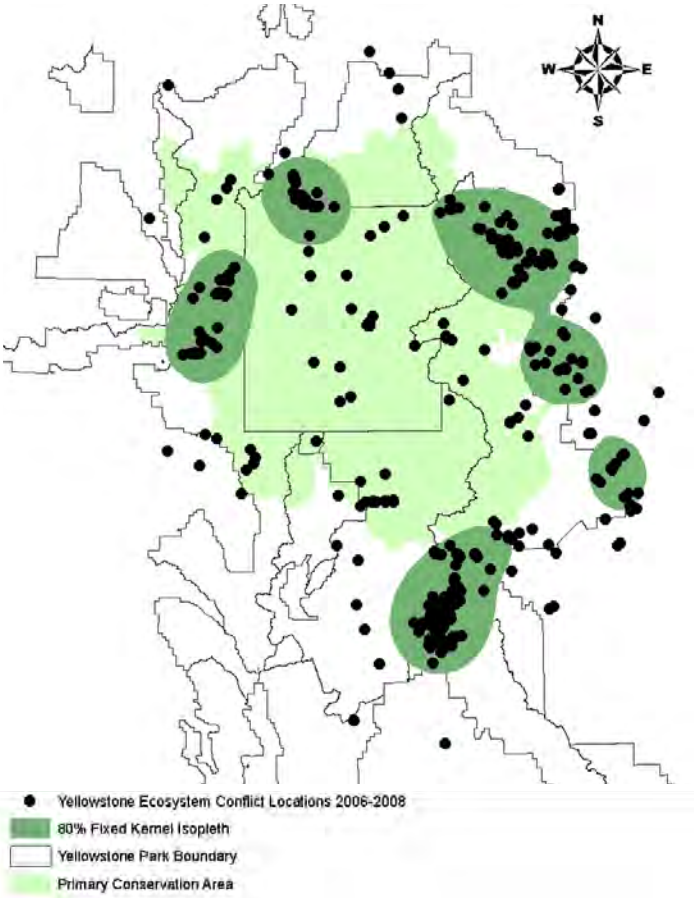

Fig. 16. Concentrations (dark shaded polygons) of grizzly bear-human conflicts that occurred from 2006–2008, identified using the 80% fixed kernel isopleth. The lightly shaded background area represents the Greater Yellowstone Grizzly Bear Primary Conservation Area.

Table 26. Comparison between the number of incidents of different types of grizzly bear-human conflicts in 2008 and the average annual number of conflicts recorded from 1992–2007 in the Greater Yellowstone Ecosystem.

Type of conflict	1992–2007 Average ± SD	2008
Human injury	4 ± 3	6
Property damage	20 ± 12	38
Anthropogenic foods	56 ± 39	72
Gardens/orchards	6 ± 5	7
Beehives	3 ± 4	0
Livestock depredations	51 ± 18	67
Total conflicts	139 ± 56	190

Literature Cited

Andrascik, R. 1992. Lake area-Bridge Bay spawning survey. Pages 29–35 *in* R. Andrascik, D.G. Carty, R.D. Jones, L.R. Kaeding, B.M. Kelly, D.L. Mahony, and S.T. Olliff. Annual project report for 1991, Fishery and Aquatic Management Program, Yellowstone National Park. U.S. Fish and Wildlife Service, Fisheries Assistance Office, Yellowstone National Park, Wyoming, USA.

Basile, J. 1982. Grizzly bear distribution in the Yellowstone area, 1973–79. Research Note INT-321. U.S. Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah, USA.

Blanchard, B. 1985. Field techniques used in the study of grizzly bears. Interagency Grizzly Bear Study Team report. National Park Service, Bozeman, Montana, USA.

Blanchard, B.M. 1987. Size and growth patterns of the Yellowstone grizzly bear. International Conference on Bear Research and Management 7:99–107.

Blanchard, B.M. 1990. Relationship between whitebark pine cone production and fall grizzly bear movements. Pages 362–363 *in* W.C. Schmidt and K.J. McDonald, compilers. Proceedings of symposium on whitebark pine ecosystems: ecology and management of a high-mountain resource. U.S. Forest Service General Technical Report INT-270. U.S. Department of Agriculture, Forest Service, Ogden, Utah, USA.

Blanchard, B., and R. Knight. 1991. Movements of Yellowstone grizzly bears, 1975–87. Biological Conservation 58:41–67.

Blanchard, B.M., and R.R. Knight. 1996. Effects of wildfire on grizzly bear movements and foraging strategies. Pages 117–122 *in* J.M. Greenlee, editor. Proceedings of the second biennial scientific conference on the Greater Yellowstone Ecosystem. International Association of Wildland Fire, Fairfield, Washington, USA.

Blanchard, B.M., R.R. Knight, and D.J. Mattson. 1992. Distribution of Yellowstone grizzly bears during the 1980s. American Midland Naturalist 128:332–338.

Burnham, K.P., and D.R. Anderson. 2002. Model selection and multimodel inference: a practical information-theoretic approach. Second edition. Springer-Verlag, New York, New York, USA.

Chao, A. 1989. Estimating population size for sparse data in capture-recapture experiments. Biometrics 45:427–438.

Cherry, S., M.A. Haroldson, J. Robison-Cox, and C.C. Schwartz. 2002. Estimating total human-caused mortality from reported mortality using data from radio-instrumented grizzly bears. Ursus 13:175–184.

Cherry, S., G.C. White, K.A. Keating, M.A. Haroldson, and C.C. Schwartz. 2007. Evaluating estimators for numbers of females with cubs-of-the-year in the Yellowstone grizzly bear population. Journal of Agricultural, Biological, and Environmental Statistics 12(2):195–215.

Cole, G.F. 1971. An ecological rationale for the natural or artificial regulation of native ungulates in parks. Transactions of the North American Wildlife and Natural Resources Conference 36:417–425.

Craighead, J.J., K.R. Greer, R.R. Knight, and H.I. Pac. 1988. Grizzly bear mortalities in the Yellowstone Ecosystem, 1959–1987. Report of the Montana Department of Fish, Wildlife and Parks; Craighead Wildlife Institute; Interagency Grizzly Bear Study Team; and National Fish and Wildlife Foundation.

Craighead, J.J., J. Sumner, and J.A. Mitchell. 1995. The grizzly bears of Yellowstone: their ecology in the Yellowstone ecosystem, 1959–1992. Island Press, Washington, D.C., USA.

Eberhardt, L.L. 1995. Population trend estimates from reproductive and survival data. Pages 13–19 *in* R.R. Knight and B.M. Blanchard, authors. Yellowstone grizzly bear investigations: report of the Interagency Study Team, 1994. National Biological Service, Bozeman, Montana, USA.

Eberhardt, L.L., B.M. Blanchard, and R.R. Knight. 1994. Population trend of Yellowstone grizzly bear as estimated from reproductive and survival rates. Canadian Journal of Zoology 72:360–363.

Environmental Systems Research Insitute. 2002. ArcView GIS. Version 3.3. Environmental Systems Research Institute, Inc., Redlands, California, USA.

Farnes, P.E. 1991. A scaled index of winter severity. 59th Proceedings of the Western Snow Conference, 12–15 April 1991, Juneau, Alaska, USA.

French, S.P., M.G. French, and R.R. Knight. 1994. Grizzly bear use of army cutworm moths in the Yellowstone ecosystem. International Conference on Bear Research and Management 9:389–399.

Green, G.I. 1994. Use of spring carrion by bears in Yellowstone National Park. Thesis, University of Idaho, Moscow, Idaho, USA.

Gunther, K.A., M.T. Bruscino, S. Cain, J. Copeland, K. Frey, M.A. Haroldson, and C.C. Schwartz. 2000. Grizzly bear-human conflicts confrontations, and management actions in the Yellowstone ecosystem, 1999. Pages 55–108 *in* C.C. Schwartz and M.A. Haroldson, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1999. U.S. Geological Survey, Bozeman, Montana, USA.

Gunther, K.A., M.T. Bruscino, S. Cain, J. Copeland, K. Frey, M.A. Haroldson, and C.C. Schwartz. 2001. Grizzly bear-human conflicts confrontations, and management actions in the Yellowstone ecosystem, 2000. Pages 64–109 *in* C.C. Schwartz and M.A. Haroldson, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2000. U.S. Geological Survey, Bozeman, Montana, USA.

Gunther, K.A., M.A. Haroldson, K. Frey, S.L. Cain, J. Copeland, and C.C. Schwartz. 2004. Grizzly bear-human conflicts in the Greater Yellowstone Ecosystem, 1992-2000. Ursus 15(1):10–24.

Haroldson, M.A., K.A. Gunther, D.P. Reinhart, S.R. Podruzny, C. Cegelski, L. Waits, T. Wyman, and J. Smith. 2005. Changing numbers of spawning cutthroat trout in tributary streams of Yellowstone Lake and estimates of grizzly bears visiting streams from DNA. Ursus 16(2):167–180.

Haroldson, M.A., M. Ternent, G. Holm, R.A. Swalley, S. Podruzny, D. Moody, and C.C. Schwartz. 1998. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1997. U.S. Geological Survey, Biological Resources Division, Bozeman, Montana, USA.

Harris, R.B., G.C. White, C.C. Schwartz, and M.A. Haroldson. 2007. Population growth of Yellowstone grizzlies: uncertainty, correlation, and future monitoring. Ursus 18(2):167–177.

Henry, J., and D.J. Mattson. 1988. Spring grizzly bear use of ungulate carcasses in the Firehole River drainage: third year progress report. Pages 51–59 *in* R.R. Knight, B.M. Blanchard, and D.J. Mattson, authors. Yellowstone grizzly bear investigations: annual report of the Interagency Study Team, 1987. National Park Service, Bozeman, Montana, USA.

Hooge, P.N., and B. Eichenlaub. 1997. Animal movement extension to ArcView. Version 1.1. Alaska Biological Science Center, U.S. Geological Survey, Anchorage, Alaska, USA.

Hoskins, W.P. 1975. Yellowstone Lake tributary study. Interagency Grizzly Bear Study Team unpublished report, Bozeman, Montana, USA.

Houston, D.B. 1982. The northern Yellowstone elk. Macmillan Publishing Company, New York, New York, USA.

Interagency Grizzly Bear Study Team. 2005. Reassessing methods to estimate population size and sustainable mortality limits for the Yellowstone grizzly bear. Interagency Grizzly Bear Study Team, U.S. Geological Survey, Northern Rocky Mountain Science Center, Montana State University, Bozeman, Montana, USA.

Interagency Grizzly Bear Study Team. 2006. Reassessing methods to estimate population size and sustainable mortality limits for the Yellowstone grizzly bear: workshop document supplement. Interagency Grizzly Bear Study Team, U.S. Geological Survey, Northern Rocky Mountain Science Center, Montana State University, Bozeman, Montana, USA.

Interagency Grizzly Bear Study Team. 2008. Reassessing methods to distinguish unique female grizzly bears with cubs-of-the-year in the Greater Yellowstone Ecosystem. Interagency Grizzly Bear Study Team, U.S. Geological Survey, Northern Rocky Mountain Science Center, Montana State University, Bozeman, Montana, USA.

Keating, K.A., C.C. Schwartz, M.A. Haroldson, and D. Moody. 2002. Estimating numbers of females with cubs-of-the-year in the Yellowstone grizzly bear population. Ursus 13:161–174.

Knight, R.R., B.M. Blanchard, and L.L. Eberhardt. 1995. Appraising status of the Yellowstone grizzly bear population by counting females with cubs-of-the-year. Wildlife Society Bulletin 23:245–248.

Knight, R.R., and L.L. Eberhardt. 1985. Population dynamics of Yellowstone grizzly bears. Ecology 66:323–334.

Knight, R.R., D.J. Mattson, and B.M. Blanchard. 1984. Movements and habitat use of the Yellowstone grizzly bear. Interagency Grizzly Bear Study Team report. National Park Service, Bozeman, Montana, USA.

Koel, T.M., J.L. Arnold, P.E. Bigelow, P.D. Doepke, B.D. Ertel, and D.L. Mahony. 2005*b*. Yellowstone Fisheries & Aquatic Sciences: Annual Report, 2004. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, USA.

Koel, T.M., J.L. Arnold, P.E. Bigelow, P.D. Doepke, B.D. Ertel, and M.E. Ruhl. In press. Yellowstone Fisheries & Aquatic Sciences: Annual Report, 2008. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, USA. YCR-NR-2008.

Koel, T.M., P.E. Bigelow, P.D. Doepke, B.D. Ertel, and D.L. Mahony. 2005*a*. Nonnative lake trout result in Yellowstone cutthroat trout decline and impacts to bears and anglers. Fisheries 30(11):10–19.

Koel, T.M., D.L. Mahony, K.K. Kinnan, C. Rasmussen, C.J. Hudson, S. Murcia, and B.L. Kerans. 2006. *Myxobolus cerebralis* in native cutthroat trout of the Yellowstone Lake ecosystem. Journal of Aquatic Animal Health 18:157–175.

Mattson, D.J. 1997. Use of ungulates by Yellowstone grizzly bears *Ursus arctos*. Biological Conservation 81:161–177.

Mattson, D.J., B.M. Blanchard, and R.R. Knight. 1991*a*. Food habits of Yellowstone grizzly bears. Canadian Journal of Zoology 69:1619–1629.

Mattson, D.J., B.M. Blanchard, and R.R. Knight. 1992. Yellowstone grizzly bear mortality, human-habituation, and whitebark pine seed crops. Journal of Wildlife Management 56:432–442.

Mattson, D.J., C.M. Gillin, S.A. Benson, and R.R. Knight. 1991*b*. Bear feeding activity at alpine insect aggregation sites in the Yellowstone ecosystem. Canadian Journal of Zoology 69:2430–2435.

Mattson, D.J., and D.P. Reinhart. 1995. Influences of cutthroat trout (*Oncorhynchus clarki*) on behavior and reproduction of Yellowstone grizzly bears (*Ursus arctos*), 1975-1989. Canadian Journal of Zoology 73:2072–2079.

Mealey, S.P. 1975. The natural food habits of free ranging grizzly bears in Yellowstone National Park, 1973–1974. Thesis, Montana State University, Bozeman, Montana, USA.

Mealey, S.P. 1980. The natural food habits of grizzly bears in Yellowstone National Park, 1973–74. International Conference on Bear Research and Management 4:281–292.

Olliff, S.T. 1992. Grant Village spawning stream survey. Pages 36–43 *in* R. Andrascik, D.G. Carty, R.D. Jones, L.R. Kaeding, B.M. Kelly, D.L. Mahony, and S.T. Olliff. Annual project report for 1991, Fishery and Aquatic Management Program, Yellowstone National Park. U.S. Fish and Wildlife Service, Fisheries Assistance Office, Yellowstone National Park, Wyoming, USA.

Pritchard, G.T., and C.T. Robbins. 1990. Digestive and metabolic efficiencies of grizzly and black bears. Canadian Journal of Zoology 68:1645–1651.

Reinhart, D.P. 1990. Grizzly bear habitat use on cutthroat trout spawning streams in tributaries of Yellowstone Lake. Thesis, Montana State University, Bozeman, Montana, USA.

Reinhart, D.P., and D.J. Mattson. 1990. Bear use of cutthroat trout spawning streams in Yellowstone National Park. International Conference on Bear Research and Management 8:343–350.

Schwartz, C.C., M.A. Haroldson, and S. Cherry. 2006*a*. Reproductive performance of grizzly bears in the Greater Yellowstone Ecosystem, 1983–2002. Pages 17–24 *in* C.C. Schwartz, M.A. Haroldson, G.C. White, R.B. Harris, S. Cherry, K.A. Keating, D. Moody, and C. Servheen, authors. 2006. Temporal, spatial and environmental influences on the demographics of grizzly bears in the Greater Yellowstone Ecosystem. Wildlife Monographs 161:1–68.

Schwartz, C.C., M.A. Haroldson, S. Cherry, and K.A. Keating. 2008. Evaluation of rules to distinguish unique female grizzly bears with cubs in Yellowstone. Journal of Wildlife Management 72(2):543–554.

Schwartz, C.C., M.A. Haroldson, and G.C. White. 2006*b*. Survival of cub and yearling grizzly bears in the Greater Yellowstone Ecosystem, 1983–2001. Pages 25–31 *in* C.C. Schwartz, M.A. Haroldson, G.C. White, R.B. Harris, S. Cherry, K.A. Keating, D. Moody, and C. Servheen, authors. 2006. Temporal, spatial and environmental influences on the demographics of grizzly bears in the Greater Yellowstone Ecosystem. Wildlife Monographs 161:1–68.

Schwartz, C.C., S.D. Miller, and M.A. Haroldson. 2003. Grizzly bear. Pages 556–586 *in* G.A. Feldhammer, B.C. Thompson, and J.A. Chapman, editors. Wild Mammals of North America: biology, management, and conservation. Second edition. The John Hopkins University Press, Baltimore, Maryland, USA.

Seber, G.A.F. 1982. The estimation of animal abundance and related parameters. Macmillian Publishing Company, Incorporated, New York, New York, USA.

Ternent, M., and M. Haroldson. 2000. Grizzly bear use of insect aggregation sites documented from aerial telemetry and observations. Pages 36–39 *in* C.C. Schwartz and M.A. Haroldson, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1999. U.S. Geological Survey, Bozeman, Montana, USA.

U.S. Fish and Wildlife Service. 2007*a*. Final Rule designating the Greater Yellowstone Area population of grizzly bears as a Distinct Population Segment and removing the Yellowstone Distinct Population Segment of grizzly bears from the Federal List of Endangered and Threatened Wildlife. 72 FR 14866. Available at http://www.fws.gov/mountain-prairie/species/mammals/grizzly/FR_Final_YGB_rule_03292007.pdf.

U.S. Fish and Wildlife Service. 2007*b*. Grizzly Bear Recovery Plan Supplement: revised demographic criteria for the Yellowstone Ecosystem. 72 FR 11377. Available at http://www.fws.gov/mountain-prairie/species/mammals/grizzly/Grizzly_bear_Recovery_Plan_supplement_demographic.pdf.

U.S. Fish and Wildlife Service. 2007*c*. Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area. Available at http://www.fws.gov/mountain-prairie/species/mammals/grizzly/Final_Conservation_Strategy.pdf.

Wilson, R.M., and M.F. Collins. 1992. Capture-recapture estimation with samples of size one using frequency data. Biometrika 79:543–553.

Bear tracks and digs in Pelican Valley, 10 May 2006. Photo courtesy of Steve Ard

2008 Annual Progress Report

Jennifer Fortin
Washington State University

Title: Assessing habitat and diet selection for grizzly (*Ursus arctos*) and American black bears (*Ursus americanus*) in Yellowstone National Park

Introduction: A broad study of grizzly (*Ursus arctos*) and black bears (*Ursus americanus*) using the area around Yellowstone Lake was initiated in the fall of 2006. The purpose of this 3-year study is to determine if spawning cutthroat trout (*Oncorhynchus clarkii*) continue to be an important food for bears, or if the trout population has declined to the level that bears no longer use this resource. If trout are no longer a food resource, we want to determine what geographical areas and foods the bears are using and if those foods are an adequate replacement to maintain a healthy population of grizzly bears.

Capture and collaring: Bears were trapped around Yellowstone Lake during the fall of 2006 and early summer and fall of both 2007 and 2008. Sixteen grizzly bears (6 females and 10 males) and six male black bears have been captured and fitted with Spread Spectrum Technology (SST) Global Positioning System (GPS) collars.

Telemetry results: Nine grizzly bears (5 female and 4 male) and five male black bears were radio tracked during this year's field season (13 May–19 Oct 2008). Approximately 28,480 GPS locations were recorded by these collars during the 2008 field season. Two male grizzly bears, #568 and #570, captured in the fall of 2007 dropped their collars in the early spring of 2008 and collars were retrieved. Male grizzly bear 574's collar fell off prematurely on 21 July 2008. Female grizzly bear 541's collar fell off prematurely on 30 May and she was recollared on 22 July 2008. Male grizzly bear 585 died of natural causes on 12 August 2008 and female grizzly bear 149 also died of natural causes around 17 October 2008. Female grizzly #559's collar "released" as programmed on 1 September 2008. All collars were retrieved. Six grizzly bears (2 female and 4 male) and five male black bears will continue to wear their collars through the 2009 field season. Female grizzly bear 559 had one two year old in the spring of 2008.

Site visits: Four crews of two persons each (2 graduate students along with 6 volunteers) were employed for the 2008 field season. The field crews visited GPS locations to record bear activity, including habitat and dietary item use. We visited 1,416 GPS locations at which we collected 87 hair samples, 252 fecal samples, and forage samples. Of these sites, 529 were Level 1 only in their analysis, 887 continued to Level 2 analysis, and 167 to Level 3 analysis. All data was entered into an Access database.

Level 2 site visits that included feeding consisted of carcasses, insects, roots, false-truffles, and nuts. Carcasses consisted of 11 elk (*Cervus elaphus*), 4 bison (*Bison bison*) and 1 black bear (*Ursus americanus*). Insect sites consisted of 109 ant hills or log tears, 47 yellow jacket nests, 5 bee nests, and 56 other insect and/or earthworms sites. Roots were mainly yampa (*Perideridia gairdnerii*) at 57 sites with 7 biscuit root (*Lomatium* spp.). There were 65 fungi sites (*Rhizopogon* spp.), 10 rodent caches, and 5 whitebark pine (*Pinus albicaulis*) nut middens. It was a poor whitebark pine cone year with counts averaging 8.6 cones/tree in the Greater Yellowstone Ecosystem.

Level 3 foraging or grazing sites were composed of all three categories: graminoids, forbs, and berries. Graminoid site visits included: 32 rye grass (*Elymus* spp.), 17 bluegrass (*Poa* spp.), 12 each of bluejoint reedgrass (*Calamagrostis canadensis*), timothy (*Phleum* spp.) and onion grass (*Melica* spp.), 10 sedge (*Carex* spp.), 6 fescue (*Festuca* spp.), and 2 wheatgrass (*Agropyron* spp.). The dominant forbs at site visits were elk thistle (*Cirsium scariosum*) at 37 and dandelion (*Taraxacum* spp.) at 32. Other forbs used were: 19 of

both fireweed (*Epilobium* spp.) and clover (*Trifolium* spp.), 9 lousewort (*Pedicularis* spp.), 4 of both licorice root (*Osmorhiza* spp.) and bistort root (*Polygonum bistortoides*), 3 both of angelica (*Angelica*) and sticky geranium (*Geranium viscosissimum*), 2 each of chives (*Allium* spp.), fern-leaved lovage (*Ligusticum filicinum*), arrowleaf balsamroot (*Balsamorhiza sagittata*) and horsetail (*Equisetum arvense*), and 1 each of pondweed (*Potamogeton*), meadow buttercup (*Ranunculus acris*), goat's beard (*Tragopogon* spp.), viola (*Viola* spp.) and common sowthistle (*Sonchus oleraceus*). Berry production was good in 2008 with use composed of: 32 globe huckleberry (*Vaccinium membranaceum*), 15 grouse whortleberry (*Vaccinium scoparium*), 11 elderberry (*Sambucus racemosa*), 3 buffaloberry (*Shepherdia canadensis*), and 1 each of dwarf huckleberry (*Vaccinium caespitosum*) and gooseberry (*Ribes* spp.).

Hair snares: Forty-eight hair snares were deployed on 35 streams on Yellowstone Lake. Hair snares were visited bi-weekly from mid-May through mid-August during which time 419 hair samples were collected. Stream surveys for spawning cutthroat trout were conducted in conjunction with hair snare visits. During stream surveys 14 hair samples and 34 fecal samples were collected. Of the 35 streams surveyed, 14 contained spawning cutthroat and 21 contained fry and/or fingerlings during at least one stream survey. Maximum number of cutthroat trout spawners seen during one stream survey was 15. Fry and/or fingerling counts were often estimated to be several hundred. One incident of fishing by bears was observed. All data was entered into an Access database.

2007 Hair Snare Results: In 2007, 761 hair samples were collected at hair snag corrals (n = 48) located along tributary streams of Yellowstone Lake from May to August. 438 samples were sent to Wildlife Genetics International (WGI) for genetic analyses. 371 (85%) of these samples were assigned to individual bears using a suite of seven microsatellite loci (observed heterozygosity, H_o, across seven loci = 0.743). From this assignment, we now know at least 40 grizzly bears (25 male : 15 female) and 16 black bears (11 male:5 female) visited tributary stream courses during this time. Of those bears identified, 8 black bears (50%) and 14 (35%) grizzly bears visited streams located near human development (front-country).

Sixteen of the 438 (3.7%) samples analyzed were blind positives from a captive population of grizzly bears at Washington State University (WSU). WGI correctly matched replicate samples of six individual bears from this facility. Further, the team of geneticists matched two of the blind samples to an actual bear (Star) whose genotype they had obtained during WGI's analysis of samples from the Northern Continental Divide Ecosystem (NCDE). Star became a member of the WSU colony after removal from the NCDE. Through the use of parentage techniques, WGI technicians also gained reason to believe that two bears within the dataset were putative offspring of Star and a male from the Greater Yellowstone Ecosystem (GYE). Their conjecture was correct, as WSU personnel provided the hair of two cubs from a cross between Star and a captive male from the GYE.

2008 Wyoming Bear Wise Community Project Update

Tara Hodges, Bear Wise Community Coordinator
Tara.Hodges@wgf.state.wy.us
Wyoming Game and Fish Department
2820 State Highway 120
Cody, WY 82414

Mike Boyce, Bear Management Specialist
Michael.Boyce@wgf.state.wy.us
Wyoming Game and Fish Department
420 North Cache
Jackson, WY 83001

Introduction

The Bear Wise Community program is an innovative, proactive initiative that seeks to minimize human/bear conflicts, minimize management-related bear mortalities associated with preventable conflicts, and to safeguard human communities in northwest Wyoming. The overall objective of the program is to promote individual and community ownership of the ever-increasing human-bear conflict issue and eventually, create a social conscience regarding responsible attractant management. What's more, this project will raise awareness and proactively influence local waste management infrastructures with the specific intent of preventing conflicts from recurring. Strategies used to meet the campaign's objectives are: 1) minimize accessibility of unnatural attractants to bears in developed areas; 2) employ a public outreach and education campaign to reduce knowledge gaps about bears and the causes of conflicts; and 3) employ a bear resistant waste management system and promote bear-resistant waste management infrastructure.

This report provides a summary of program accomplishments in 2008. Progress and past accomplishments are reported in the 2007 annual report of the Interagency Grizzly Bear Study Team (IGBST) (Hodges and Bruscino 2008).

Background

In 2004, a subcommittee of the IGBST conducted an analysis of the causes and spatial distribution of grizzly bear (*Ursus arctos*) mortalities and conflicts in the Greater Yellowstone Area (GYA) during the period of 1994–2003. The analysis identified that the majority of known, human-caused bear mortalities occurred due to agency management actions in response to conflicts (34%), self defense killings, primarily by ungulate hunters (20%), and vandal killings (11%). The report made 33 recommendations to reduce human-grizzly bear conflicts and mortalities with focus on three actions that could be positively influenced by agency resources and personnel: 1) reduce conflicts at developed sites; 2) reduce self-defense killings; and 3) reduce vandal killings (Servheen et al. 2004).

To address action number one, the committee recommended that a demonstration area be established to focus proactive, innovative, and enhanced management strategies where developed site conflicts and agency management actions resulting in relocation or removal of bears had historically been high. Spatial examination of conflicts identified the Wapiti area in northwest Wyoming as having one of the highest concentrations of black bear (*Ursus americanus*) and grizzly bear conflicts in the GYA. The North Fork of the Shoshone River drainage west of Cody was then chosen as the first area composed primarily of private land to have a multi-agency/public approach to reducing conflicts at developed sites.

In 2005, the Wyoming Game & Fish Department (WGFD) began implementation of the Bear Wise Community program. Although the program's efforts were focused primarily in the Wapiti area, the WGFD also initiated a smaller scale project in Teton County to address the increasing number of black and grizzly bear conflicts in the Jackson area.

For the last three years, the Bear Wise Community programs in both Cody and Jackson have deployed a multi-facetted education and outreach campaign in an effort to minimize human-bear conflicts and promote proper attractant management. Although a wide array of challenges remain and vary between communities, many accomplishments have been made, and significant progress is expected to continue as Bear Wise efforts gain momentum.

Wapiti Project Update

The Wapiti Bear Wise Community program is at the end of the third year since implementation. Thus far, the program has utilized radio and television advertisements, newspaper and magazine articles, public workshops and programs, contact with youth organizations such as the Boy Scouts, 4H, and public schools, mass mailings, and the use of signing on private and public land to convey the educational messages surrounding human-bear conflict prevention. To compliment the educational initiatives, the program also uses an extensive outreach campaign that assists the community in obtaining and utilizing bear-resistant products and alternative methods of attractant management. Efforts and accomplishments for 2008 are as follows:

Ongoing Efforts:

1. In 2007, over 100 95-gallon bear resistant garbage carts were purchased with grant funding. The carts are offered to community members for the reduced price of $49.99. To date, 75 carts have been placed and 40 more are in stock and available to the public.

2. Partnership with the North Fork Bear Wise Group continues. The group, comprised of five local Wapiti citizens, meets monthly to articulate community needs and assist in the development of educational and outreach initiatives.

3. Continue to maintain three educational "Bear Aware" kiosks located in Wapiti and the Crandall/Sunlight area north of Cody. Message boards and literature are updated and revised four times during the non-denning season.

4. Public libraries across northwest Wyoming continue to offer *Staying Safe in Bear Country* and *Living in Bear Country* DVD's or videos and the *Living in Bear Country* book by Linda Masterson that the Bear Wise Community program purchased and donated in 2006.

5. Bear Aware tips were included in the local Wapiti School calendar for the third consecutive year. Tips contain seasonally appropriate messages regarding bear behavior/biology and conflict prevention. The calendar is sold to local Wapiti residents as a school fundraiser each fall.

6. Bear Aware information is included in the "Welcome Wagon" gift bags put together by local businesses for new residents.

New Initiatives and Accomplishments:

1. A Bear Aware highway billboard was designed, purchased, and posted in 2008. The billboard is located on Highway 14-16-20 (North Fork Highway) in Wapiti and features a message that encourages residents to secure attractants so they are unavailable to bears (Figure 1).

Figure 1. North Fork highway informational billboard located on Highway 14-16-20 in Wapiti, Wyoming.

2. Seven "Bear Use Area" highway signs were posted in the spring of 2008. Two are located on the North Fork Highway in Wapiti and five on the Chief Joseph Highway north of Cody (Figure 2).

Figure 2. One of seven "Bear Use Area" signs posted throughout Wapiti and the Crandall/Sunlight area in Park County, Wyoming.

3. Over 30 presentations, workshop, and talks were given regarding human-bear conflict prevention to audiences including, but not limited to Wapiti, Eastside, Sunset, and Valley Elementary Schools, Girl Scouts, 4H, Park County Commissioners, Living on a Few Acres Seminar, Crandall community residents, Sportsman for Fish and Wildlife, and the Cody Optimists Club.

4. Hosted second annual Bear Aware Day event at the Wapiti school. Eighty students from three elementary schools participated and had the opportunity to learn a variety of skills including how to hang a bird feeder in bear country and how to behave in an encounter with a bear.

5. Implementation of the Carcass Management Program began in June 2008. The Carcass Management Program is a domestic livestock carcass removal service offered to livestock producers located in occupied grizzly bear habitat within Park County, Wyoming. The program offers an alternative to the use of on-site carcass dumps, which are a significant bear attractant and indirectly contribute to numerous human-bear conflicts.

6. Purchased and placed 20 bear-resistant grain storage barrels within the community.

7. Provided a Crandall area campground and restaurant with seven bear-resistant mailbox drop type garbage cans.

8. Provided recommendations concerning storage of garbage and other attractants for new development in occupied bear habitat to the Park County Planning and Zoning Commission. The Coordinator reviews developments on a case-by-case basis and attends monthly meeting. To date, these recommendations have been adopted as a condition of approval for six new developments within Park County.

9. Bear Aware information was included in the *Cody Relocation Guide* published by the Cody Chamber of Commerce. The full page of information is displayed in color and was included in the publication without charge. The *Guide* is produced for the purpose of conveying local information to non-residents interested in relocating to the Cody area.

10. Worked with the Outfitters and Guides Association and the Wild Sheep Foundation to produce and air two "Hunting Safely in Bear Country" public service announcements. The ads were aired on three local radio stations for four weeks in September 2008 immediately before the opening of the elk rifle season.

11. Worked with students from the Wapiti school to record a public service announcement regarding proper attractant management. The message aired for three weeks on two local radio stations in October 2008.

12. The Bear Wise Community program expanded in 2008 to include the Crandall/ Sunlight area north of Cody.

Objectives for 2009 include expansion of the program into the South Fork area southwest of Cody, development of an interactive Bear Aware traveling display for use by education institutions and libraries across northwest Wyoming, refocusing waste management efforts in Wapiti, and the development of a short Be Bear Aware and conflict avoidance DVD for children.

Although the Bear Wise Community program in Wapiti has made great strides in recent years, challenges remain. In Park County, there are no ordinances or laws prohibiting the feeding of bears or requiring that attractants be stored unavailable to bears. The Bear Wise Community program relies on voluntary compliance through educational efforts designed to discourage residents from feeding or attracting bears. The rural sections of Park County also lack organized groups, such as homeowner's associations, and have a large number of summer-only residents, limiting educational opportunities and contact with this portion of the community. Lastly, the past several years have been very inactive in terms of bear conflicts in the community of Wapiti. In fact, there were only five human-bear conflicts in Wapiti last year that were associated with bears receiving food rewards at developed sites. The lack of bear activity has resulted in complacency and lack of interest by some residents.

Jackson Hole Project Update

In 2008, the Bear Wise Jackson Hole program focused its public outreach efforts on education, signage, distribution of informational pamphlets, personal contacts, distribution of bear resistant garbage carts, and implementing the recently adopted Teton County "Bear Conflict Mitigation and Prevention" Land Development Regulation (LDR).

1. In 2007, WGFD staff developed a series of recommendations that would require private property owners within Teton County to store garbage and other attractants unavailable to bears. In April 2008, the Teton County Commissioners adopted these recommendations in the form of a LDR. The regulation requires that all residents and businesses within identified high conflict priority areas must store garbage and birdseed unavailable to bears. Sections of Teton County in phase one must comply by 1 July 2009, and other areas of the county in phase two must comply by 1 July 2010.

2. The WGFD worked closely with the Jackson Hole Wildlife Foundation on the sales and distribution of bear resistant garbage carts, which were made available to the public at a reduced cost. To date, 61 cans have been placed and 189 are in stock.

3. Numerous public service announcements (PSAs) were broadcast on four local radio stations for a total of eight weeks in duration. These announcements focused on storing attractants unavailable to bears and hunting safely in bear country.

4. Educational talks were presented to various groups including Moran and Teton Village residents, Jackson Hole Backcountry Horsemen, Boy Scouts, Girl Scouts, and school groups.

5. Numerous personal contacts were made with private residents in Teton County. This has proven to be a useful way to establish working relationships with residents and maintain an exchange of information about bear activity in specific areas.

6. Booths containing information on bear identification, attractant storage, hunting and recreating safely in bear country, and properly using bear spray, were manned at the Jackson Hole Antler Auction and the Teton Science School's annual Science Fair.

7. Assisted two hunting outfitters and the Teton Science School with the installation and maintenance of electric fence systems around their field camps located in the Bridger-Teton National Forest.

8. Signage detailing information on hunting safely in bear country, recent bear activity, and proper attractant storage were placed at trailheads and entrances to residential areas throughout Teton County.

9. Consultations were conducted at multiple businesses and residences where recommendations were made regarding sanitation infrastructure and compliance with the Bear Conflict Mitigation and Prevention LDR.

Objectives for the Bear Wise Jackson Hole program in 2009 are focused on supporting Teton County and local waste management companies with projects that will help disseminate information and achieve compliance of the recently adopted Teton County Bear Conflict Mitigation and Prevention LDR. Specific objectives are as follows:

1. Develop, print, and distribute informational pamphlets containing information on responsible attractant management and the new Bear Conflict Mitigation and Prevention LDR.

2. Develop and place an “insert” in the Jackson Hole News and Guide detailing how to comply with the LDR.

3. Develop and post signage detailing the LDR. Signage will be placed in key locations throughout Teton County.

4. Develop, produce, and distribute Spanish language information pamphlet containing information on attractant storage in order to reach specific demographic segments of the Jackson community. The Teton County Latino Resource Center will be utilized to help distribute this information.

5. Develop and air public service announcements about the Bear Conflict Mitigation and Prevention LDR on local radio and television media outlets.

6. Work with local businesses to get bear resistant garbage carts distributed at retail locations.

The recent adoption and upcoming implementation of the Teton County Bear Conflict Mitigation and Prevention LDR will greatly reduce the amount of available attractants on the landscape and is a tremendous step forward for the Bear Wise Jackson Hole program. The new challenges that we face will be achieving full compliance with the county LDR from the residents of Teton County. Bear Wise Jackson Hole will convey the importance of compliance and offer ways to help residents comply through public outreach and education projects.

In order for the Jackson program to be successful, the program must continually identify information and education needs within the community while being adaptive to changing situations across different geographic areas. This will require us to coordinate with other government agencies and local non-government organizations working across multiple jurisdictions to develop a uniform and consistent message. If we achieve this level of coordination, we will be more effective in gaining support and building enthusiasm for Bear Wise Jackson Hole, directing resources to priority areas, and reaching all demographics.

References

Hodges, T., and M. Bruscino. 2008. 2007 Wapiti and Jackson Hole Bear Wise Community Projects update. Pages 111-114 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone Grizzly Bear Investigations: annual report of the Interagency Grizzly Bear Study Team, 2007. U.S. Geological Survey, Bozeman, Montana, USA.

Servheen, C., M. Haroldson, K. Gunther, K. Barber, M. Bruscino, M. Cherry, B. DeBolt, K. Frey, L. Hanauska-Brown, G. Losinski, C. Schwartz, and B. Summerfield. 2004. Yellowstone mortality and conflicts reduction report: presented to the Yellowstone Ecosystem Subcommittee (YES) 7 April 2004.

2008 Wind River Indian Reservation Grizzly Bear Camera Study

Prepared by: Samuel T. Lockwood, Lee I. Knox, Daniel D. Bjornlie, and Daniel J. Thompson

Wyoming Game and Fish Department
Trophy Game Section - Management/Research Branch

September 2008

INTRODUCTION

Recently there have been an increased number of grizzly bear (*Ursus arctos*) sightings reported in the Northern Wind River Range in central Wyoming, especially within the boundaries of the Wind River Indian Reservation (WRIR). Due to the topographically diverse and heavily timbered habitat associated with the region within the reservation, documentation of grizzly bears by aerial surveys is very difficult. Therefore we used remote cameras to document the presence/absence of grizzly bears within the WRIR (Barr et al. 2007).

Previous research validated the use of remote sensing cameras to document grizzly bear presence and probability of detection in forested regions of Wyoming (Barr et al. 2007, Wyoming Game and Fish Department [WGFD] 2008). Our objective was to determine if grizzly bears inhabited the southwestern portion of the WRIR. The region studied is at the southern edge of known grizzly bear distribution in Wyoming and therefore paramount in gaining a better working knowledge of their distribution and abundance throughout the ecosystem.

STUDY AREA

The study area was located in the southwestern corner of the WRIR, from Bull Lake to the Dinwoody Rim (Figure 1). The Wind River Indian Reservation includes both the Shoshone and Arapahoe tribes and wildlife species are managed in a joint effort between the tribes with assistance from the U.S. Fish and Wildlife Service.

We placed cameras in four sections of the study area; Willow Creek /Crow Mountain, Kirkland Park/ South Fork of Willow Creek, Bold Mountain, and Bob's Creek/Bob's Lake. Sites ranged in elevation from 7,643 ft (2,330 m) to 10,513 ft (3,204 m). Vegetative communities varied from stands of lodgepole pine (*Pinus contorta*), mixed conifers consisting of lodgepole pine, subalpine fir (*Pseudotsuga menziesii*), dispersed whitebark pine (*Pinus albicaulis*) and aspen (*Populus tremuloides*), and stands of whitebark pine at the higher elevation sites. We also had sites located at the edge of large open meadows containing various species of grasses and forbs, and along riparian areas containing sedges (*Carex* spp.) and willows (*Salix* spp.).

METHODS

We modified the original camera study methods (Barr et al. 2007, WGFD 2008) to better suit this area. In order to increase statistical rigor of the study, a 3 km x 3 km camera grid was created using ArcGIS. Grid cells with no suitable habitat for placement of cameras were removed. In the remaining grid cells a camera site was placed within the grid. Camera sites were chosen based on the probability that bears would use the area, with input from the tribal game wardens and by using natural wildlife corridors (i.e., drainages and game trails) (Figure 1). Each camera site consisted of two cameras and was checked once a week to replace memory cards and the blood lure if needed (Anderson and Haroldson 1997). Date, time, photo number, camera number, number of individuals, and unique characteristics of each individual (size, color, and markings) were recorded at each site (Barr et al. 2007, WGFD 2008). Photo detections of both black bears (*U. americanus*) and grizzly bears were recorded and used to document presence/absence within the WRIR.

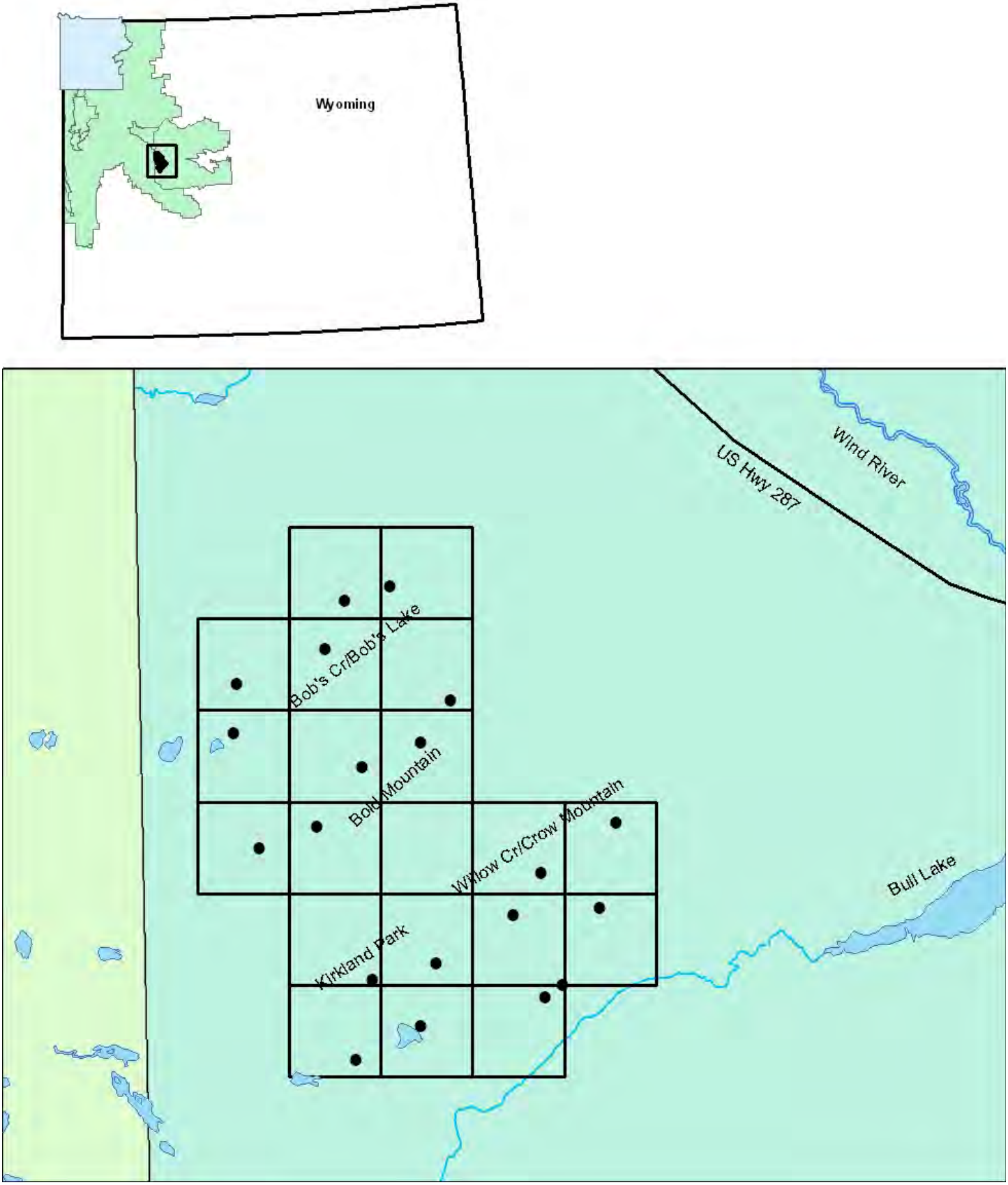

Figure 1. Wind River Indian Reservation camera study area, 2008.

RESULTS

The study was conducted for 52 days (7 Jul – 28 Aug 2008), with a total of 769 camera days (number of cameras times operational days). We collected a total of 122 bear detections, 114 of which were black bears. Of the eight grizzly bear photo detections, six were of a previously marked female with two yearling cubs; one was an adult male, and one of three two-year-old bears. The highest number of detections occurred during the first two weeks of the study (Figure 2). Black bears were detected during both diurnal and nocturnal periods, with an increased number of detections during crepuscular periods (Figure 3). Grizzly bears were detected with higher prevalence in the morning (Figure 4).

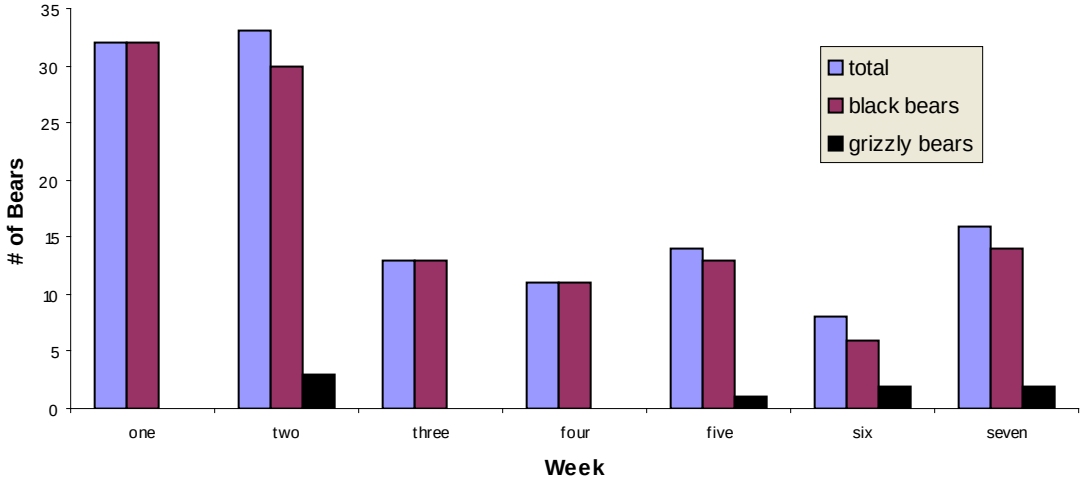

Figure 2. Weekly bear events WRIR, 2008.

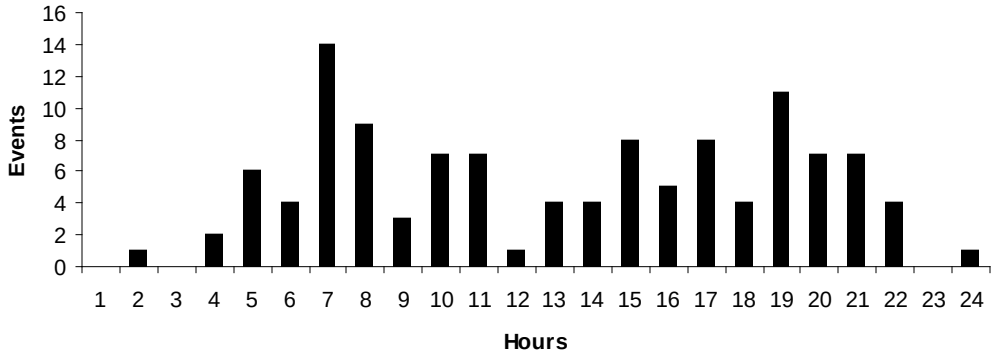

Figure 3. Photo detections by hour for black bears on the WRIR, 2008.

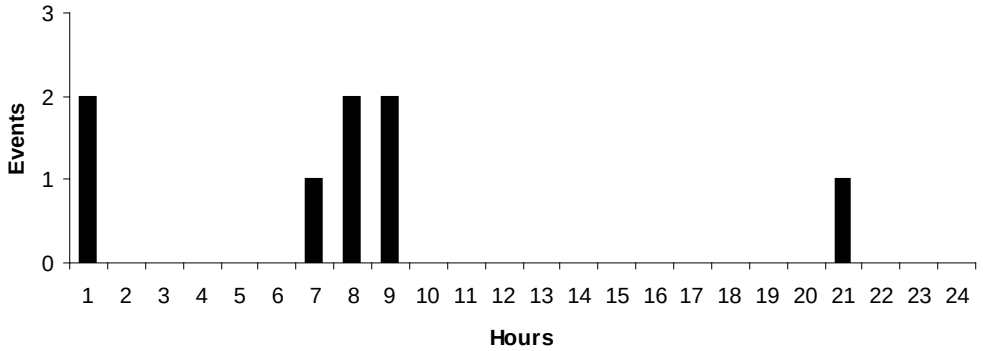

Figure 4. Photo detections by hour for grizzly bears on the WRIR, 2008.

Eighty-five percent of all bear events occurred at elevations higher than 9,200 feet (2,804 m). Eighty percent of black bear and all grizzly events were above this elevation. After correcting for the number of sites in each elevation range, bears of both species preferred sites above 10,000 feet (Figure 5).

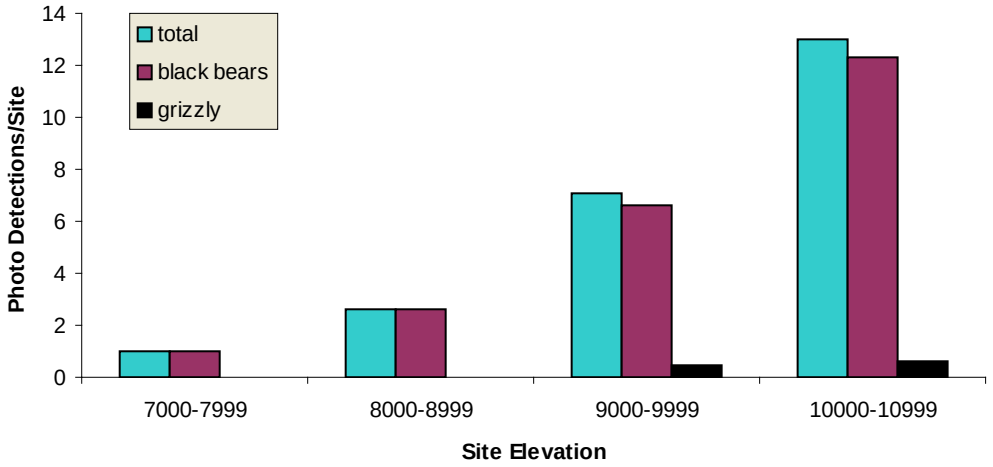

Figure 5. Bear detections by elevational gradients.

DISCUSSION

Bear visitation was highest during the first two weeks of the project, particularly with black bears. This pattern is likely due to the interest in the new blood lure in the area. Without a food reward, bears most likely lost interest in the sites after a short period of time, accounting for the decrease in detections during mid portions of the study. Grizzly bear visitation increased in the last three weeks of the study, which was also observed in Barr et al. (2007). This is most likely due to the seasonal abundance of food. Mace et al. (1994) documented bears moved less when seasonal food abundance was high, causing them to be less detectable by remote cameras.

Bear detection for both species was highest during diurnal and crepuscular periods with black bears being more diurnal and grizzly bears more crepuscular. This was also documented in Wyoming (Holm et al. 1999). Munro et al. (2006) found grizzly bear foraging activities to be highest during crepuscular periods and grizzly bears to be diurnal in areas with little human activity.

Black bear visitation increased at higher elevation sites. Grizzly bear visitations were also consistent with higher elevation sites that had a whitebark pine and sub-alpine fir habitat. This is mostly due to the seasonal availability of food sources, such as whitebark pine nuts, and the elevation at which they are present. Whitebark pine has been found to be an important food source for grizzly bears in late summer and fall (Haroldson and Podruzny 2008).

The first six sites on Crow Mountain had high black bear visitations but we did not document grizzly bear activity despite the presence of whitebark pine at the last few sites. This could be related to the lower elevation of the sites or that they were not located far enough up the drainage. The northern-most drainage (Little Bob), received very little activity from either species, even though this drainage was closest to established grizzly bear distribution in Wyoming (WGFD 2008). Many of the sites in this drainage were located at lower elevations in drier habitats, which may have lower food availability, resulting in fewer sightings. The sites higher in elevation had whitebark pine habitat and had the most visitations, but were still lower in total sightings when compared to other drainages.

Overall there were eight grizzly bear observations at five different sites. A previously marked female with two yearling cubs was sighted six times at three different sites in the Kirkland Park area, suggesting that she has established her home range within the WRIR. There was a sighting of an adult male grizzly bear and a sighting of three two-year-old grizzly bears at different locations. These data indicate that an established grizzly bear population exists on the WRIR.

ACKNOWLEDGMENTS

This project could not have taken place without the help of both the Shoshone and Arapahoe tribes and the tribal game wardens who were there every day to help with checking cameras, refilling blood, and giving us input and suggestions on bears and bear activity within the study area. The U.S. Fish and Wildlife Service also helped out a great deal in getting this project on its feet and throughout the duration of the study. This study was very important to help understand the movements and distribution of the growing grizzly bear population in Wyoming and it could not have taken place without the above-mentioned agencies.

LITERATURE CITED

Anderson, C., and M. Haroldson. 1997. Effectiveness of attractants to lure grizzly bears into hair collection sites for future DNA fingerprinting: the Blackrock/Spread Creek Area Study - 13–30 August 1996. Pages 37–47 *in* R.R. Knight, B.M. Blanchard, and M.A. Haroldson, authors. Yellowstone Grizzly Bear Investigations: annual report of the Interagency Grizzly Bear Study Team, 1996. National Park Service, Bozeman, Montana, USA.

Barr, M.B., C.R. Anderson, D.S. Moody, and D.D. Bjornlie. 2007. Testing remote sensing cameras to count independent female grizzly bears with cubs of the year: pilot study. Wyoming Game and Fish Department, Trophy Game Section, Lander, Wyoming, USA.

Haroldson, M., and S. Podruzny. 2008. Whitebark pine cone production. Pages 37–38 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone Grizzly Bear Investigations: annual report of the Interagency Grizzly Bear Study Team, 2007. U.S. Geological Survey, Bozeman, Montana, USA.

Holm, G.W., F.G. Lindzey, and D.S. Moody. 1999. Interactions of sympatric black and grizzly bears in northwest Wyoming. Ursus 11:99–108.

Mace, R.D., S.C. Minta, T.L. Manley, and K.E. Aune. 1994. Estimating grizzly bear population size using cameras sightings. Wildlife Society Bulletin 22:74–83.

Munro, R.M., S.E. Nielsen, M.H. Price, G.B. Stenhouse, and M.S. Boyce. 2006. Seasonal and diel patterns of grizzly bear diet and activity in West-Central Alberta. Journal of Mammalogy 87(6):1112–1121.

Wyoming Game and Fish Department. 2008. Testing remote cameras to count independent female grizzly bears with cubs of the year, 2006–2007. Wyoming Game and Fish Department, Trophy Game Section, Lander, Wyoming, USA.

2008 Annual Report

Greater Yellowstone Whitebark Pine Monitoring Working Group

Monitoring Whitebark Pine in the Greater Yellowstone Ecosystem

Whitebark pine occurs in the subalpine zone of western North America, including the Pacific Northwest and northern Rocky Mountains, where it is adapted to a harsh environment of poor soils, steep slopes, high winds, and extreme cold temperatures. While its inaccessibility and sometimes crooked growth form lead to low commercial value, it is a highly valuable species ecologically and is often referred to as a "keystone" species (Tomback et al. 2001) and as a foundation species capable of changing forest structure and ecosystem dynamics (Ellison et al. 2005) in the subalpine zone. Whitebark pine contributes to a variety of ecological functions including the retention of snow in upper elevations helping to modulate runoff and streamflow (Farnes 1990). Its best known role in these ecosystems is as a high-energy food source for a variety of wildlife species, including red squirrels, Clark's nutcracker and the grizzly bear.

Background of the Program

Forest monitoring has shown a rapid and precipitous decline of whitebark pine in varying degrees throughout its range due to non-native white pine blister rust (Kendall and Keane 2001) and native mountain pine beetle (Gibson 2006, Gibson et al. 2008). Given the ecological importance of whitebark pine in the Greater Yellowstone Ecosystem (GYE) and that 98% of whitebark pine occurs on public lands, the conservation of this species depends heavily on the collaboration of all public land management units in the GYE. Established in 1998, the Greater Yellowstone Whitebark Pine Subcommittee, comprised of resource managers from eight federal land management units, has been working together to ensure the viability and function of whitebark pine throughout the region. As a result of this effort, a working group of the subcommittee was formed for the purpose of integrating the common interests, goals and resources into one unified monitoring program for the Greater Yellowstone area. The Greater Yellowstone Whitebark Pine Monitoring Working Group (GYWPMWG) consists of representatives from the U.S. Forest Service (USFS), National Park Service (NPS), U.S. Geological Survey (USGS), and Montana State University (MSU). Since 2004 the working group has collaborated to design and implement a long-term monitoring program. The purpose of the monitoring program is to detect how rates of blister rust infection and the survival and regeneration of whitebark are changing over time. A protocol for monitoring whitebark pine throughout the GYE was completed by the working group (GYWPMWG 2007*a*) and approved in 2007 by the NPS Intermountain Region Inventory and Monitoring Coordinator. Approved monitoring protocols are a key component of quality assurance helping to ensure the methods are repeatable and detected changes are truly occurring in nature and not simply a result of measurement differences. The complete protocol is available at: http://www.greateryellowstonescience.org/topics/biological/vegetation/whitebarkpine/projects/healthmonitoring/protocol.

This monitoring effort provides critical information on the status of whitebark pine on a comprehensive regional scale. The results of monitoring will help to establish the likelihood of this species' ability to persist as a functional part of the ecosystem and can be used to help justify and guide restoration efforts. This report is a summary of the monitoring data collected between 2004 and 2008 from this long-term monitoring project.

Photo courtesy Rachel Simons

Objectives

Our objectives are to monitor the health of whitebark pine relative to levels of white pine blister rust and, to a lesser extent, mountain pine beetle. An additional monitoring objective to assess recruitment of whitebark pine into the cone producing population is in the early planning stages and not presented here.

> *Objective 1 - To estimate the proportion of live whitebark pine trees (>1.4 m tall) infected with white pine blister rust, and to estimate the rate at which infection of trees is changing over time.*

Objective 2 - Within transects having infected trees, to determine the relative severity of infection of white pine blister rust in whitebark pine trees >1.4 m tall.

Objective 3 - To estimate survival of individual whitebark pine trees >1.4 m tall explicitly taking into account the effect of blister rust infection rates and severity and mountain pine beetle activity, fire damage, and other agents.

Study Area

Our study area is within the GYE and includes six National Forests and two National Parks (the John D. Rockefeller Memorial Parkway is included with Grand Teton National Park) (Figure 1). The target population is all whitebark pine trees in the GYE as defined by mapped stands or polygons in a GIS vegetative layer. The sample frame includes stands of whitebark pine approximately 2.5 ha or greater within the grizzly bear Primary Conservation Area (PCA) and was derived from the cumulative effects model for grizzly bears (Dixon 1997). Outside the PCA, the sample frame includes whitebark stands mapped by the US Forest Service. Areas that burned since the 1988 fires were excluded from the sample frame.

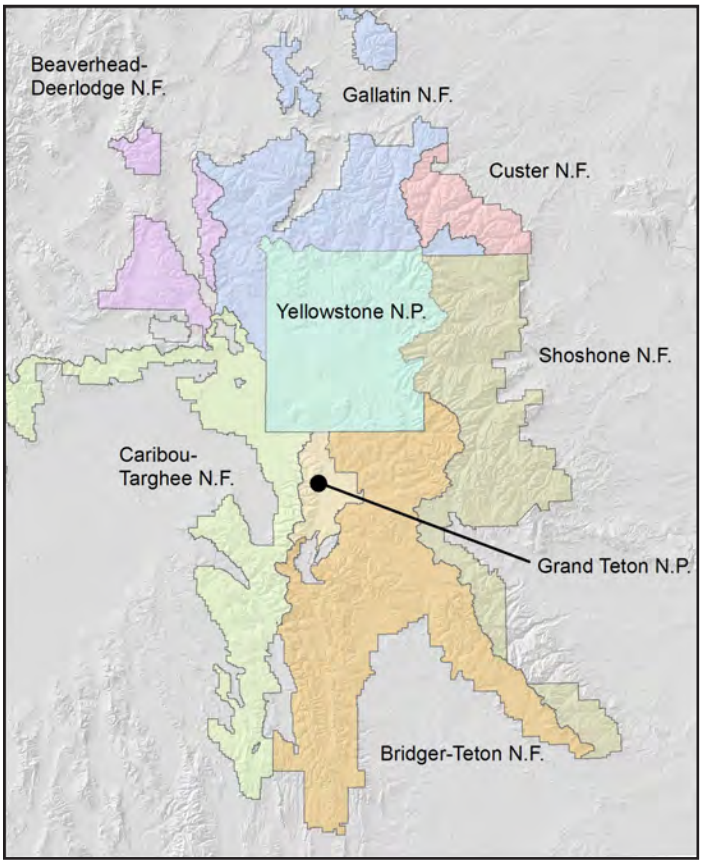

Figure 1. Study area showing national forest and national park units.

Methods

Details of our sampling design and field methodology can be found in the Interagency Whitebark Pine Monitoring Protocol for the Greater Yellowstone Ecosystem (GYWPMWG 2007*a*) and in past project reports (GYWPMWG 2005, 2006, 2007*b*, and 2008). The basic approach is a 2-stage cluster design with stands (polygons) of whitebark pine being the primary units and 10x50 m transects being the secondary units. Initial establishment of permanent transects took place between 2004 and 2007; during this period 176 permanent transects in 150 whitebark pine stands were established and 4,774 individual trees >1.4 m tall were permanently marked in order to estimate changes in white pine blister rust infection and survival rates over an extended period. The sample of 176 transects is a probabilistic sample that provides statistical inference to the GYE.

In 2008, we randomly assigned individual transects to one of four panels. Each panel consists of approximately 44 transects. This is the number of transects that can be realistically visited in a given field season by one, two-person field crew. Sampling every 4 years is sufficient to detect change in blister rust infection. However, with the recent increase in whitebark pine mortality due to mountain pine beetle, the monitoring group became concerned that a 4 year revisit interval might not be sufficient to document overall mortality of whitebark pine trees >1.4 m tall. In response, we temporarily modified our revisit design to incorporate the dynamic nature of the current mountain pine beetle epidemic to a two-year revisit schedule. With this design, two of the four panels are surveyed annually; one panel is subject to the full survey documenting blister rust infection and mountain pine beetle indicators while the second panel is subject to a partial survey focused solely on mountain pine beetle indicators. Both surveys record tree status as live, dead or recently dead.

NPS Photo, Rosalie LaRue

Eighty-five transects were resurveyed in 2008 by two, 2-person crews, one led by the NPS Greater Yellowstone Inventory & Monitoring Network and the other led by the USGS Interagency Grizzly Bear Study Team. Of the 85 transects, 42 (panel 1) were subject to the full survey documenting indicators of blister rust infection and mountain pine beetle infestation and 43 (panel 3) were subject to a partial survey focused on indicators of mountain pine beetle. Tree status e.g. a determination of whether the whitebark pine tree is live or dead was recorded on all 85 transects.

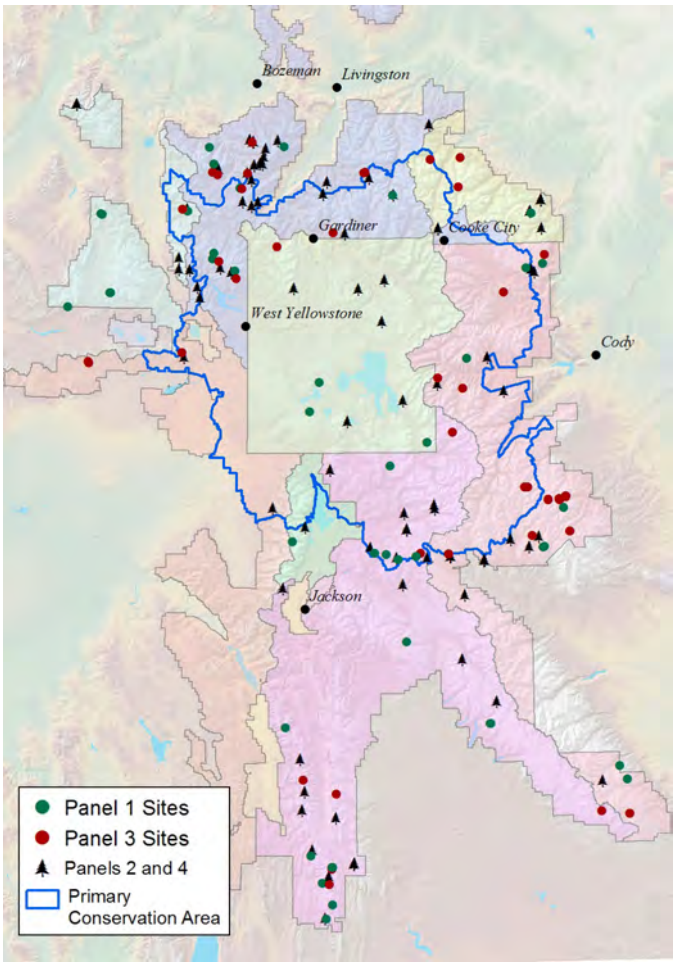

Figure 2. Location of whitebark pine survey transects, Greater Yellowstone Ecosystem. In 2008 transects in panel 1 had a full resurvey documenting blister rust infection and mountain pine beetle indicators and transects in panel 3 had a partial survey focused solely on mountain pine beetle indicators.

White Pine Blister Rust

For each live tree in panel 1, the presence or absence of indicators of white pine blister rust infection was recorded. For the purpose of analyses presented here, a tree was considered infected if either aecia or cankers were present. For a canker to be conclusively identified as resulting from white pine blister rust, at least three of five ancillary indicators needed to be present. Ancillary indicators of white pine blister rust included flagging, rodent chewing, oozing sap, roughened bark, and swelling (Hoff 1992).

Mountain Pine Beetle

Prior to 2008, mountain pine beetle evidence was simply recorded as 'present' or not present' based on whether or not pitch tubes, J-shaped galleries, or others signs of infestation were observed on a tree. Beginning in 2008, mountain pine beetle evidence was recorded in all whitebark pine for each of the three indicators: pitch tubes, mountain pine beetle galleries (on dead trees only) and frass. Pitch tubes are small, popcorn-shaped resin masses produced by a tree as a means to stave off a mountain pine beetle attack. Mountain pine beetle galleries are the crooked or J-shaped tubes where adult mountain pine beetle and their larvae live and feed. The galleries are found under the bark of the infested host tree. Frass is the boring dust created during a mountain pine beetle invasion and can be found in bark crevices and around the base of an infested tree.

Observer Effects

We continue to investigate the role of observer variability in blister rust detection (see Huang 2006) and detection of mountain pine beetle indicators. Each field season, 25% (approximately 10) of the full blister rust survey transects are subject to the double observer survey described in the working group protocol (GYWPMWG 2007*a*). By monitoring observer differences, we can examine the consistency between observers and correct problems through improved training and retention of trained and experienced individuals. If the observer variability is found to be a large contributor to the standard error for our estimated parameters, we will need to account for this in our data analysis.

Results

Status of White Pine Blister Rust

Ecosystem wide estimates of the proportion of whitebark pine trees infected with white pine blister rust were first reported by the working group in 2008 and are reported again here for background information. Our initial baseline estimate of the proportion of live trees with blister rust in

the GYE was 0.20 (± 0.037 se) (GYWPMWG 2008). This estimate was based on data from 4,774 individual live trees in 176 transects collected over a four year period between 2004 and 2007.

Results from our 2008 resurvey of panel 1 provide a preliminary estimate of the rate of change in blister rust infection in whitebark pine over time. Our preliminary estimate is based on data from 984 individual live trees in 42 transects randomly distributed across the GYE. Our results indicate that the proportion of trees across the GYE infected with blister rust increased from 0.20 to 0.25 between time1, when each transect was first established, and time2, when the transects were resurveyed in 2008. We expect that these values will change as panels 2, 3 and 4 are resurveyed in 2009, 2010, and 2011, respectively. An official rate of change in blister rust infection will be available following the 2011 season when all the panels have been resurveyed at least once.

Table 1. 2008 white pine blister rust summary statistics for Panel 1.

Location	Within PCA	Outside PCA	Total for GYE
Number Stands	15	22	37
Number of Transects	15	27	42
Number of Unique Trees Sampled	323	661	984 live trees
Proportion of Transects Infected	13 of 15	19 of 27	32 of 42
Estimated Proportion of Trees Infected in 2008	0.137 ± (0.055 se)	0.281 ± (0.0366 se)	0.250 ± (0.0314 se)

Survival and mortality of whitebark pine

A total of 2,290 permanently monumented whitebark pine trees were examined in Panels 1 and 2 to determine if the tree was alive or dead and to record indicators of mountain pine beetle. Our survey data recorded 130 dead whitebark pine trees >1.4 m tall. This equates to 5.7% of the whitebark pine sample population. Our definition of dead is strict in that it requires that no green needles are present on the tree. This definition has little ambiguity, however it should be noted that field crews recorded fading crowns on additional whitebark pine trees determined to be alive because of the continued presence of green needles.

Mountain pine beetle indicators were observed in 11% of the 2,290 trees examined. Of the 130 dead whitebark pine in our transects, 41% had indicators of mountain pine beetle activity. We cannot determine cause of death with confidence, however fire, mountain pine beetle, and blister rust were recorded as causal factors by the field crews. Fire alone accounted for 31% of the dead.

Discussion

Our preliminary estimate shows an increase in the number of trees with blister rust infection, however since this estimate is based on a single panel, this estimate is provisional only and must be interpreted with caution. Each year as we resurvey transects we will recalculate the proportion of trees infected and revise our provisional estimate. We expect to have an official rate of change in blister rust infection following 2011 when all the transects have been resurveyed once.

There is currently widespread mortality of whitebark pine in the Greater Yellowstone Ecosystem associated with the current mountain pine beetle epidemic. Several lines of evidence including aerial detection surveys by the USDA Forest Service (Gibson 2006, Gibson et al. 2008), mid-level forest canopy mortality maps created by the Forest Service Remote Sensing Application Center (Goetz et al. 2009) and a citizen monitoring effort (Logan et al. 2009) all report high levels of mortality in the overstory canopy of whitebark forest stands.

In contrast to aerial detection surveys which look mainly at the overstory canopy, our monitoring looks at the survival of whitebark pine across all tree height classes above 1.4 m tall. In addition we are adding new whitebark pine trees into our sample population as they reach 1.4 m in height. We do not view the differences in our results as contradictory but rather as support for a combination of aerial and ground based methods to adequately describe the condition of whitebark pine in the GYE.

Photo courtesy Anne Schrag

Future Directions

For the 2009 field season, we plan to conduct a full resurvey for each transect in panel 2 and a partial resurvey focused on mountain pine beetle indicators in panel 4. As before, both surveys will record tree status as live, dead or recently dead. At the end of 2009 we will have revisited 100% of our transects looking specifically at mountain pine beetle indicators and mortality/survival of whitebark pine. Depending on funding, we may continue with the split panel revisit design for another 2 years.

The USGS Status and Trend program has funded the Interagency Grizzly Bear Study Team to conduct an integrated synthesis and analysis of our whitebark pine data. This project will explore the rate of blister rust infection and mountain pine beetle mortality in the GYE using spatial regression models and a suite of spatially explicit covariates. The NPS Greater Yellowstone Inventory & Monitoring Network and statisticians from Department of Mathematics Sciences at Montana State University are collaborating with the study team on this project.

Acknowledgments

We thank our current and past field technicians Rachel Simons, John Fothergill, Jonathan Ball, Jennifer Birdsall, Polly Buotte, Justin Hof, Karla Sartor, and Amy Jesswein. We thank former Greater Yellowstone Network ecologist Rob Bennetts for his contribution to the sample design and development of the monitoring protocol. We also thank Karrie West, Nancy Bockino, Kelly McCloskey, Maria Newcomb, Veronika Klukas, Dale Dawson, Rachel Feigley, Andy Pils, Bill Oliver, Rob Daley, Jim Robertson, Steve Schacht, Jodie Canfield, Dennis Barron, Allen Kyles, Jay Frederick, Liz Davy, Tim Bennetts, David Meyers, Marcus Engler, Jeff Dibenedetto, Ellen Jungck, Bev Dixon, Heidi Whitlach, Nate Haynes and Anne Schrag for their advice and/or field and logistic support. Seed funding for this project was provided by the NPS Greater Yellowstone Inventory & Monitoring Network. Additional funding and in-kind support for this project is provided by USFS Forest Health Monitoring, USGS (Interagency Grizzly Bear Study Team), the Greater Yellowstone Coordinating Committee (GYCC), the US Fish and Wildlife Service and from Yellowstone and Grand Teton National Parks.

Literature Cited

Dixon, B.G. 1997. Cumulative Effects Modeling for grizzly bears in the Greater Yellowstone Ecosystem. Thesis, Montana State University, Bozeman, Montana, USA. 143 pages plus appendices.

Ellison, A.E., M.S. Banks, B.D. Clinton, E.A. Colburn, K. Elliott, C.R. Ford, D.R. Foster, B.D. Kloeppel, J.D. Knoepp, G.M. Lovett, J. Mohan, D.A. Orwig, N.L. Rodenhouse, W.V. Sobczak, K.A. Stinson, J.K. Stone, C.M. Swan, J. Thompson, B. Von Holle, and J.R. Webster. 2005. Loss of foundation species: consequences for the structure and dynamics of forested ecosystems. Frontiers in Ecology and the Environment 3(9):479-486.

Farnes, P.E. 1990. SNOTEL and snow course data describing the hydrology of whitebark pine ecosystems. *In* W.C. Schmidt and K.J McDonald, editors. Proceedings of a symposium on whitebark pine ecosystems: ecology and management of a high mountain resource. Ogden, UT: USDA Forest Service Intermountain Research Station.

Gibson, K. 2006. Mountain pine beetle conditions in whitebark pine stands in the Greater Yellowstone Ecosystem, 2006. USFS. Forest Health Protection, Numbered Report 06-03, Missoula, Montana, USA.

Gibson, K., K. Skov, S. Kegley, C. Jorgensen, S. Smith, and J. Witcosky. 2008. Mountain pine beetle impacts in high-elevation five-needle pines: current trends and challenges. USFS Forest Health Protection, Number report R1-08-020, Missoula, Montana, USA.

Goetz, W., P. Maus, and E. Nielsen. 2009. Mapping whitebark pine canopy mortality in the Greater Yellowstone area. RSAC-0104-RPT1. Salt Lake City, UT: U.S. Department of Agriculture Forest Service, Remote Sensing Application Center. 9 p.

Greater Yellowstone Whitebark Pine Monitoring Working Group. 2005. Interagency Whitebark Pine Health Monitoring Program for the Greater Yellowstone Ecosystem, 2004 Annual Report. Pages 92-125 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2004. U.S. Geological Survey, Bozeman, Montana, USA.

Greater Yellowstone Whitebark Pine Monitoring Working Group. 2006. Monitoring whitebark pine in the Greater Yellowstone Ecosystem: 2005 Annual Report. Pages 73-80 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2005. U.S. Geological Survey, Bozeman, Montana, USA.

Greater Yellowstone Whitebark Pine Monitoring Working Group. 2007a. Interagency Whitebark Pine Monitoring Protocol for the Greater Yellowstone Ecosystem, Version 1.00. Greater Yellowstone Coordinating Committee, Bozeman, Montana, USA.

Greater Yellowstone Whitebark Pine Monitoring Working Group. 2007*b*. Monitoring Whitebark Pine in the Greater Yellowstone Ecosystem: 2006 Annual Report. Pages 46-54 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2006. U.S. Geological Survey, Bozeman, Montana, USA.

Greater Yellowstone Whitebark Pine Monitoring Working Group. 2008. Monitoring whitebark pine in the Greater Yellowstone Ecosystem: 2007 Annual Report. Pages 50-56 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2007. U.S. Geological Survey, Bozeman, Montana, USA.

Huang, M. 2006. A statistical analysis of observer variability in the identification of blister rust infection occurring in white-bark pine monitoring. Unpublished Report prepared for the Whitebark Pine Monitoring Working Group. Department of Mathematical Sciences, Montana State University, Bozeman, Montana, USA.

Hoff, R.J. 1992. How to recognize blister rust infection on whitebark pine. USDA Forest Service, Intermountain Research Station, Research Note INT-406, Ogden, Utah., USA.

Kendall, K.C., and R.E. Keane. 2001. Whitebark pine decline: infection, mortality, and population trends. Pages 221–242 *in* D.F. Tomback, S.F. Arno, and R.E. Keane, editors. Whitebark pine communities. Island Press, Washington, D.C., USA.

Logan J.A, W.W. Macfarlane, and L. Willcox. 2009. Effective monitoring as a basis for adaptive management: a case history of mountain pine beetle in Greater Yellowstone Ecosystem whitebark pine. iForest 2: 19-22 [online: 2009-01-21] URL: http://www.sisef.it/iforest/show.php?id=477.

Tomback D.F., S.F. Arno, and R.E. Keane. 2001. The compelling case for management intervention. Pages 3-25 *in* D.F. Tomback, S.F. Arno, and R.E. Keane, editors. Whitebark pine communities: ecology and restoration. Island Press, Washington, D.C. USA.

Cooperating Organizations:

Greater Yellowstone Coordinating Committee (GYCC)

USDA Forest Service

Forest Health Protection
Beaverhead-Deerlodge National Forest
Bridger-Teton National Forest
Caribou-Targhee National Forest
Custer National Forest
Gallatin National Forest
Shoshone National Forest

USDI National Park Service

Greater Yellowstone Inventory and Monitoring Network
Grand Teton National Park
John D. Rockefeller, Jr. Memorial Parkway
Yellowstone National Park

USDI Geological Survey

Interagency Grizzly Bear Study Team
Northern Rocky Mountain Science Center
National Biological Information Infrastructure

Montana State University

Department of Mathematical Sciences

Greater Yellowstone Whitebark Pine Monitoring Working Group

Current Working Group Participants[a]

Greater Yellowstone Whitebark Pine Monitoring Working Group: A workgroup of the Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee

Jodie Canfield
USDA Forest Service, Gallatin National Forest

Steve Cherry
Montana State University
Department Of Mathematical Sciences

Rob Daley
USDI National Park Service
Greater Yellowstone Network

Gregg DeNitto
USDA Forest Service
Forest Health Protection

Cathie Jean
USDI National Park Service
Greater Yellowstone Network

Kelly McCloskey
USDI National Park Service
Grand Teton National Park

Shannon Podruzny
USDI Geological Survey
Interagency Grizzly Bear Study Team

Dan Reinhart
USDI National Park Service
Yellowstone National Park

Charles Schwartz
USDI Geological Survey
Interagency Grizzly Bear Study Team

Erin Shanahan
USDI National Park Service
Greater Yellowstone Network

[a] This project represented a collaboration in the truest sense of the word, such that distinguishing order of participants with respect to relative contribution was virtually impossible. Consequently, order of participants is alphabetical.

Recommended citation for GYWPMWG (2009):

Greater Yellowstone Whitebark Pine Monitoring Working Group. 2009. Monitoring Whitebark Pine in the Greater Yellowstone Ecosystem: 2008 Annual Report. Pages 62-68 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2008. U.S. Geological Survey, Bozeman, Montana, USA.

Copies of this, and other products from this project can be found at the Greater Yellowstone Science Learning Center at: http://www.greateryellowstonescience.org/topics/biological/vegetation/whitebarkpine.

Grizzly Bear Habitat Monitoring Report
Greater Yellowstone Area National Forests and National Parks
Yellowstone Grizzly Coordinating Committee
Habitat Modeling Team
June 2009

Background

The *Final Conservation Strategy* (here in after referred to as Strategy) *for the Grizzly Bear in the Greater Yellowstone Area* (USFWS 2007) requires annual reporting of the evaluation of adherence to the habitat standards identified in that document. These monitoring requirements and habitat standards were formalized for the 2 national parks in the Greater Yellowstone Area (GYA) by addition to the respective parks Superintendent's Compendium (Grand Teton National Park 2007 and Yellowstone National Park 2007). Whereas, The *Forest Plan Amendment for Grizzly Bear Habitat Conservation for the Greater Yellowstone Area National Forest, Record of Decision* (here in after referred to as Amendment, USDA Forest Service 2006) incorporated the Strategy habitat standards and monitoring requirements. There are slight wording differences between some of the monitoring requirements and standards in the Strategy and Amendment, but wording differences do not significantly change the monitoring and reporting requirements or the application of the standards. These changes were made primarily for clarification and to fit the Amendment format. Additional monitoring requirements were added to the Amendment that only apply to the national forests. Monitoring requirements from the Strategy are listed in Attachment A and those from the Amendment in Attachment B. Additional guidance included in the Amendment, not found in the Strategy, is not listed in Attachment B unless the guidance is associated with a monitoring requirement.

Introduction

This report is the combined response to the Strategy and Amendment requirements from the national parks and national forests in the GYA. This is the second monitoring report since the Strategy and the Amendment went into affect upon the delisting of the grizzly bear in April 2007. The first report was completed in June 2008. This report documents 1) changes in secure habitat, open motorized access route density >1 mile/mile^2 (OMARD) and total motorized access route density greater than 2 miles/mile^2 (TMARD) inside the Primary Conservation Area (PCA, Figure 1); 2) changes in number and capacity of developed sites inside the PCA; 3) changes in number of commercial livestock allotments and changes in the number of permitted domestic sheep animal months (AMs) inside the PCA; and 4) livestock allotments with grizzly bear conflicts during the last fiscal year (FY2008).

These monitoring items are required to be reported annually and the developed site and motorized access changes are required to be reported by Bear Management Unit (BMU) subunit (Figure 1). All, except the livestock conflict information, are compared to the 1998 baseline. Tables included in each monitoring section show the 1998 baseline and the current situation. Changes from year to year are also discussed. In some cases the 1998 baseline presented in the Strategy and the Amendment differs from that shown here. Differences are generally small and reflect a few errors where features were missed, features were counted that were not actually on the ground, or simply coded incorrectly. The 1998 baseline in this report represents the most accurate information to date. Forests and parks are consistently improving the quality of their information to more accurately reflect what was actually on the ground in 1998.

In addition to monitoring requirements in the Conservation Strategy, the Amendment requires the monitoring of changes in the percent secure habitat on national forests outside the PCA every 2 years in areas determined to biologically suitable and socially acceptable for grizzly bear occupancy. Although the requirement is to

report changes by national forest it was determined that Bear Analysis Units (BAU) were necessary to be consistent with how the analyses were completed for inside the PCA and to better evaluate impacts to grizzly bears. These changes are monitored by BAU (Figure 2) and compared to secure habitat values in 2003, which was the vintage of the information used in the Amendment to evaluate secure habitat status outside the PCA. The BAU used here to evaluate secure habitat changes outside the PCA are different than those used in the Amendment analysis. The analysis units used in the Amendment were limited to coincide with a specific Alternative boundary. The new BAUs are tied to areas where the states are currently managing for grizzly bears populations or are considering for future management and are of a size that is meaningful for evaluating impacts to grizzly bears. There are 43 BAUs and they are approximately the size of BMU subunits inside the PCA. There are no standards to be met, but this monitoring is part of the overall evaluation of the condition of grizzly bear habitat in the GYA. Changes in secure habitat outside the PCA were not reported in the June 2008 report but are included here and will be reported every other year in subsequent reports.

The monitoring requirement in the Amendment and the Strategy for changes in Habitat Effectiveness will be reported in future years. Monitoring of whitebark pine (*Pinus albicaulis*) occurrence, productivity, and health inside and outside the PCA, as identified in the Amendment, is also part of this annual Interagency Grizzly Bear Study Team (IGBST) report (see Appendix A).

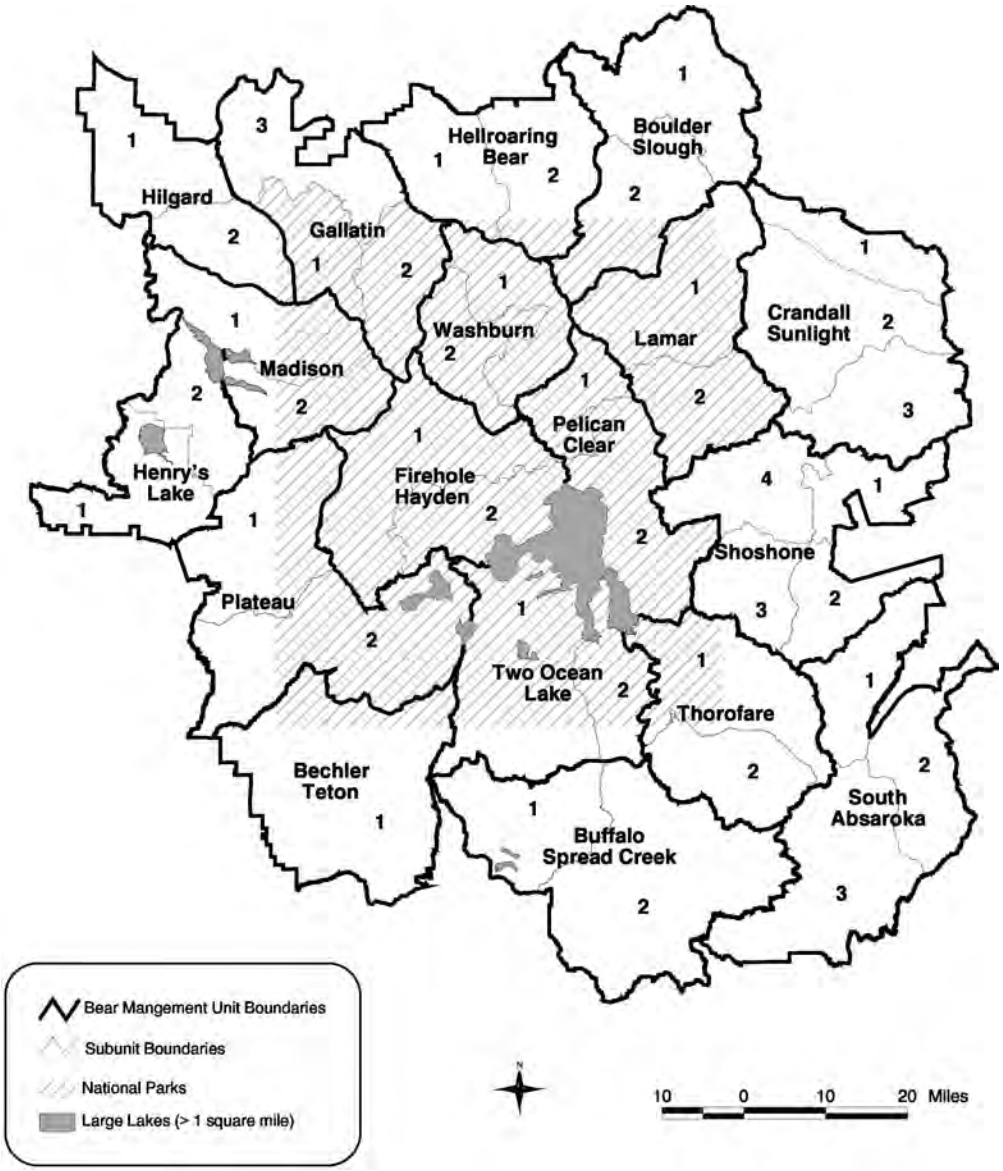

Figure 1. Bear Management Units and subunits inside the Primary Conservation Area.

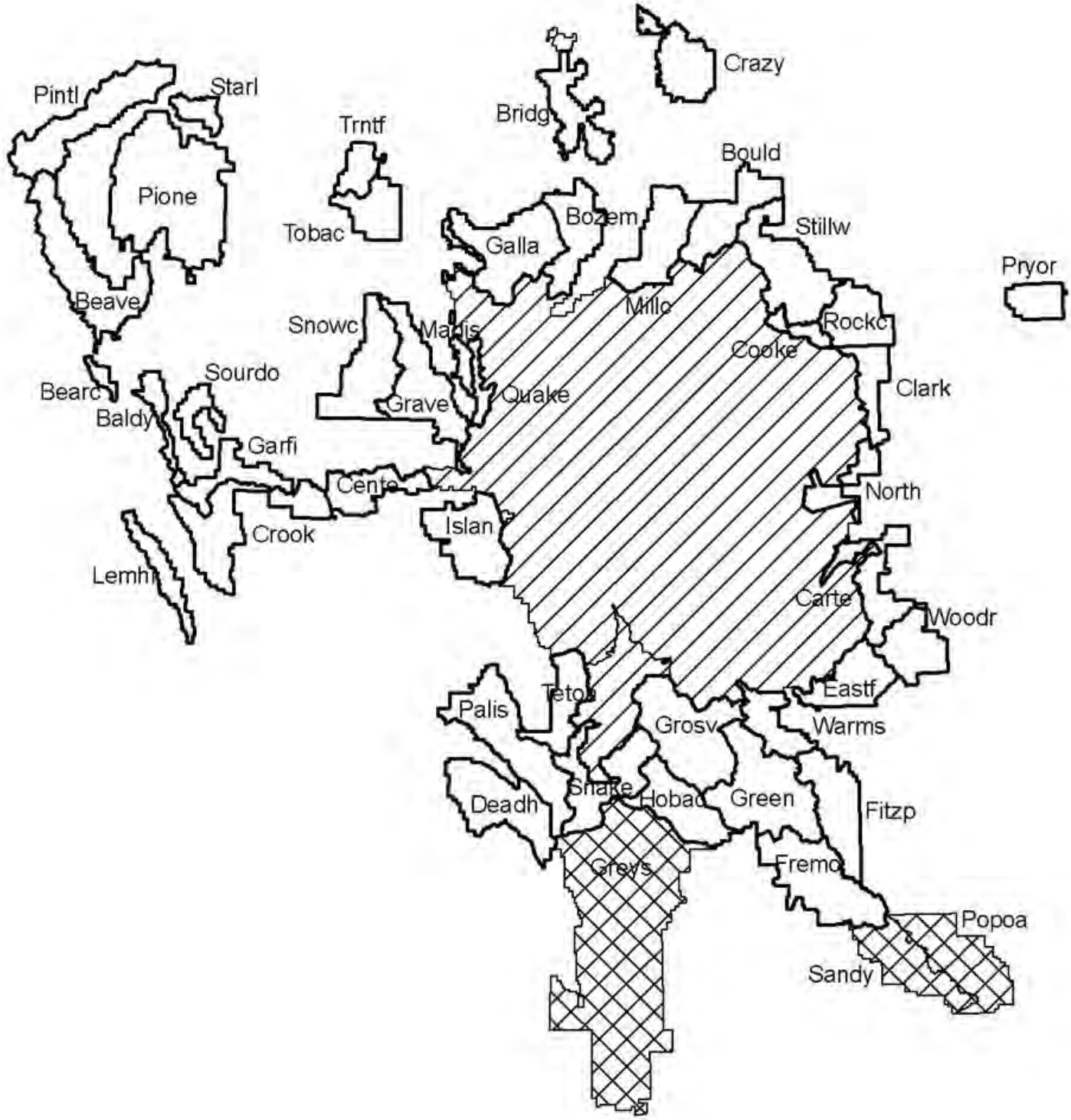

Figure 2. Bear Analysis Units outside the Primary Conservation Area on the 6 national forests in the Greater Yellowstone Area. (Simple hatched areas are the Primary Conservation Area and Grand Teton National Park. Crosshatched Bear Analysis Units are not currently evaluated, as they are considered socially unacceptable for grizzly bear occupancy in Wyoming.

Monitoring for Livestock Grazing

Numbers of Allotments and Sheep Animal Months inside the PCA

There were a total of 83 Cattle/Horse Grazing Allotments (hereinafter referred to as cattle allotments) inside the PCA in 1998 (71 active and 12 vacant, Figure 3)[1]. These allotments include commercial allotments and grazing in allotments authorized under special use permits on the national forests. Livestock grazing associated with outfitters in backcountry situations is not included.

Four cattle allotments that were vacant in 1998 and 1 cattle allotment that was active in 1998 have been closed since 1998. Two allotments active in 1998 on the Bridger-Teton National Forest were partially closed with small portions remaining vacant for use as a forage reserve. Two large pastures in another allotment active in 1998 on the Shoshone National Forest were closed in 2008. Ten cattle allotments that were active in 1998 are now vacant and 1 vacant allotment has been activated (2007). This allotment was on the Caribou-Targhee National Forest where 3 allotments active in 1998 were vacant by 2007. Numbers of permitted cattle did not increase as a result of activating the vacant allotment. There has been a reduction of 10 active allotments with a subsequent increase in 5 vacant allotments since 1998 for overall reduction of 5 cattle allotments. Figure 3 summarizes the changes by administrative unit in numbers of active and vacant cattle/horse allotments from 1998 to 2008.

A total of 13 active and vacant sheep allotments have been closed inside the PCA since 1998, 10 on the Caribou-Targhee National Forest and 1 on the Gallatin National Forest and 2 on the Shoshone National Forest. Two additional sheep allotments active in 1998 on the Gallatin National Forest are now vacant. There is only 1 remaining active sheep allotment inside the PCA on the Caribou-Targhee National Forest. Sheep animal months have gone from a total of 23,090 permitted AMs in 1998 to 1,970 permitted AMs in 2008 (Figure 3).

Livestock Conflicts Inside and Outside the PCA

During the last 5 years, conflicts have occurred on 33 different livestock allotments (16 entirely or partially inside the PCA) that are currently active (Figure 4). The only sheep allotment is the Lime Creek/Rock Creek allotment, which is located outside the PCA. Five of these allotments experienced the first documented conflicts during the most recent 5-year period in 2008. Grizzly bear livestock conflicts were documented on 14 different cattle allotments on the 6 national forests in the GYA during 2008 (11 allotments in 2007) and no conflicts were documented on the single sheep allotment. Seven of the cattle allotments with conflicts in 2008 are entirely or partially within the PCA. Several cattle and sheep allotments that have experienced conflicts during the last 5 years have been closed or are now vacant and are not listed in Figure 4.

Three allotments, 1 each on the Shoshone, the Caribou-Targhee, and the Bridger-Teton are having recurring conflicts. The Amendment defines recurring conflicts as allotments that have experienced conflicts with grizzly bears 3 out of the last 5 years. Two of these allotments (Green River and Squirrel Meadows) experienced conflicts in both 2007 and 2008. An allotment on the Shoshone National Forest that was considered as having recurring conflicts in 2007 (Table Mountain) was not stocked in 2008. The Badger Creek allotment on the Bridger-Teton that was identified as having recurring conflicts by 2007 did not have any conflicts in 2008 and has only had conflicts 2 out of the last 5 years as of 2008. Three grizzly bears were removed from the population and another relocated as a result of conflicts on the Green River cattle allotment on the Bridger-Teton National Forest.

[1] The numbers of cattle and sheep allotments and sheep AMs in the 1998 baseline presented here differ slightly from numbers reported in the Strategy and the Amendment and in the 2007 monitoring report. Several allotments were inadvertently missed when previously tallying the 1998 baseline and some were incorrectly identified as vacant and vice versa. The data presented here are the best available at describing the number of livestock allotments and numbers of sheep AMs in the PCA in 1998 and 2008.

Allotment changes from 2007 to 2008

Two cattle allotments that were vacant in 1998 were closed and an active cattle allotment in 1998 became vacant in 2008, all on the Gallatin National Forest. Two pastures of a cattle allotment active in 1998 on the Shoshone National Forest were closed and 1 sheep allotment active in 1998 on the Caribou-Targhee National Forest was closed in 2008. All of these allotments were inside the PCA. In addition the Beaverhead/Deerlodge permanently closed 4 sheep allotments outside the PCA in the Gravelly Mountains in 2008. These allotments had been vacant for years but 2 have been as grass banks. These were Cascade-Lobo, West Creek, Selway & Clover Creek sheep allotments.

Figure 3 . Number of commercial livestock grazing allotments and sheep animal months (AMs) inside the Primary Conservation Area in 1998 and in 2008.

Administrative unit	Cattle/Horse allotments				Sheep allotments				Sheep AMs[1]	
	Active		Vacant[1]		Active		Vacant[1]			
	1998 Base	Current 2008	1998 Base	Current 2008	1998 Base	Current 2008	1998 Base	Current 2008	1998 Base	Current 2008
Beaverhead-Deerlodge NF[2]	3	3	2	0	0	0	0	0	0	0
Bridger-Teton NF[3]	9	6	0	2	0	0	0	0	0	0
Caribou-Targhee NF[4]	11	9	1	3	7	1	4	0	14,163	1,970
Custer NF	0	0	0	0	0	0	0	0	0	0
Gallatin NF[5]	23	19	9	11	2	0	3	4	3,540	0
Shoshone NF	24	24	0	0	2	0	0	0	5,387	0
Grand Teton NP[6]	1	0	0	1	0	0	0	0	0	0
Total in PCA	71	61	12	17	11	1	7	4	23,090	1,970

[1] Vacant allotments are those without an active permit but could be used periodically by other permittees at the discretion of the land management agency to resolve resource issues or other concerns.

[2] The 2 vacant allotments shown in 1998, Indian Creek and Shedhorn, are now closed. Active cattle allotments in 1998 include the Jeffers On/Off that was incorrectly shown as vacant in the Strategy and the Amendment.

[3] Portions of 2 allotments within the PCA have been closed since 1998. These include the Blackrock-Spread Creek (75,759 acres closed 2003) and Fish Creek (77,135 acres closed 2007) allotments. The remaining portions of these 2 allotments are presently vacant and in a forage reserve status (Blackrock-Spread Creek – 12,941 acres and Fish Creek – 35,018 acres) that would allow periodic use by grazing permittees at the discretion of the Forest Supervisor, but an environmental assessment of any such action must be completed prior to permitting future grazing on the vacant range areas within these allotments. The 2 vacant allotments shown for 2008 are the remaining portions of the Blackrock-Spread Creek and Fish Creek Allotments. The 2007 report showed 8 active allotments in 1998. This was an error. The Fir Creek C&H allotment, active in 1998, was closed in 2004 but not reported in the 2007 report which contributed to the confusion over the number of active allotments in 1998.

[4] Three cattle allotments active in 1998 are now vacant (Twin Creek C&H, Meadow Creek C&H, and Garner Canyon C&H). Meadow View C&H, vacant in 1998 is now active. One sheep allotment that was active in 1998 and 2007 was closed in 2008. Ten sheep allotments have been closed since 1998.

[5] Park, Beaver Creek, and Horse Butte cattle allotments were active in 1998 and vacant by 2007. One additional cattle allotment that was active in 1998 was vacant in 2008 (Cache Eldridge) and 2 cattle allotments that were vacant in 1998 (Duck Creek and Dry Gulch) were closed in 2008. One sheep allotment that was vacant in 1998 (University) was officially closed in 2008. Active and inactive cattle allotments shown in the 2007 report for the 1998 base and 2007 were incorrect. Numbers of active allotments shown here for 1998 and 2008 are correct.

[6] The Dunoir cattle allotment, active in 1998, was partially closed in 2008 resulting in a reduction of about 37,000 total acres: all of which was inside the PCA. Only about 15,700 acres of the allotment are still being grazed with abut 2,100 acres inside the PCA.

[7] Cattle traditionally using this allotment (Pacific Creek) were moved to the Elk Ranch allotment in the Park but outside the PCA in 2006. Permit holder took non-use in 2007. In 2008 and beyond, cattle will be permitted outside PCA at the Elk Ranch allotment. Pacific Creek allotment expected to remain vacant for the foreseeable future.

Figure 4. Currently active livestock allotments in the Greater Yellowstone national forests with documented conflicts with grizzly bears during the last 5 years. Allotments with conflicts during 3 of the last 5 years are considered to be experiencing recurring conflicts. (All allotments are cattle/horse allotments except Lime Creek/ Rock Creek that is a sheep allotment).

			Conflicts					
Allotment name	Total acres	Acres inside PCA	2004 (Y/N)	2005 (Y/N)	2006 (Y/N)	2007 (Y/N)	2008 (number of conflicts	Recurring conflicts Y or N (comments)
Beaverhead-Deerlodge National Forest								
West Fork Madison	53,093	0	N	Y	N	Y	0	N
Bridger-Teton National Forest								
Bacon Creek	66,328	0	N	N	Y	N	0	N
Badger Creek	7,254	0	N	Y	Y	N	0	N
Beaver-Horse	25,358	0	N	N	N	Y	0	N
Green River	125,663	0	Y	Y	Y	Y	4	Y – Removal of 3 bears, relocation of 1 bear in 2008
Jack Creek C&H	32,386	0	N	N	Y	N	0	N
Kinky Creek	22,833	0	N	Y	N	N	0	N
Lime Creek/ Rock Creek Sheep Allotment	10,100	0	N	Y	N	N	0	N
Caribou-Targhee National Forest								
Squirrel Meadows	28,466	28,466	N	Y	N	Y	2	Y - attempt to trap bear was unsuccessful
Gerritt Meadows	1,101	0	N	N	N	N	1	N
Shoshone National Forest								
Bald Ridge	24,853	5,839	N	N	Y	N	0	N
Basin	73,115	72,067	N	N	N	Y	1	N
Bear Creek	33,672	0	N	N	N	N	1	N
Beartooth	30,316	24,169	N	Y	Y	N	0	N
Belknap	13,049	13,049	N	N	Y	N	0	N
Bench (Clarks Fork)	28,751	4,736	N	N	N	Y	2	N
Crandall	30,089	30,089	N	N	N	N	1	N
Deep Lake	6,486	228	N	N	Y	N	0	N
Dunoir	15,692	2,124	N	Y	N	N	0	N - 2 large pastures inside PCA closed in 2008
Face of the Mountain	8,553	0	N	Y	N	N	3	N
Fish Lake	12,742	0	N	N	N	Y	2	N
Hardpan Table Mountain	13,474	8,430	N	Y	N	N	1	N

Figure 4. Continued.

			Conflicts					
Allotment name	Total acres	Acres inside PCA	2004 (Y/N)	2005 (Y/N)	2006 (Y/N)	2007 (Y/N)	2008 (number of conflicts	Recurring conflicts Y or N (comments)
Horse Creek	29,980	18,513	N	N	N	N	1	N
Little Rock	4,901	0	N	N	Y	N	0	N
Parque Creek	13,527	4,601	N	N	N	Y	0	N
Piney	14,287	30	N	Y	N	N	0	N
Salt Creek	8,263	0	N	N	Y	N	4	N
Table Mtn.	13,895	13,895	Y	N	N	Y	0	(Livestock removed early in 2007 and not stocked in 2008. Considered as having recurring conflicts in 2007)
Union Pass	39,491	0	N	N	N	N	1	N
Warm Spgs.	16,875	0	N	N	N	Y	0	N
Wiggins Fork	37,653	88	N	Y	Y	N	1	Y
Wind River	44,156	14,899	N	N	N	Y	0	N

Monitoring for Developed Sites

Changes in Number of Developed Sites

There were 592 developed sites inside the PCA in 1998 and 587 in 2007 and 2008 (Figures 5 and 6)[2]. Numbers of developed sites changed from 1998 to 2007 for 7 subunits. Total number of developed sites increased by 1 in 2 subunits, decreased by 1 in 4 subunits and decreased by 3 in another subunit.

A new site was added to Henry's Lake subunit #2 on the Gallatin National Forest (Figures 5 and 6). This site was added to help mitigate the potential for bears obtaining food rewards along a high use motorized trail. It was determined that the addition of this site was beneficial to the grizzly bear (Henry's Lake #2, Figure 7) and did not violate the developed site standard.

[2] The total number of developed sites inside the PCA presented here (592) is slightly different that the 1998 baseline reported in the Strategy (590) and the Amendment (598) and the 2007 monitoring report (591). This is due to an improvement in data quality and an improved inventory of developed sites present in 1998. Several sites included in the 1998 baseline were found not to exist, several sites were inadvertently missed and not included in original tallies, several sites that should have been counted as a single site were identified as individual sites, several sites originally included in the 1998 baseline were actually not on the national forest but on private land, at least 1 site counted in the 1998 baseline is not really a developed site but just the end of the road, and at least 1 site was counted twice for separate subunits. The data presented here are the best available at describing the number of developed sites within each BMU subunit in the PCA in 1998.

The only other increase in numbers of developed sites was in Hilgard #2 (Figures 5 and 6). A trailhead was moved from one side of the road to the other. In so doing the trailhead was moved from Hilgard #1 to Hilgard #2. It was determined that this was of no impact to the grizzly bear and did not violate the developed site standard (Figure 7).

The decrease of 1 site in Buffalo/Spread Creek #2 will result from closing a picnic area and a Visitor information center in association with the Togwotee Highway reconstruction project (Figure 7). This is proposed to mitigate for a commercial composting site permitted within an administrative site on the Bridger-Teton National Forest. The composting site has been approved but is not yet operational, although some chipping did occur at the site in 2008. These 2 sites are planned for closure in 2009. Also see Buffalo/Spread Creek #2 in Figures 5 and 6.

Decreases in numbers of developed sites occurred in Hilgard #1 due to the abandonment of 2 cow camps on the Beaverhead-Deerlodge National Forest and the movement of the trailhead across the road to Hilgard #2 on the Gallatin National Forest. Madison #1 lost 1 developed site due to the closure of a snowmobile parking area on the Gallatin National Forest and an outfitter transfer corral closure on the Shoshone National Forest resulted in a decrease of one site in the South Absaroka #3. The Kitty Creek Trailhead in Shoshone #3 was closed in 1999 as part of the mitigation for the reconstruction of the North Fork of the Shoshone Highway (Figures 5, 6, and 7).

Changes from 2007 to 2008

All of the above changes were reported in the monitoring report for 2007. There were no changes in numbers of developed sites from 2007 to 2008.

Figure 5. The 1998 baseline and the 2008 numbers of developed sites on public lands within each of the Bear Management Unit subunits in the Greater Yellowstone Area.

Bear Management subunit	Area (mi^2)[1]	Admin units[2]	Total number of developed sites in subunit 1998 base	Summer home complexes		Developed campgrounds[3]		Trailheads		Major developed sites and lodges[4]		Administrative or maintenance sites		Other developed sites		Plans of Operation for minerals activities[5]		Change in number of sites from 1998 base (+ or -)
				1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	
Bechler/Teton #1	534	CTNF	60	0	0	1	1	5	5	2	2	4	4	16	16	0	0	0
		YNP		0	0	0	0	2	2	0	0	2	2	2	2	0	0	
		GTNP		0	0	8	8	3	3	1	1	4	4	10	10	0	0	
Boulder/Slough #1	282	CNF	20	0	0	0	0	1	1	0	0	0	0	0	0	6	6	0
		GNF		0	0	1	1	6	6	0	0	1	1	3	3	2	2	
Boulder/Slough #2	232	GNF	9	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
		YNP		0	0	1	1	3	3	0	0	2	2	1	1	0	0	
Buffalo/Spread Creek #1	222	BTNF	18	0	0	1	1	1	1	0	0	0	0	2	2	0	0	0
	(220)	GTNP		0	0	0	0	7	7	2	2	2	2	3	3	0	0	
Buffalo/Spread Creek #2	508	BTNF	22	1	1	4	4	3	3	3	3	5	5	5	4[6]	1	1	-1
Crandall/Sunlight #1	130	SNF	23	0	0	2	2	5	5	1	1	1	1	5	5	0	0	0
		GNF		0	0	2	2	2	2	0	0	0	0	5	5	0	0	
Crandall/Sunlight #2	316	SNF	18	0	0	5	5	4	4	1	1	2	2	5	5	1	1	0
		GNF		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Crandall/Sunlight #3	222	SNF	11	0	0	2	2	3	3	0	0	1	1	2	2	0	0	0
		WG&F		0	0	2	2	0	0	0	0	1	1	0	0	0	0	
Firehole/Hayden #1	339	YNP	26	0	0	1	1	5	5	1	1	6	6	13	13	0	0	0
Firehole/Hayden #2	172	YNP	15	0	0	1	1	3	3	1	1	2	2	8	8	0	0	0
Gallatin #1	128	YNP	4	0	0	0	0	3	3	0	0	1	1	0	0	0	0	0
Gallatin #2	155	YNP	21	0	0	2	2	5	5	1	1[7]	12	12[8]	1	1	0	0	0
Gallatin #3	218	GNF	17	0	0	2	2	9	9	0	0	0	0	6	6	0	0	0
		YNP		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hellroaring/Bear #1	185	GNF	35	0	0	5	5	11	11	0	0	3	3	6	6	8[9]	8[9]	0
		YNP		0	0	0	0	1	1	0	0	0	0	1	1	0	0	
Hellroaring/Bear #2	229	GNF	4	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0
		YNP		0	0	0	0	0	0	0	0	2	2	0	0	0	0	
Henry's Lake #1	201	CTNF	20	2	2	3	3	1	1	0	0	3	3	10	10	1	1	0
	(191)																	
Henry's Lake #2	153	CTNF	18	0	0	0	0	1	1	0	0	1	1	1	1	1	1	+1
	(140)	GNF		5	5	3	3	4	4	0	0	0	0	2	3[10]	0	0	

Figure 5. Continued.

Bear Management subunit	Area (mi^2)[1]	Admin units[2]	Total number of developed sites in subunit 1998 base	Summer home complexes		Developed campgrounds[3]		Trailheads		Major developed sites and lodges[4]		Administrative or maintenance sites		Other developed sites		Plans of Operation for minerals activities[5]		Change in number of sites from 1998 base (+ or -)
				1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	
Hilgard #1	202	BDNF	14	0	0	0	0	0	0	0	0	3	1[10]	0	0	0	0	-3
		GNF		0	0	0	0	6	5[12]	1	1	2	2	2	2	0	0	
Hilgard #2	141	GNF	9	0	0	0	0	4	5[12]	0	0	1	1	1	1	0	0	+1
		YNP		0	0	0	0	3	3	0	0	0	0	0	0	0	0	
Lamar #1	300	YNP	37	0	0	1	1	5	5	0	0	3	3	2	2	0	0	0
		GNF		0	0	2	2	6	6	0	0	6	6	3	3	6	6	
		SNF		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		CNF		0	0	0	0	1	1	0	0	0	0	0	0	2	2	
Lamar #2	181	YNP	4	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0
Madison #1	228	GNF	21	0	0	1	1	11	11	0	0	1	1	8	7[13]	0	0	-1
		YNP		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Madison #2	157	GNF	25	8	8	2	2	1	1	1	1	4	4	5	5	0	0	0
	(149)	YNP		0	0	0	0	1	1	0	0	2	2	1	1	0	0	
Pelican/Clear #1	108	YNP	2	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
Pelican/Clear #2	252	YNP	13	0	0	1	1	4	4	1	1	4	4	3	3	0	0	
Plateau #1	286	CTNF	3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0
		GNF		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		YNP		0	0	0	0	0	0	0	0	1	1	0	0	0	0	
Plateau #2	431	CTNF	7	0	0	0	0	1	1	0	0	1	1	1	1	0	0	0
	(420)	YNP		0	0	0	0	0	0	0	0	4	4	0	0	0	0	
Shoshone #1	122	SNF	9	1	1	2	2	0	0	0	0	0	0	6	6	0	0	0
Shoshone #2	132	SNF	2	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
Shoshone #3	141	SNF	4	2	2	0	0	1	0[14]	1	1	0	0	0	0	0	0	-1
Shoshone #4	189	SNF	23	3	3	3	2[15]	3	3	6	6	0	0	8	9[15]	0	0	0
South Absaroka #1	163	SNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Absaroka #2	191	SNF	2	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
South Absaroka #3	348	SNF	15	1	1	3	3	4	4	1	1	1	1	5	4[16]	0	0	-1

Figure 5. Continued.

Bear Management subunit	Area (mi²)[1]	Admin units[2]	Total number of developed sites in subunit 1998 base	Summer home complexes		Developed campgrounds[3]		Trailheads		Major developed sites and lodges[4]		Administrative or maintenance sites		Other developed sites		Plans of Operation for minerals activities[5]		Change in number of sites from 1998 base (+ or -)
				1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	1998 Base	2008	
Thorofare #1	273	BTNF	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		YNP		0	0	0	0	0	0	0	0	4	4	0	0	0	0	
Thorofare #2	180	BTNF	2	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
		YNP		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Two Ocean/Lake #1	485	YNP	14	0	0	2	2	3	3	1	1	3	3	2	2	0	0	0
	(372)	BTNF		0	0	1	1	0	0	0	0	0	0	0	0	0	0	
		GTNP		0	0	0	0	1	1	0	0	0	0	1	1	0	0	
Two Ocean/Lake #2	143	YNP	4	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
	(125)	BTNF		0	0	0	0	0	0	0	0	1	1	1	1	0	0	
Washburn #1	178	YNP	25	0	0	2	2	8	8	2	2	7	7	6	6	0	0	0
Washburn #2	144	YNP	12	0	0	1	1	6	6	0	0	1	1	4	4	0	0	0
Primary Conservation Area	**9,210 (9,036)**	**ALL**	**592**	**24**	**24**	**67**	**66**	**161**	**160**	**28**	**28**	**117**	**115**	**167**	**166**	**28**	**28**	-5

[1] Area in parenthesis is the area of the subunit without large lakes >1 square mile.

[2] BDNF = Beaverhead-Deerlodge National Forest, BTNF = Bridger-Teton National Forest, CNF = Custer National Forest, CTNF = Caribou-Targhee National Forest, GNF = Gallatin National Forest, GTNP = Grand Teton National Park, SNF = Shoshone National Forest, WG&F = Wyoming Game and Fish, YNP = Yellowstone National Park.

[3] Four trailheads on the Bridger-Teton combined with associated campground as a single developed site.

[4] Mining claims with Plans of Operation are considered developed sites for this baseline. Not all sites currently have active projects.

[5] Grant, Lake, Fishing Bridge, Old Faithful, Canyon and Mammoth in Yellowstone National Park are coded as Major Developed Areas. However, these sites are a combination of recreation facilities and administrative facilities. There are too many sites to track individually. Changes in use or capacity will be evaluated based on whether the use is recreational or administrative. Individual buildings or other facilities within these areas are not tracked individually.

[6] UW Forestry Walk VIS and Four Mile Picnic Area closed to mitigate for a new site - Terra Firma Landscaping and Organics composting site.

[7] New courthouse constructed in Mammoth Major Developed Area. Individual sites not tracked in several major developments in Yellowstone National Park. See footnote #4. The courthouse is considered an administrative site and mitigation not necessary. See Figure 7.

[8] Closed Gardiner gravel/crusher site present in 1998 and added the Heritage Research Center in Gardiner.

[9] Includes 1 materials mineral site with an outside contractor.

[10] New Rees Pass day use site added in 2006.

[11] Indian Creek and Shedhorn cow camps no longer in use.

[12] Taylor Falls/Lightning Trailhead moved across the road from Hilgard #1 to Hilgard#2 in 2005.

[13] Tepee Creek snowmobile parking area eliminated.

[14] Kitty Creek Trailhead was closed in 1999.

[15] Sleeping Giant Campground was converted to a picnic area in 2003.

[16] Outfitter transfer corrals closed in 2002 and use transferred to existing facilities at Brooks Lake Lodge.

Figure 6. Type and name of developed sites that constitute the 1998 baseline and the 2008 numbers of developed sites within each of the Bear Management Unit subunits in the Greater Yellowstone Area. (Developed sites that are new since 1998, removed since 1998, or where type of site has changed are shaded and italicized).

Bear Management subunit	Admin Unit[1]	Name and type of each site tallied in Figure 5
Bechler/Teton #1	**CTNF**	**Developed Campgrounds:** Cave Falls. **Trailheads*:*** Coyote Meadows, Hominy Peak, S. Boone Creek, Fish Lake, Cascade Creek. **Major Developed Sites:** Loll Scout Camp, Idaho Youth Services Camp. **Administrative or Maintenance Sites:** Squirrel Meadows Guard Station/Cabin, Porcupine Guard Station, Badger Creek Seismograph Site, and Squirrel Meadows GS/WY Game & Fish Cabin. **Other Developed Sites:** Grassy Lake Dam, Tillery Lake Dam, Indian Lake Dam, Bergman Res. Dam, Loon Lake Disperse sites, Horseshoe Lake Disperse sites, Porcupine Creek Disperse sites, Gravel Pit/Target Range, Boone Creek Disperse Sites, Tillery Lake O&G Camp, Calf Creek O&G Camp, Bergman O&G Camp, Granite Creek Cow Camp. Poacher's TH, Indian Meadows TH, McRenolds Res. TH/Wildlife Viewing Area/Dam.
	YNP	**Trailheads**: 9K1 and Cave Falls. **Administrative or Maintenance Sites:** South Entrance and Bechler Ranger Stations. **Other Developed Sites:** Union Falls and Snake River picnic areas.
	GTNP	**Developed Campgrounds:** Grassy Lake Road campsites (8 individual car camping sites). **Trailheads**: Glade Creek, Lower Berry Creek, Flagg Canyon. **Major Developed Sites:** Flagg Ranch (lodge, cabins and campground including remote cistern and sewage treatment plant sites). **Administrative or Maintenance Sites:** Flagg Ranch Ranger Station, employee housing, maintenance yard, Snake River pit road construction staging area. **Other Developed Sites:** 3 Backcountry cabins (Upper Berry, Lower Berry, and Moose Basin), 5 Backcountry campsites {Berry Designated Horse Camp, Jackson Lake designated campsites (1 group, 3 individual)}, 2 boat launches (Flagg Ranch, Yellowstone South Entrance.)
Boulder/Slough #1	**CNF**	**Trailheads:** Goose Lake/Grasshopper Glacier (administered by Gallatin National Forest). **Plans of Operation:** East Iron Mtn Beartooth Plateau 1, East Iron Mtn Beartooth Plateau 2, Iron Mountain Idaho Construction Metal, Crescent Creek Pan Palladium, Crescent Creek Chromium Corp America, and Crescent Creek Beartooth Platinum. (Note: Goose Lake TH in Gallatin coverage)
	GNF	**Developed Campgrounds:** Hicks Park. **Trailheads**: Upsidedown Creek, Independence, Sheep Creek, Copper Creek, Bridge Creek, Box Canyon. **Administrative or Maintenance Sites:** Box Canyon. **Other Developed Sites**: 2 recreation residences (Rasnick and Mandeville), Independence Mine Site (no plan of operations). **Plans of Operation:** 2 (Carolyn and Cray)
Boulder/Slough #2	**GNF**	**Administrative or Maintenance Sites:** Slough Creek and Buffalo Fork Cabins.
	YNP	**Developed Campgrounds:** Slough Creek. **Trailheads:** Specimen ridge, Slough Creek, and the Lamar Ford. **Administrative or Maintenance Sites:** Elk Tongue and Lower Slough patrol cabins. **Other Developed Sites:** Yellowstone River picnic area.

Figure 6. Continued.

Bear Management subunit	Admin unit[1]	Name and type of each site tallied in Figure 5
Buffalo/Spread Creek #1	**BTNF**	**Developed Campgrounds:** Pacific Creek CG/TH. **Trailheads:** Colter Dump. **Other Developed Sites:** Teton Horseback Adventures, Shoal Creek Outfitters Base Camp
	GTNP	**Trailheads:** Grand View Point, Two Ocean Lake, Christian Pond, Arizona Creek #1, Pilgrim Creek, Arizona Lake, Arizona Creek #2. **Major Developed Sites:** Moran Entrance Station housing, Jackson Lake housing. **Administrative or Maintenance Sites:** Moran Entrance Ranger Station, Jackson Lake Ranger Station. **Other Developed Sites:** Moran Post Office, Moran School, Colter Bay storage/staging area.
Buffalo/Spread Creek #2	**BTNF**	**Summer Home Complex:** Turpin Meadows. **Developed Campgrounds:** Box Creek CG/TH, Hatchet, Turpin Meadows, and Angles CG/TH. **Trailheads:** Turpin Meadows, Lava Creek, Clear Creek. **Major Developed Sites:** Heart Six Ranch, Turpin Meadows Ranch, and Togwotee Lodge. **Administrative or Maintenance Sites:** Buffalo Ranger District Office, Buffalo Ranger District Compound (Includes a gravel pit), Enos Lake Patrol Cabin, Nowlin Meadows Patrol Cabin; Hatchet administrative site. **Other Developed Sites:** *UW Forestry Walk VIS and Four Mile Picnic Area (closed to mitigate for composting site)*, Lost Lake Info Station, Togwotee Overlook, Historic ranger station; *Blackrock Administrative Area Composting Site (Terra Firma Landscaping and Organics). New since 1998 but not currently operational*. **Plans of Operation:** 1 gravel pit
Crandall/Sunlight #1	**SNF**	**Developed Campgrounds:** Beartooth and Island Lake. **Trailheads:** Beartooth Lake, Island Lake, Clay Butte, Muddy Creek, Morrison Jeep. **Major Developed Sites:** The Top of the World Store complex. **Administrative or Maintenance Sites:** YNP highway maintenance site, which includes 2 summer residences. **Other Developed Sites:** Island Lake Boat Ramp, Beartooth Lake Boat Ramp, Clay Butte Lookout, Pilot/Index Overlook, and Beartooth Lake Picnic Area.
	GNF	**Developed Campgrounds:** Chief Joseph and Ovis Lake Road Camp. **Trailheads:** Broadwater, Clarks Fork Foot Trailhead. **Other Developed Sites:** Arbor Day Watchable Wildlife site, Kersey Lake rental cabin and boat dock, Round Lake rental cabin/warming hut, Clarks Fork fishing platform and interpretive exhibit, 1 recreation residence (summer home).
Crandall/Sunlight #2	**SNF**	**Developed Campgrounds:** Fox Creek, Lake Creek, Hunter Peak, Crazy Creek and Lily Lake Campsites. **Trailheads:** Pilot Creek, Clarks Fork, North Crandall and Crazy Creek. **Major Developed Sites:** K-Z Lodge. **Administrative or Maintenance Sites:** Crandall admin site (2 residences, office, shop and bunkhouse), Crandall Game and Fish Cabin. **Other Developed Sites:** Crandall waste transfer site, Clarks Fork Overlook, Lily Lake Boat ramp, Swamp Lake Boat Ramp, and Reef Creek Picnic Area. **Plan of Operations**: Commercial sale gravel pit at Ghost Creek for Beartooth Hwy Construction.
	GNF	**No Developed Sites**
Crandall/Sunlight #3	**SNF**	**Developed Campgrounds:** Dead Indian, Little Sunlight. **Trailheads:** Little Sunlight trailhead and corrals, Dead Indian and Hoodoo Basin/Lamar. **Administrative or Maintenance Sites:** Sunlight Ranger Station. **Other Developed Sites:** Sunlight Picnic Area, Sunlight Bridge Overlook.
	WG&F	**Developed Campgrounds:** Sunlight Unit Campground #1, Sunlight Unit Campground #2. **Administrative or Maintenance Sites:** Sunlight Unit Complex.

Figure 6. Continued.

Bear Management subunit	Admin unit[1]	Name and type of each site tallied in Figure 5
Firehole/Hayden #1	**YNP**	**Developed Campgrounds:** Madison Junction. **Trailheads:** Nez Perce Cr, 7-Mile Bridge, Fountain freight road, Lone Star, and OK5. **Major Developed Sites:** Old Faithful. **Administrative or Maintenance Sites:** Norris employee/govt area, Norris hot mix plant, Madison employee/govt site, the Mesa Pit site; and the Mary Lake and Nez Perce patrol cabins. **Other Developed Sites:** Norris, Gibbon Meadows, Tuft Cliffs, Gibbon Falls, Madison, Buffalo Ford, Cascade, Firehole Canyon, Nez Perce, Feather Lake, Goose Lake, Excelsior picnic areas and Norris Geyser Basin Museum.
Firehole/Hayden #2	**YNP**	**Developed Campgrounds:** Bridge Bay. **Trailheads:** Divide, Beach Lake, and DeLacy Creek. **Major Developed Sites:** Lake. **Administrative or Maintenance Sites:** Lake gov't area and the Bridge Bay Marina. **Other Developed Sites:** Gull Point and Sand Point picnic areas with 6 additional lakeshore picnic areas.
Gallatin #1	**YNP**	**Trailheads:** WK2, WK3, and WK6. **Administrative or Maintenance Sites:** Daly Creek patrol cabin.
Gallatin #2	**YNP**	**Developed Campgrounds:** Mammoth and Indian Creek**.** **Trailheads:** Rescue Creek, Lava Creek, Golden Gate, Bunsen Peak, and Fawn Pass. **Major Developed Sites:** Mammoth. **Administrative or Maintenance Sites:** Stephens Creek area, *closed Gardiner gravel crusher/asphalt site present in 1998 and added the Heritage Research Center in Gardiner;* Xanterra headquarters site in Gardiner, Lower Mammoth employee housing area, YCC employee housing area, Indian Creek pit site, Deaf Jim patrol cabin (burned in 2001), North Entrance Ranger Station, Fawn Pass and Winter Creek patrol cabins, Bunsen Peak radio repeater site, and Mt Holmes fire lookout. **Other Developed Sites:** Sheepeater picnic area.
Gallatin #3	**GNF**	**Developed Campgrounds:** Tom Miner, Red Cliff. **Trailheads:** Buffalo Horn, Sphinx Creek, Elkhorn, Wilson Draw, Tom Miner, Tom Miner Horse Facilities, Sunlight, Twin Cabin, Tepee Creek (Bozeman Ranger district). **Other Developed Sites:** Corwin Spring fishing and boat access, Yankee Jim fishing access and boat ramp, Elkhorn River Ford (horse access), Windy Pass rental cabin, Yankee Jim picnic area, Porcupine Creek recreation residence.
	YNP	**No Developed Sites**
Hellroaring/Bear #1	**GNF**	**Developed Campgrounds:** Eagle Creek campground, Eagle Creek horse facility, Bear Creek, Timber Camp, and Canyon. **Trailheads:** Cedar Creek, LaDuke, Little Trail Creek, Pine Creek, Palmer Mt. (3 trailheads), North Fork of Bear Creek, Joe Brown, Bear Creek, Sixmile. **Administrative or Maintenance Sites:** OTO Ranch, Blanding Station house and barn (horse facility), Hayes/McPherson property. **Other Developed Sites:** LaDuke picnic area, LaDuke bighorn sheep watchable wildlife site, 1 recreation cabin, Lonesome Pond camping area, McConnell fishing and boat access, Watchable Wildlife-Big Game Winter Range, Watchable Wildlife Site-fish. **Plans of Operation:** total 8; Counts (1), Mineral Hill Mine (3), and (2), Independence (1), Livingston (1).
	YNP	**Trailheads:** Crevice. **Other Developed Sites:** Crevice Cabin
Hellroaring/Bear #2	**GNF**	**Trailheads:** West Fork Mill Creek. **Administrative or Maintenance Sites:** Hellroaring Cabin and tack shed.
	YNP	**Administrative or Maintenance Sites:** Buffalo Plateau and Hellroaring patrol cabins.

Figure 6. Continued.

Bear Management subunit	Admin unit[1]	Name and type of each site tallied in Figure 5
Henry's Lake #1	**CTNF**	**Summer Home Complexes:** Big Springs SHA North, Big Springs SHA South. **Developed Campgrounds**: Big Springs, Flat Rock, and Upper Coffee Pot. **Trailheads:** Howard Creek. **Administrative or Maintenance Sites:** Sawtelle Peak Electronics Site, Keg Springs Seismograph Site, Big Springs Fire Tower. **Other Developed Sites:** Big Springs Interpretive Trail, Big Springs Bridge Fish Viewing, Johnny Sack Cabin, Big Springs Boat Ramp, Big Springs Snow Park/Warming Hut, Macks Inn Water Treatment Plant, Macks Inn Substation, County/State Sheds Complex, FAA Maintenance Sheds, Cold Springs Substation. **Plans of Operation:** Willow Creek Mining Claim
Henry's Lake #2	**CTNF**	**Trailheads:** Targhee Creek. **Administrative or Maintenance Sites:** Defosses Cabin. **Other Developed Sites:** Howard Springs Family Picnic/Wayside Area. **Plans of Operation:** Turquoise Mountain Mine
	GNF	**Summer Home Complexes:** Clark Springs (8 lots), Rumbaugh Ridge (5), Romsett (9), Lonsomehurst A, Lonsomehurst B. **Developed Campgrounds:** Lonesomehurst, Cherry Creek, Spring Creek. **Trailheads:** Basin, Watkins Creek, Targhee Pass, West Denny Creek. **Other Developed Sites:** Basin rental cabin, Lonsomehurst boat ramp, *Reas Pass day use site added in 2006*.
Hilgard #1	**BDNF**	**Administrative or Maintenance Sites:** McAtee Cabin, *Indian Creek Cow Camp and Shedhorn Cow Camps present in 1998 no longer in use as of 2007.*
	GNF	**Trailheads:** Upper Buck Ridge, Cinnamon, Meadow Creek Cutoff, Cache Creek, Lower Buck Ridge, *Taylor Falls/ Lightning Creek (moved to Hilgard #2 in 2005)*. **Major Developed Sites:** Covered Wagon Ranch. (**Administrative or Maintenance Sites:** Cinnamon Cabin, Cinnamon Mountain Lookout. **Other Developed Sites:** Yellow Mule Rental Cabin. Buck Creek Recreation Residence.
Hilgard #2	**GNF**	**Trailheads:** Eldridge, Wapiti, Lower Wapiti/Albino Lake, Sage/Elkhorn. *Taylor Falls/Lightning Creek (moved here from Hilgard #1 in 2005)*. **Administrative or Maintenance Sites:** Eldridge Cabin. **Other Developed Sites:** Wapiti rental cabin.
	YNP	**Trailheads:** WK1, WK5, and WK4.
Lamar #1	**YNP**	**Developed Campgrounds:** Pebble Creek. **Trailheads:** 3K1, 3K3, 3K4, Trout Lake, and Lamar**. Administrative or Maintenance Sites:** The Northeast Entrance Ranger Station and supporting govt operation, the Lamar Buffalo Ranch Ranger Station/Institute, and the Cache Creek patrol cabin**. Other Developed Sites:** Warm Creek and Buffalo Ranch Picnic areas.
	GNF	**Developed Campgrounds:** Soda Butte, Colter. **Trailheads**: Republic Creek; Lady of Lake (lower) and parking lot, Lady of Lake 1, Woody Pass, Daisy Pass and Lost Wolverine. **Administrative or Maintenance Sites:** Cooke City guard station and warehouse, 2nd Forest Service warehouse, Highway borrow pit, mine tailings repository, old mine buildings at Woody Pass trailhead, mine reclamation pond. **Other Developed Sites**: Cooke City dump (SUP), Beartooth Highway Interpretive site (near Silver Gate) and Cooke City burn pile. **Plans of Operation**: 6, all New World Mine.
	CNF	**Trailheads:** Abundance Lake/upper Stillwater (Custer admin by Gallatin**). Plans of Operation:** Cray Placer and New World Mine*. (note: this TH is in the Gallatin coverage)*
	SNF	**No Developed Sites**

Figure 6. Continued.

Bear Management subunit	Admin unit[1]	Name and type of each site tallied in Figure 5
Lamar #2	**YNP**	**Administrative or Maintenance Sites:** Calfee Creek, Upper Miller Creek, Cold Creek, and Lamar Mountain patrol cabins.
Madison #1	**GNF**	**Campgrounds:** Cabin Creek. **Trailheads**: Potamogeton, West Fork Beaver Creek, Whit's Lake, Johnson Lake, Tepee Creek (Hebgen RD), Red Canyon, Kirkwood, Cub Creek, Fir Ridge, Hebgen Mountain and Cabin Creek. **Administrative or Maintenance Sites:** Building Destruction Site. **Other Developed Sites:** gravel pit, *Tepee Creek snowmobile parking area removed in 2007,* Watchable Wildlife Site at Beaver Creek, Beaver Creek rental cabin, Cabin Creek rental cabin, Hebgen Dam fishing access and admin site; 2 day use areas (Yellowstone Holiday picnic area and North Shore picnic area).
	YNP	**No Developed Sites.**
Madison #2	**GNF**	**Summer Home Complexes:** California (2 lots), Lakeshore A (6), Lakeshore B (8), Lakeshore C (3), Lakeshore E (19), Baker's Hole (3), Railroad (3), Horse Butte (2). **Developed Campgrounds:** Rainbow Point, Baker's Hole (includes watchable wildlife site). **Trailheads:** Rendezvous Ski Trail (includes 2 cabins and a biathlon range). **Major Developed Sites:** Madison Arm Resort. **Administrative or Maintenance Sites:** West Yellowstone Ranger Station, WY Interagency Fire Center (Includes crew quarters IAFCC, fire control center and mixing site), Bison capture facility (SUP), Game Warden Residence. **Other Developed Sites:** Solid Waste Transfer Station (SUP), Madison picnic area/boat ramp, Rainbow Point picnic area/boat ramp, Horse Butte Lookout/Picnic Site, South Plateau shooting range.
	YNP	**Trailhead:** Cable Car. **Administrative or Maintenance Sites:** West Entrance Ranger Station/housing complex, and the Cougar Cr patrol cabin. **Other Developed Sites:** Madison River picnic area.
Pelican/Clear #1	**YNP**	**Trailheads:** Lower Falls and Sour Creek.
Pelican/Clear #2	**YNP**	**Developed Campgrounds:** Fishing Bridge RV Park. **Trailheads:** Pelican Valley, 9-mile, Clear Creek, and AvalanchePeak. **Major Developed Sites:** Fishing Bridge store/gas station/employee housing/museum. **Administrative or Maintenance Sites:** East Gate Ranger Station/housing complex, the Fern Lake, Pelican Cone, and Pelican Springs patrol cabins. **Other Developed Sites:** Steamboat Point, Lake Butte, and Sylvan Lake picnic areas.
Plateau #1	**CTNF**	**Summer Home Complexes:** Moose Creek SHA. **Other Developed Sites:** Lucky Dog Lodge/TNC/SUP
	GNF	**No Developed Sites.**
	YNP	**Administrative or Maintenance Sites:** South Riverside patrol cabin.
Plateau #2	**CTNF**	**Developed Campgrounds:** None. **Trailheads:** Moose Creek/Trail Canyon. **Administrative or Maintenance Sites:** Warm River Springs GS/Cabin. **Other Developed Sites:** Snow Creek Pond Disperse sites
	YNP	**Administrative or Maintenance Sites:** Cove, Outlet, Buffalo Lake, and 3 Rivers patrol cabins.
Shoshone #1	**SNF**	**Summer Home Complexes:** Moss Creek (7). **Developed Campgrounds:** Newton Creek and Rex Hale. **Other Developed Sites:** One summer home across from Newton Creek Campground (isolated lot E), the Fire Memorial, Robbers Roost Cabin (Cow Camp), Newton Springs Picnic Area, Blackwater Pond Picnic/Fishing Area, Palisades Interpretive Site.

Figure 6. Continued.

Bear Management subunit	Admin unit[1]	Name and type of each site tallied in Figure 5
Shoshone #2	**SNF**	**Trailheads:** Blackwater. **Major Developed Sites:** Blackwater Lodge.
Shoshone #3	**SNF**	**Summer Home Complexes:** Eagle Creek (8) and Kitty Creek (14). **Trailheads:** *Kitty Creek (Closed in 1999).* **Major Developed Sites:** Buffalo Bill Boy Scout Camp.
Shoshone #4	**SNF**	**Summer Home Complexes:** Grinnell Creek (2), Pahaska (2), Mormon Creek (13). **Developed Campgrounds:** Eagle Creek and Three Mile; *Sleeping Giant was a campground in 1998 and was converted to a picnic area in 2003.* **Trailheads:** Fishhawk North, Eagle Creek, and Pahaska. **Major Developed Sites:** Elephant Head Lodge, Absaroka Mountain Lodge, Shoshone Lodge, Cross Sabers Lodge, Goff Creek Lodge, and Pahaska Tepee. **Other Developed Sites:** Sleeping Giant ski area, Wyoming Game and Fish cabin, Wayfarers Chapel, 1 summer home near Game and Fish cabin (50 Mile, isolated lot C), 2 summer homes across from Eagle Creek summer home complex (isolated lots A and B, West Gateway Interpretive Site, and Cody Peak Interpretive Site, and *Sleeping Giant picnic area (converted from a campground to a picnic area in 2003)*.
South Absaroka #1	**SNF**	**No Developed Sites.**
South Absaroka #2	**SNF**	**Administrative or Maintenance Sites:** Venus Creek Cabin and the Needle Creek Administrative site (2 cabins.
South Absaroka #3	**SNF**	**Summer Home Complexes:** Pinnacles (20). **Developed Campgrounds:** Brooks Lake, Pinnacles (23) and the dispersed campground near Brooks Lake Campground (23 sites). **Trailheads:** Long Creek/Dunoir, Brooks Lake, Pinnacles Trailhead, and Bonneville. **Major Developed Sites:** Brooks Lake Lodge. **Administrative or Maintenance Sites:** Wolf Creek. **Other Developed Sites:** Brooks Lake boat ramp, transfer corral/Bud Betts, Transfer Corral/Paul Gilroy, *Transfer Corral/Bridger Teton Outfitter on Brooks Lake Creek removed in 2002*, Winter Cabin/warming hut.
Thorofare #1	**BTNF**	**No Developed Sites.**
	YNP	**Administrative or Maintenance Sites:** Cabin Creek, Howell Creek, Trail Creek, and Thorofare patrol cabins.
Thorofare #2	**BTNF**	**Administrative or Maintenance Sites:** Hawk's Rest patrol cabin (USFS) and WY G&F patrol cabin.
	YNP	**No Developed Sites.**
Two Ocean/Lake #1	**YNP**	**Developed Campgrounds:** Lewis Lake and Grant Village. **Trailheads:** Shoshone Lake, Heart Lake, and Riddle Lake. **Major Developed Sites:** Grant Village. **Administrative or Maintenance Sites:** Heart Lake and Harebell patrol cabins, and Mt Sheridan fire lookout. **Other Developed Sites:** West Thumb warming hut, and the Frank Island picnic area.
	BTNF	**Developed Campgrounds:** Sheffield Creek Campground/Trailhead.
	GTNP	**Trailheads:** Sheffield Creek. **Other Developed Sites:** Snake River Picnic Area.

Figure 6. Continued.

Bear Management subunit	Admin unit[1]	Name and type of each site tallied in Figure 5
Two Ocean/Lake #2	**YNP**	**Administrative or Maintenance Sites:** Peale Island and Fox Creek patrol cabins.
	BTNF	**Administrative or Maintenance Sites:** Fox Park Patrol Cabin. **Other Developed Sites:** Huckleberry Lookout Historic Site on edge of Two Ocean Lake #2 and Buffalo/Spread Creek #1.
Washburn #1	**YNP**	**Developed Campgrounds:** Tower and Canyon Village. **Trailheads:** Lower Blacktail, Upper Blacktail, Blacktail Plateau Rd/ski trail, Hellroaring, Wraith Falls, Mount Washburn, Dunraven Pass, and the Howard Eaton trail. **Major Developed Sites:** Canyon Village and the Roosevelt Lodge complex. **Administrative or Maintenance Sites:** Frog Rock and Grebe Lake pits, Tower Ranger Station (Includes maintenance building and employee housing), and the Upper Blacktail, Lower Blacktail, and Observation Pk patrol cabins; and the Mount Washburn fire lookout. **Other Developed Sites:** the Lava Creek, Antelope Creek, Dunraven Pass, Dunraven, and Howard Eaton picnic areas; and the Yancey's Hole cookout site.
Washburn #2	**YNP**	**Developed Campgrounds:** Norris. **Trailheads:** Bighorn Pass, Winter Creek, Solfatara Creek, Grizzly, Grebe, and Ice Lakes. **Administrative or Maintenance Sites:** Ice Lake gravel pit. **Other Developed Sites:** Apollinaris Springs, Beaver Lake, Norris Junction, and Virginia Meadows picnic areas.

[1]**Admin Unit - BDNF** = Beaverhead-Deerlodge National Forest, **BTNF** = Bridger-Teton National Forest, **CTNF** = Caribou-Targhee National Forest, **CNF** = Custer National Forest, GNF = Gallatin National Forest, **GTNP** = Grand Teton National Park, **WG&F** = Wyoming Game and Fish Department, **YNP** = Yellowstone National Park.

Figure 7. Developed site changes from 1998 baseline and associated mitigation.

Subunit	Developed Site	Change from 1998 Baseline	Mitigation as per the application rules	Comments
Beaverhead-Deerlodge National Forest				
Hilgard #1	Indian Creek Cow Camp	No longer in use	None required	Site and Capacity banked
Hilgard #1	Shedhorn Cow Camp	No longer in use	None required	Site and Capacity banked
Bridger-Teton National Forest				
Buffalo/Spread Creek #2	Blackrock Administrative Site	New Plan of Operations (POO) and Contract for Blackrock Administrative Mineral Materials Site, March 6, 2006. Includes trailers for office space and occasional overnight stays.	This site replaces the gravel pit POO for the Minerals Material site present in the Blackrock Administrative Site. This site will only be used for highway reconstruction and is part of the Administrative Site. Mitigation under the application rules not required. On-going site reclamation includes development of additional wetlands on excavated areas (7.49 acres of which have already been completed). Other disturbed areas will be seeded using native species after gravel removal. Food Storage required (Order #04-00-104). Site is fenced.	This mineral materials site is within the Blackrock Administrative site and supports reconstruction of the Dubois US Highway 287/26 project. The POO and Contract authorized WDOT to mine; process and stockpile gravel, and occupy an 80 acre site from May 1, 2006 through December 31, 2015.
Buffalo/Spread Creek #2	Composting Site	New Special Use Permit (SUP), and Site and Operating Plans for Terra Firma Landscaping and Organics composting site within the permitted area for the minerals materials site noted above and added to the 2007 values	SUP Terms and Conditions for grizzly bear protection and requirements of SUP Grizzly Bear Management and Protection Plan attachment. Disturbed sites will be seeded with native plant species during reclamation phase. Two developed sites (Four Mile Meadow picnic area and UW Forestry Walk VIS) will be removed with the highway reconstruction project between 2008 and 2011 as mitigation for the composting operation. *Sites to be removed in 2009. Some chipping occurred at this site in 2007 but no composting.*	SUP authorizes Terra Firma to develop 4.88 acres into a composting site within the Blackrock Administrative site from September 2005 through December 31, 2016. This site is not yet active.

Figure 7. Continued.

Subunit	Developed Site	Change from 1998 Baseline	Mitigation as per the application rules	Comments
Buffalo/Spread Creek #2	Four Mile Meadow Picnic Area and UW Forestry Walk VIS	These 2 sites categorized as 'other developed sites' in 1998 closed as integral part of the Togwotee Highway reconstruction.	*Will be closed in 2009* to mitigate for the new composting site listed above	Results in a decrease of one developed site from the 1998 baseline in this subunit. This decrease will not be banked.
Gallatin National Forest				
Henry's Lake #2	Reas Pass day use site	This is a new site constructed in 2006.	This site lies on a major motorized trail which receives heavy use. The rationale is that if this site was not developed with an outhouse and pull out that there would be more difficulty dealing with dispersed trash and garbage in this area. No opportunities in subunit to mitigate. Beneficial to the grizzly bear. See comments.	This is a very small day use site with 1 outhouse and no overnight use. Bear resistant garbage containers installed. Closure of Tepee Creek snowmobile parking area in Madison #1 partial mitigation.
Hilgard #1	Taylor Fall/ Lightning Creek Trailhead	Moved across the road in 2005 and into Hilgard #2.	No mitigation – see comments	There would be no change in the impact to bears of moving this trailhead across the road.
Hilgard #2	Taylor Fall/ Lightning Creek Trailhead	Moved from Hilgard #1 across the road in 2005.	No mitigation – see comments	There would be no change in the impact to bears of moving this trailhead across the road.
Madison #1	Tepee Creek snowmobile parking area	Removed in 2007	No mitigation necessary, beneficial to the grizzly bear.	Capacity not banked used to offset new Rees Pass day use site in Henry's #2.
Grand Teton National Park				
Buffalo/Spread Creek #1	Moran Entrance Station Administrative site	Widened road at station from 3 to 4 lanes, 3 new kiosks replaced 2 old kiosks, added 28 space parking lot.	None required.	Necessary for administration of the park. Affected road is PCA boundary.

Figure 7. Continued.

Subunit	Developed Site	Change from 1998 Baseline	Mitigation as per the applicaiton rules	Comments
Shoshone National Forest				
Crandall/Sunlight #2	Fox Creek Campground	Addition of 7 campsites in this developed campground in June of 2006 (increased from 27 sites to 34 sites).	Eight dispersed sites in this subunit were closed to mitigate for the expansion of the campground which was opened to the public at the same time the disperesed sites were closed. Five sites were closed by putting up a permanent barrier where the access road left the Chief Joseph Highway. Three other sites were closed using large rocks to prevent access to the sites.	This campground was reconstructed to serve as a work camp for the workers on the reconstruction of the Beartooth Highway. Highway construction did not begin as anticipated. This campground may still be closed to the public in the future and used as a work camp.
Crandall/Sunlight #2	Sunlight Ranger Station	House at this administrative site converted to a public use cabin.	Season of use and intensity of use same with public use cabin as when used as employee housing. In addition a road accessing 3 dispersed camping sites was closed with a permanent barrier.	As a rental cabin food storage is required. No pets or livestock are allowed. The house will not be rented during the hunting season. On site caretaker to monitor compliance with food storage regulations.
Shoshone #3	Kitty Creek Trailhead	Closed in 1999	None required.	Capacity not banked as closure was part of the mitigation for the reconstruction of the North Fork Highway.
Shoshone #4	Pahaska Tepee Lodge and Sleeping Giant Ski Area	Use of corrals and barn as staging area for an outfitter eliminated at Pahaska Tepee in 2006. *Moved operation to Pahaska Trailhead in 2008.*	Moved outfitter staging operation to the Sleeping Giant ski area parking lot in the same subunit in 2006. No new permanent structures. Same season and type of use. *New corrals at Pahaska Trailhead. Mitigation not required.*	Capacity at barn and corrals will not be refilled. *Capacity at Sleeping Giant Ski area parking lot will not be refilled during the season of operation of the outfitter staging area. Capacity and season use at new site for 2008 the same as 1998.*
Shoshone #4	Sleeping Giant Campground	The 10 overnight sites were converted to picnic area sites in 2003.	No mitigation necessary. Beneficial to the grizzly bear.	The 10 overnight sites were banked for possible future use within the subunit. Each site is considered to have an average use of 4 people from May 16-November 15. Two sites used to mitigate expansion at Sleeping Giant ski area in 2007. See below. Eight sites remain banked.

Figure 7. Continued.

Subunit	Developed Site	Change from 1998 Baseline	Mitigation as per the applicaiton rules	Comments
Shoshone #4	Sleeping Giant Ski Area	Construction of a residence for a full time caretaker, addition of a storage shed and an extension of the ski run.	Capacity bank from the change of Sleeping Giant campground to a picnic area allowed for the residence. Food storage required. The storage shed will be used to house snow grooming equipment, supplies and various chemicals/petroleum products for the maintenance of the ski area, that in the past had been left outside and unattended.	Two of the overnight sites banked from the closure of Sleeping Giant overnight sites were used to offset the increased use associated with the residence. Eight overnight sites remain banked.
South Absaroka #3	Brooks Lake Lodge and Brooks Lake Creek Outfitter Transfer Corrals	Lodge added 2 cabins (8 pillows) and a spa in 2002.	Eliminated outfitter hunting transfer corral operation and 0.15 miles of road to Brooks Lake Creek, included trailer house used by wrangler, haystack, corrals, vehicle parking and water gap to creek, area rehabilitated and road closed. Area closed before additions at Brooks Lake Lodge.	Outfitter moved transfer corral operation to existing facilities at Brooks Lake Lodge.
Yellowstone National Park				
Gallatin #2	New Heritage Research Center in Gardiner, MT	No change in number of sites.	No mitigation necessary. Replacement of 1 administrative site for another.	Old gravel crushing site/asphalt plant closed and Heritage Center built on same site in the town of Gardiner. No change in overnight capacity. No effect on grizzly bear.
Gallatin #2	New Mammoth Justice Center	Increase in number of buildings in the Mammoth Major Developed Area	No Mitigation necessary. Administrative site necessary to meet new security guidelines for a courthouse.	Located in the Mammoth major developed area between the Post Office and a concessions dormitory and the engineering building. No change in overnight visitor use. No effect on grizzly bear.
Washburn #2	Canyon Visitor Center	Replaced old visitor center	No mitigation necessary.	Removed old single story building and built new two-story building on the same site in a highly developed area. No increase in overnight use. Increased quality of grizzly bear education facilities. No effect on grizzly bear.

Monitoring for Secure Habitat, Open (OMARD >1 mile/mile^2) and Total (TMARD >2 miles/mile^2) Motorized Access Route Density inside the PCA

Maintaining or improving secure habitat at or above 1998 levels in each of the Bear Management Unit subunits inside the PCA is required by the Strategy and the Amendment. Both permanent and temporary changes in secure habitat are allowed under the application rules.

A project may permanently change secure habitat if secure habitat of equivalent habitat quality (as measured by the Cumulative Effects Model (CEM) or equivalent technology) is replaced in the same Bear Management Unit subunit. To meet the intent of this requirement; the replacement secure habitat must be of equal or greater size and the Secure Area Habitat Value Score (SHVS) in the replacement secure habitat must be the same or greater as the lost secure habitat. Calculation of SHVS will be accomplished by multiplying the habitat value of each habitat component in the secure habitat area times area of the habitat component and then summing all these calculated values for the secure habitat area. SHVSs for lost secure habitat are then compared to SHVS for the replacement secure habitat. SHVSs are not banked. This analysis of SHVSs is used to document that permanent changes in secure habitat do not result in an erosion of the habitat value of the secure habitat in the subunit.

There are no standards for maintenance of seasonal open motorized access route density >1 mile/mile^2 (OMARD) or total motorized access route density > 2 miles/mile^2 (TMARD), but changes in these parameters must be monitored and reported annually (Attachments A and B). OMARD >1 mi/mi^2 and TMARD >2 miles/mile^2 will be referred to as OMARD and TMARD throughout this and following sections for simplicity. OMARD is monitored for 2 seasons. Season 1 is March 1 through July 15 and Season 2 is July 16 through November 30. Motorized access from December 1 through the end of February is not considered.

Motorized access route density is calculated using Arc Info software and a moving windows process with 30-meter cells and a 1-mile square window. All motorized access routes are included in the TMARD calculation. This includes gated, permanently restricted and open motorized routes. Only open motorized access routes are included in the OMARD calculations. Secure habitat is defined as any area ≥10 acres that is >500 meters from an open or gated motorized access route. Recurring helicopter flight lines are considered open motorized access routes. See Figure A-1 in Attachment A and Figure B-1 in Attachment B for more information and definitions of terms.

Baseline values for 1998 for secure habitat, seasonal OMARD and TMARD are reported to the nearest tenth of a percent here in Figure 8 and in the Strategy and the Amendment. The actual percent change from 1998 to 2007 for each subunit is tracked in the motorized access analysis process and in the project record to 4 decimal places. Any positive changes in these parameters not evident by rounding to the nearest tenth of a percent are discussed to the nearest hundredth of a percent in the following sections for individual subunits. Increases in secure habitat or decreases in OMARD or TMARD less than one hundredth of a percent are not presented. Any decreases in secure habitat or increases in OMARD or TMARD are discussed such that rounding is not misrepresenting any changes.

The following sections summarize the permanent changes in these motorized access parameters since 1998 and on going or approved projects that temporarily affect secure habitat.

Summary of Permanent Changes in Secure Habitat

Secure habitat increased in 16 subunits from that identified in the 1998 baseline. Secure habitat percentage did not decrease in any of the 40 subunits. Increases ranged from as little as 0.02% (Buffalo/Spread Creek #2 and Crandall/Sunlight #2) up to 13.4% for Gallatin #3 (Figure 8). The average secure habitat for the PCA increased from 86.0% to 86.6%. Secure habitat was unchanged in the remaining subunits. Increases in secure habitat

were always accompanied by decreases in OMARD for 1 season or both seasons or TMARD and most often by decreases in all 3 motorized access route density parameters.

The increase in secure habitat in most of the subunits was a result of decommissioning or permanently restricting motorized routes that were open or gated in 1998. In some cases motorized routes were officially changed to non-motorized routes. Increases in secure habitat in 9 subunits were due solely to the Gallatin National Forest and their recent Travel Management Planning Effort. Increases occurred in 4 subunits on the Shoshone National Forest, 1 subunit on the Bridger-Teton National Forest, 1 subunit on the Caribou-Targhee National Forest, and in 1 subunit secure habitat increased due to actions by both the Caribou-Targhee and Gallatin National Forests.

The increase in secure habitat for Buffalo/Spread Creek #2, Crandall/Sunlight #2, and Madison #1 and #2 also included new route construction, realignment or the opening of permanently restricted roads as well as decommissioning or permanently restricting motorized access routes resulting in a net gain of secure habitat. An analysis was performed comparing the acres and Secure Area Habitat Value Scores (SHVSs) of secure habitat lost and secure habitat gained in these subunits and is discussed below in the sections summarizing changes in secure habitat for specific subunits. In all instances the net SHVSs increase
Increases in secure habitat may be banked to offset the impacts of future projects of that administrative unit within that subunit. However, increases in secure habitat in those subunits identified as 'Subunits with Potential for Improvement' in the Strategy (Gallatin #3, Henry's Lake #2, and Madison# 2) will not be banked for future projects.

Summary of Permanent Changes in OMARD and TMARD

OMARD decreased for 16 subunits for Season 1 and 17 subunits for Season 2. TMARD decreased for 17 subunits (Figure 8). Decreases for OMARD ranged from 0.01% in the Henry's Lake #1 to 13.9% in Gallatin #3 for both seasons. Decreases in TMARD ranged from 0.01% for Henry's Lake #1 to 6.8% for Gallatin #3. Decreases in OMARD and TMARD did not always result in an increase in secure habitat by definition. The mean OMARD for Season 1 decreased from 10.4 % in 1998 to 9.8% in 2007. Similarly OMARD for Season 2 decreased from 10.7% to 10.1% and TMARD decreased from 5.3% to 4.7%. The follow sections summarize changes in OMARD and TMARD by subunit.

OMARD increased by 1.2% in Buffalo/Spread Creek #2 in Season 1. This is the only subunit showing any increase in OMARD or TMARD. See discussion below for Buffalo/Spread Creek #2.

Permanent Changes in Secure Habitat, OMARD, and TMARD by Subunit

Bechler/Teton #1

This small decrease (0.2%) in OMARD >1 mi/sq mi for Season 1 and Season 2 was the result of land exchanges wherein the Caribou-Targhee acquired private land at Squirrel Meadows, which enabled the Forest to change an open access road to a gated access road.

Buffalo/Spread Creek #2

OMARD increased by about 1.2% in subunit #2 of the Buffalo/Spread Creek BMU during Season 1 since 1998. This is primarily due to administrative decisions by the Bridger-Teton National Forest since 1998 regarding seasonal closures of gated roads. Roads that were gated in Season 1 and Season 2 in 1998 were administered as open roads during Season 1 after 1998. Similarly some roads that were permanently restricted during both seasons in 1998 are currently administered as open roads for Season 1 and gated roads for Season 2.

OMARD for Season 2 decreased by about 0.4% due to roads that were open during Season 2 in 1998 being administered as gated roads since 1998.

There was a slight increase in secure habitat and some permanent changes in secure habitat in this subunit. The permanently restricted roads that were opened for Season 1 and gated for Season 2 discussed above resulted in a decrease in secure habitat of about 695 acres. However, several roads that were open in 1998 were decommissioned resulting in an increase of 751 acres of secure habitat. The overall result was a net increase of 56 acres of secure habitat which is an increase of about 0.02% over the 1998 baseline. The Cumulative Effects Model was used to evaluate the habitat value of the permanent change in secure habitat. The secure area habitat value score for secure habitat lost was 382,020.4 and 529,911.8 for the new secure habitat. This resulted in an SHVS increase of 147,891.4. These figures were based on the average yearly habitat values for each habitat component in the secure habitat areas. The newly created secure habitat will remain for at least 10 years.

As a result of the changes in motorized access routes in this subunit, the TMARD in this subunit decreased by 0.3% from the 1998 baseline.

Crandall/Sunlight #1
OMARD for Season 1 and Season 2 and TMARD decreased by about 0.02% due to decommissioning of about 1 mile of road in association with the New World Mine Reclamation effort near Cooke City on the Gallatin National Forest. Decommissioning these roads did not increase secure habitat due to the proximity of these roads to other existing open roads.

Crandall/Sunlight #2
OMARD decreased by about 0.5% during Season 1 and by about 0.4% for Season 2. TMARD decreased by about 0.1%. These changes are due to the decommissioning of roughly 1.4 miles of road that were open in 1998 and the addition of about 0.5 miles of a new gated road in the subunit in association with a timber sale project on the Shoshone National Forest.

There was a slight increase in secure habitat and some permanent changes in secure habitat. The new year-round gated road resulted in a decrease in secure habitat of about 12.4 acres. However, the decommissioning of the roads that were open in 1998 resulted in an increase of 43.4 acres of secure habitat. The overall result was a net increase of 31 acres of secure habitat which is an increase of about 0.02% over the 1998 baseline. (Rounding issues show the increase to be 0.1% in Figure 8). The Cumulative Effects Model was used to evaluate the habitat value of the permanent change in secure habitat. The secure area habitat value score for secure habitat lost was 3,844.8 and 6,509.6 for the new secure habitat. This resulted in an SHVS increase of 2,664.8. These figures were based on the average yearly habitat values for each habitat component in the secure habitat areas. The newly created secure habitat will remain for at least 10 years.

Crandall/Sunlight #3
OMARD decreased by approximately 0.2% for both seasons 1 and 2 and secure habitat increased by about 0.3% or roughly 382 acres due to the permanent restriction of the Little Sunlight Road, a 1.1-mile long road which was open in 1998. This was completed in association with closing some dispersed sites as mitigation for change in use at the Sunlight Ranger Station. TMARD did not change.

Gallatin #1
OMARD for Season 1 and 2 decreased by about 0.4% and secure habitat increased by 0.6%. Several motorized access routes along the border between Gallatin #1 and Gallatin #3 that were open in 1998 were designated as non-motorized routes as a result of the Travel Management Planning effort on the Gallatin National Forest. See Gallatin #3 below. TMARD did not change.

Gallatin #3
This subunit is located at the south end of the Gallatin Mountain Range, and a significant portion of the subunit is the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area. This subunit had the most significant increase in

secure habitat (13.4%) and reduction in OMARD for Season 1 and Season 2 (13.9%) and TMARD (6.8%) of all subunits in the PCA. This is one of the subunits designated as 'Subunits with Potential for Improvement' in the Strategy. This improvement was accomplished through the Travel Management Planning effort on the Gallatin National Forest where many previously motorized routes were designated as non-motorized routes when the Travel Plan was signed.

Hellroaring/Bear #1
OMARD for Season 1 and 2 and TMARD decreased by about 1.1% and secure habitat increased by about 0.7%. This was a result of the decommissioning of numerous small sections of motorized routes that were open in 1998 on the Gallatin National Forest.

Henry's Lake #2
Henry's Lake #2, one of the subunits identified as 'Subunits with Potential for Improvement' in the Strategy had numerous roads decommissioned on the Gallatin National Forest since 1998. However, because of their proximity to other motorized routes, OMARD for Season 1 and Season 2 only decreased by about 0.6% and secure habitat only increased by 0.3%. TMARD however did decrease by 1.6%. Henry's Lake #2 will likely show a further increase in secure habitat and decrease in OMARD and TMARD as the Travel Plan on the Gallatin National Forest is fully implemented.

Hilgard #1
This subunit on the west side of the Gallatin National Forest, specifically the Taylor Fork area, has been the focus of major road decommissioning efforts since 1998. This was also the location of some changes in land ownership both in the Taylor Fork (increase in National Forest System lands) and south of Big Sky (adjustment of National Forest System and private lands). In addition, several routes that were motorized use in 1998 were changed to non-motorized use by the Gallatin Travel Plan decision. OMARD for both Season 1 and 2 and TMARD decreased by over 6% and secure habitat increased by about 4.4%. There will be some additional changes which result in increased secure habitat and decreased OMARD and TMARD as the Gallatin Travel Plan is fully implemented.

Hilgard #2
This subunit showed an increase of about 1.7% in secure habitat and a 0.4% decrease in OMARD for each season and a 1.3% decrease in TMARD. These improvements are due to road decommissioning efforts on the Gallatin National Forest since 1998. There will be additional improvements in this subunit with full implementation of the Travel Plan.

Lamar #1
Several roads were decommissioned and 2 roads were constructed on the Gallatin National Forest in this subunit but these changes had no affect on secure habitat due to the proximity to other motorized access routes. OMARD decreased by about 70 acres for each season but did not result in a change to these values in Figure 8 due to rounding. TMARD decreased by 0.1%.

Madison #1
Small decreases in OMARD for Season 1 and 2 and an increase secure habitat (0.2%) were due to the decommissioning of several other motorized routes. TMARD decreased by about 1%.

The rerouting of several motorized routes resulted in a decrease of about 36 acres of secure habitat. The decommissioning of the many other motorized routes resulted in an increase of about 298 acres of secure habitat for a net gain of 262 acres of secure habitat. The Cumulative Effects Model was used to evaluate the habitat value of the permanent change in secure habitat.

The secure area habitat value score for secure habitat lost was 13,839.3 and 100,384.6 for the new secure habitat. This resulted in an SHVS increase of 86,545.3. These figures were based on the average yearly habitat values for each habitat component in the secure habitat areas. The newly created secure habitat will remain for at least 10 years.

Madison #2
This subunit was identified as one of the 'Subunits with Potential for Improvement' in the Strategy. OMARD decreased for each season by about 1%, TMARD by over 2% and secure habitat increased by 0.8% due to the decommissioning of numerous motorized routes near West Yellowstone on the Gallatin National Forest since 1998. This subunit will show some additional improvement as the Gallatin Travel Plan is fully implemented.

In addition to the many roads that were decommissioned a couple of new roads were constructed. The newly constructed roads resulted in a loss of about 27 acres of secure habitat. The road decommissioning resulted in about 757 acres of new secure habitat for a net increase of about 730 acres of secure habitat. The Cumulative Effects Model was used to evaluate the habitat value of the permanent change in secure habitat. The secure area habitat value score for secure habitat lost was 2,715.6 and 169,657.8 for the new secure habitat. This resulted in an SHVS increase of 166,942.2. These figures were based on the average yearly habitat values for each habitat component in the secure habitat areas. The newly created secure habitat will remain for at least 10 years.

Plateau #1
Secure habitat increased by about 2.0%, OMARD decreased by 1.5% for each season and TMARD decreased by 2.6%. Improvements occurred both on the Caribou-Targhee and Gallatin National Forests. Changes on the Caribou-Targhee included a situation where 2 roads open in 1998 on 2 Idaho State land sections are no longer accessible to the public because of road decommissioning and road restrictions on the surrounding National Forest System land. One road was gated yearlong and the other was decommissioned. In another instance 2 roads on National Forest System land on the Caribou-Targhee that were restricted by gates yearlong in 1998 were decommissioned before 2007. Numerous roads were decommissioned on the Gallatin National Forest since 1998 in this subunit.

Plateau #2
There was a small decrease in TMARD of 0.2% and a small increase in secure habitat of 0.1%. These changes occurred because of the following: a) Roads open in 1998 on one Idaho State land section are no longer accessible to the public because of road decommissioning on the surrounding National Forest System land; b) 1 short road segment (less than ½ mile) on National Forest System land that was open in 1998 was decommissioned.

Shoshone #1
OMARD decreased by about 0.04% for both Season 1 and Season 2, TMARD decreased by about 0.1% and secure habitat increased by around 0.06%, or roughly 44 acres. These improvements occurred on the Shoshone National Forest due to the decommissioning about 0.4 miles of road open in 1998 within the subunit. Road decommissioning was related to the North Fork Shoshone road reconstruction project done by the Federal Highways Administration.

Shoshone #2
No road changes were made in subunit 2. TMARD decreased by about 0.04% due to the decommissioned road in the adjacent subunit 1. Secure Habitat did not change from 1998.

Shoshone #4
OMARD decreased by about 0.9% for both Season 1 and Season 2, TMARD decreased by about 0.2%, and Secure Habitat increased by 0.7%. These improvements were due to decommissioning about 3.0 miles of roads

open in 1998 on the Shoshone National Forest. Road changes were associated with the North Fork Shoshone road reconstruction project. This increase in secure habitat will not be banked as these roads were closed as mitigation for the road reconstruction project.

Permanent changes in OMARD, TMARD and secure habitat from 2007 to 2008

All of the above document permanent changes in the motorized access parameters occurred between 1998 and 2007 with the exception of an additional increase in secure habitat and corresponding decreases in OMARD and TMARD in Henry's Lake subunit #1 due to the decommissioning of a small section of gated road on the Caribou-Targhee National Forest. This resulted in a 0.3% increase in secure habitat and a 0.01% decrease in OMARD for each season and TMARD (Figure 8). No changes in motorized access parameters occurred in other subunits during 2008. Mean secure habitat remained at 86.6%.

Temporary Changes in Secure Habitat

Projects that temporarily affect secure habitat must follow the application rules for temporary changes to secure habitat (Attachments A and B). A project under the secure habitat standard is one that involves building new roads, reconstructing roads or opening a permanently restricted road. In other words, secure habitat is reduced due to the new motorized access. The application rules require that only 1 project that affects secure habitat can be active at one time in a subunit and the total acreage of secure habitat affected by those projects within a given Bear Management Unit (BMU) will not exceed 1% of the acreage in the largest subunit within that BMU.

There are currently 4 approved projects in 3 subunits inside the PCA (Figure 9). Three of these projects are on the Shoshone National Forest and the other is on the Bridger-Teton National Forest. Two projects have been approved for the Crandall/Sunlight #2 subunit. The project listed first in Figure 9 will be completed and roads decommissioned or permanently restricted before the second project is initiated. All of the projects affect less than 1% of the acreage of the largest subunit within the respective BMU (Figure 9). All of these projects involve vegetation management.

Two projects were identified in the 2007 report for the Shoshone #4 subunit on the Shoshone National Forest. These 2 projects, Canfield and Sleeping Giant, were completed according to the application rules for projects temporarily affecting secure habitat. The Sleeping Giant helicopter logging operation was completed before starting the temporary road construction for the Canfield project. Upon completion of the Canfield project all associated temporary roads were permanently closed or decommissioned.

The Deadman project on the Shoshone National Forest has been ongoing since 2005, and has now met the 4-year requirement for temporary projects and the roads must be decommissioned to meet the requirements of the secure habitat standard. Vegetation management activities were completed in the required 3-year time period but 2 small spur roads that were to be decommissioned in late 2008 remain open. These roads will be decommissioned in early 2009. The Horse Creek project on the Bridger-Teton and the other 2 projects on the Shoshone National Forest have been approved but temporary road construction has not been initiated.

Figure 8. The 1998 baseline and 2008 values for secure habitat, open motorized access route density (OMARD) >1 mile/mile², and total motorized access route density (TMARD) >2 miles/mile² for 40 Bear Management Unit (BMU) subunits in the Greater Yellowstone Area. Includes Forest Service, Bureau of Land Management, state, county, and private motorized access routes (OMARD AND TMARD values for the 1998 baseline changed slightly from that reported in the Strategy and the Record of Decision (ROD) for the Amendment due to technical analysis issues, see footnote.[1])

BMU subunit Name	OMARD % >1 mi/mi²						TMARD % >2 miles/mile²			% Secure Habitat			Size [2]	
	Season 1 (3/1-7/15)			Season 2 (7/16-11/30)									Sq Miles	1000's of Acres
	1998	2008	% chg	1998	2008	% chg	1998	2008	% chg	1998	2008	% chg		
Bechler/Teton	12.7	12.5	-0.2	12.7	12.5	-0.2	4.0	4.0	0.0	78.1	78.1	0.0	534.3	341.9
Boulder/Slough 1	2.2	2.2	0.0	2.2	2.2	0.0	0.1	0.1	0.0	96.6	96.6	0.0	281.9	180.4
Boulder/Slough 2	1.0	1.0	0.0	1.0	1.0	0.0	0.0	0	0.0	97.7	97.7	0.0	232.4	148.7
Buffalo/Spread Creek 1	10.2	10.2	0.0	10.3	10.3	0.0	4.1	4.1	0.0	88.3	88.3	0.0	219.9 (222.4)	140.7 (142.4)
Buffalo/Spread Creek 2	13.3	14.5	+1.2	14.5	14.1	-0.4	10.4	10.1	-0.3	74.3	74.3	+ < 0.1	507.6	324.9
Crandall/Sunlight 1	12.1	11.9	-0.2	16.3	16.2	-0.1	4.0	3.9	-0.1	81.1	81.1	0.0	129.8	83.1
Crandall/Sunlight 2	13.6	13.1	-0.5	14.6	14.2	-0.4	8.8	8.7	-0.1	82.3	82.4	+0.1	316.2	202.3
Crandall/Sunlight 3	12.8	12.6	-0.2	16.6	16.4	-0.2	8.1	8.1	0.0	80.4	80.7	+0.3	221.8	142.0
Firehole/Hayden 1	6.4	6.4	0.0	6.4	6.4	0.0	1.2	1.2	0.0	88.4	88.4	0.0	339.2	217.1
Firehole/Hayden 2	6.2	6.2	0.0	6.2	6.2	0.0	0.8	0.8	0.0	88.4	88.4	0.0	172.2	110.2
Gallatin 1	1.6	1.2	-0.4	1.6	1.2	-0.4	0.2	0.2	0.0	96.3	96.9	+0.6	127.7	81.7
Gallatin 2	7.8	7.8	0.0	7.8	7.8	0.0	3.9	3.9	0.0	90.2	90.2	0.0	155.2	99.3
Gallatin 3	41.2	27.3	-13.9	41.2	27.3	-13.9	16.9	10.1	-6.8	55.3	68.7	+13.4	217.6	139.3
Hellroaring/Bear 1	20.7	19.6	-1.1	21.4	20.2	-1.1	13.5	12.3	-1.1	77.0	77.7	+0.7	184.7	118.2
Hellroaring/Bear 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.5	99.5	0.0	228.9	146.5
Henry's Lake 1	45.3	45.3	-<0.1	45.3	45.3	-<0.1	26.0	26.0	-<0.1	45.4	45.7	+0.3	191.2 (200.8)	122.4 (128.5)
Henry's Lake 2	46.1	45.5	-0.6	46.1	45.5	-0.6	28.2	26.6	-1.6	45.7	46.0	+0.3	140.2 (152.4)	89.7 (97.6)
Hilgard 1	25.0	18.9	-6.1	25.0	18.9	-6.1	12.5	6.4	-6.1	69.8	74.2	+4.4	201.2	128.8
Hilgard 2	16.2	15.8	-0.4	16.2	15.8	-0.4	10.4	9.1	-1.3	71.5	73.2	+1.7	140.5	89.9

Figure 8. Continued.

BMU subunit Name	OMARD % >1 mi/mi²						TMARD % >2 miles/mile²			% Secure Habitat			Size [2]	
	Season 1 (3/1-7/15)			Season 2 (7/16-11/30)									Sq Miles	1000's of Acres
	1998	2008	% chg	1998	2008	% chg	1998	2008	% chg	1998	2008	% chg		
Lamar 1	6.9	6.9	0.0	6.9	6.9	0.0	3.2	3.1	-0.1	89.4	89.4	0.0	299.9	191.9
Lamar 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	180.7	115.7
Madison 1	24.3	24.1	-0.2	24.6	24.4	-0.2	10.3	9.3	-1.0	71.5	71.7	+0.2	227.9	145.8
Madison 2	31.8	30.7	-1.1	31.8	30.7	-1.1	22.3	19.9	-2.4	66.5	67.3	+0.8	149.4 (156.8)	95.6 (100.4)
Pelican/Clear 1	1.3	1.3	0.0	1.3	1.3	0.00	0.4	0.4	0.0	97.8	97.8	0.0	108.4	69.4
Pelican/Clear 2	3.0	3.0	0.0	3.0	3.0	0.00	0.2	0.2	0.0	94.1	94.1	0.0	251.6	161.0
Plateau 1	18.9	17.4	-1.5	19.1	17.6	-1.5	9.6	7.0	-2.6	68.9	70.9	+2.0	286.3	183.2
Plateau 2	6.3	6.3	0.0	6.3	6.3	0.0	2.4	2.2	-0.2	88.7	88.8	+0.1	419.8 (430.8)	268.7 (275.7)
Shoshone 1	1.4	1.4	-< 0.1	1.4	1.4	-< 0.1	0.9	0.8	-0.1	98.5	98.5	+< 0.1	122.2	78.2
Shoshone 2	1.1	1.1	0.0	1.1	1.1	0.0	0.4	0.4	-< 0.1	98.8	98.8	0.0	132.4	84.7
Shoshone 3	3.4	2.5	-0.9	3.4	2.4	-0.9	1.2	1.0	-0.2	97.0	97.7	+0.7	140.7	90.1
Shoshone 4	3.9	3.9	0.0	4.6	4.6	0.0	2.0	2.0	0.0	94.9	94.9	0.0	188.8	120.8
South Absaroka 1	0.4	0.4	0.0	0.4	0.4	0.0	0.0	0.0	0.0	99.2	99.2	0.0	163.2	104.4
South Absaroka 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.9	99.9	0.0	190.6	122.0
South Absaroka 3	2.1	2.1	0.0	2.1	2.1	0.0	2.3	2.3	0.0	96.8	96.8	0.0	348.3	222.9
Thorofare 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	273.4	175.0
Thorofare 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	180.0	115.2
Two Ocean/Lake 1	1.8	1.8	0.0	1.8	1.8	0.0	0.1	0.1	0.0	96.3	96.3	0.0	371.9 (494.5)	238.0 (316.5)
Two Ocean/Lake 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	124.9 (143.6)	79.9 (91.9)

Figure 8. Continued.

BMU subunit Name	OMARD % >1 mi/mi²						TMARD % >2 miles/mile²			% Secure Habitat			Size [2]	
	Season 1 (3/1-7/15)			Season 2 (7/16-11/30)									Sq Miles	1000's of Acres
	1998	2008	% chg	1998	2008	% chg	1998	2008	% chg	1998	2008	% chg		
Washburn 1	12.3	12.3	0.0	12.3	12.3	0.0	2.9	2.9	0.0	83.0	83.0	0.0	178.3	114.1
Washburn 2	4.0	4.0	0.0	4.0	4.0	0.0	0.6	0.6	0.0	92.0	92.0	0.0	144.1	92.2
Mean for PCA/Total Acres	**10.4**	**9.8**	NA	**10.7**	**10.1**	NA	**5.3**	**4.7**	NA	**86.0**	**86.6**	NA	9,025.1 (9,209.3)	5,776.1 (5,894.0)

[1] The original analysis for OMARD, TMARD, and secure habitat in the Strategy (Appendix F, Table 2) and the Amendment ROD (Figure A-4) used the 1998 baseline motorized access coverage in NAD27. This analysis was conducted in NAD83 (the new Forest Service standard) using the same baseline coverage. The original analysis was also conducted using a PCA sized snapgrid to perform the moving windows analysis. It was discovered when finalizing the access analysis process for yearly monitoring that a slightly different answer was obtained for OMARD and TMARD in certain cases when only performing the analysis at the BMU level. The mean OMARD and TMARD values did not change; demonstrating it was a snapgrid positioning issue when calculating individual subunit values. The process has been standardized to use an individual BMU sized snapgrid and all analysis will be preformed only at the BMU level for future monitoring as reflected by the baseline data above. Secure habitat values did not change, as they were not affected by the snapgrid issue or the projection change. The mean secure habitat for the PCA in Figure A-4 (85.6%) was calculated from the PCA sized secure habitat coverage by dividing total acres of secure habitat in the PCA without lakes by total area in the PCA without lakes. The mean secure habitat shown here was calculated by averaging the percent secure habitat values from individual subunit secure habitat coverages, producing a slightly different mean due to rounding issues. The mean secure habitat shown here is the correct mean and this process will be used in all future analysis.

Acre totals for the individual subunits in the Figure A-4 in the Amendment ROD were calculated from the original square miles reported in the Strategy (Appendix F, Table 2) that were rounded to the nearest square mile. The acre and square mile totals here are calculated directly from the subunit coverage and are more precise. In some cases rounding the square miles shown in this figure to the nearest whole square mile will not match the square miles shown in the Strategy (Appendix F, Table 2). These small differences are due to corrections in the subunit boundaries associated with Yellowstone and Hebgen lakes after the Strategy analysis and before the analysis for the Amendment.

[2] Lakes >1 mile in size were removed from subunit totals, OMARD, TMARD, and secure habitat calculations. Numbers in parentheses include the area of these large lakes.

Figure 9. Approved or ongoing projects that temporarily affect secure habitat inside the Primary Conservation Area, April 2008.

Bear Management Unit (BMU) subunit	Square miles secure habitat 1998	Square miles mecure habitat 2007	1% of the area of the largest subunit in square miles[1]	Project name and Administrative Unit[2]	Square miles of secure habitat with the project	Square miles of secure habitat affected by the project	Total percent temporary change in secure habitat in the BMU based on the area of the largest subunit
Buffalo/Spread Creek #1	194.12	194.12	**5.08**		194.12	**0.00**	**0.27%**
Buffalo/Spread Creek #2	377.27	377.36		**North Fork Fish Creek** Bridger-Teton NF	375.98	**1.38**	
Crandall/Sunlight #1	105.28	105.28	**3.16**		105.28	**0.00**	**0.02%**
Crandall/Sunlight #2	260.33	260.38		**Deadman** Shoshone NF	260.31	**0.07**	
Crandall/Sunlight #3	178.40	179.00			179.00	**0.00**	
Crandall/Sunlight #1	105.28	105.28	**3.16**		105.28	**0.00**	**0.05%**
Crandall/Sunlight #2	260.33	260.38		**Upper Clarks Fork** Shoshone NF	260.23	**0.15**	
Crandall/Sunlight #3	178.40	179.00			179.00	**0.00**	
South Absaroka #1	161.89	161.89	**3.48**		161.89	**0.00**	**0.03%**
South Absaroka #2	190.31	190.31			190.31	**0.00**	
South Absaroka #3	337.14	337.14		**Upper Wind River** Shoshone NF	337.05	**0.10**	

[1] This is the maximum allowable temporary change in secure habitat for all projects within the Bear Management Unit. Only one project can be active in a BMU subunit at any time.

[2] Projects are listed in the BMU subunit where the activity occurs. Projects in a given BMU subunit may affect secure habitat in adjacent subunits or subunits in adjacent BMU's. Where two projects are shown for a given BMU subunit, the first project listed will be completed before starting the subsequent project. None of the listed projects affect secure habitat in adjacent BMU subunits.

Monitoring for Secure Habitat Outside the PCA on the 6 GYA National Forests

Monitoring changes in secure habitat every 2 years on national forests outside the Primary Conservation Area (PCA) in areas identified in state management plans as biologically suitable and socially acceptable for grizzly bear occupancy is required by the Amendment (Attachment B).

The 43 Bear Analysis Units (BAU's) used to report changes in secure habitat outside the PCA are displayed in Figure 2. Secure habitat values for 2003 and 2008 for each of these analysis units is presented below in Figure 10. Many of the changes in secure habitat reported between 2003 and 2008 are due to update of the accuracy of the data used in the Amendment in 2003 and not tied to on-the-ground changes. The discussion below gives some general information by forest as to why these changes occurred and any actual on-the-ground changes. In some instances forests have not completed the update of the 2003 information to reflect current conditions. These data will continue to be in flux for some years as forests complete updates and complete the required travel management analysis process.

Figure 10. Percent secure habitat in Bear Analysis Units outside the Primary Conservation Area for each of the 6 Greater Yellowstone Area national forests for 2003 and 2008.

Bear Analysis Unit	Percent Secure Habitat			Area (without large lakes)[1]	
	2003	2008	% change 03-08	Sq miles	1000's of acres
Beaverhead-Deerlodge National Forest					
Baldy	57.4	46.2	-11.2	96.9	62.0
Bear Creek	38.6	60.8	+22.2	36.4	23.3
Beaver Creek	52.9	48.6	-4.3	478.9	306.5
Garfield	54.1	64.8	+10.8	182.0	116.5
Gravelly	64.0	60.6	-3.4	384.4	246.0
Madison	97.0	100.0	+3.0	89.2	57.1
Pintlar	62.4	59.2	-3.2	410.3	262.6
Pioneer	62.3	53.0	-9.3	912.2	583.8
Snowcrest	66.0	71.0	+5.0	357.2	228.6
Sourdough	47.8	40.1	-7.7	111.2	71.2
Starlight	51.6	40.1	-11.5	79.0	50.6
Tobacco South	46.7	47.0	+0.3	186.3	119.2
Tobacco North[2]	-	52.8	-	106.7	68.3
Mean Secure and Total Area	**60.0**	**56.5**	**-3.5%**	**3,430.6**	**2,195.6**
Bridger-Teton National Forest					
Green[3]	65.8	65.8	0.0	527.9	337.9
Gros Ventre	63.5	64.0	+0.5	507.7	324.9
Fremont[3]	88.0	88.0	0.0	440.0	281.6
Hoback	58.9	58.0	-0.9	292.9	187.5
Snake	64.0	68.0	+4.0	348.9	223.3
Mean Secure and Total Area	**68.6**	**68.8**	**+0.2**	**2,117.3**	**1,355.1**
Caribou-Targhee National Forest					
Centennial	57.8	51.0	-6.8	199.1	127.4
Crooked	60.1	59.5	-0.7	403.0	257.9

Figure 10. Continued.

Bear Analysis Unit	Percent Secure Habitat			Area (without large lakes)[1]	
	2003	2008	% change 03-08	Sq miles	1000's of acres
Deadhorse	54.2	50.9	-3.3	364.8	233.5
Island Park	44.4	36.7	-7.7	333.9	213.7
Lemhi	71.9	70.1	-1.8	143.1	91.6
Palisades	61.4	59.9	-1.5	472.5	302.4
Teton	68.1	65.0	-3.1	209.5	134.1
Mean Secure and Total Area	**58.3**	**55.0**	**-3.3**	**2,126.0**	**1,360.6**
Custer National Forest					
Pyror	39.7	38.9	-0.7	121.8	78.0
Rock Creek	84.4	83.8	-0.6	237.2	151.8
Stillwater	86.9	85.5	-1.4	404.7	259.0
Mean Secure and Total Area	**78.6**	**77.5**	**-1.0**	**763.7**	**488.8**
Gallatin National Forest					
Boulder	76.8	64.8	-11.9	277.9	177.9
Bozeman	59.7	45.7	-14.0	270.5	173.1
Bridger	50.3	28.4	-21.9	236.3	151.2
Cooke	99.6	99.6	0.0	68.7	44.0
Crazy	65.9	57.3	-8.7	254.7	163.1
Gallatin	57.6	52.3	-5.2	415.0	265.6
Mill Creek	84.6	82.3	-2.3	312.2	199.8
Quake	86.2	85.0	-1.1	66.2	42.4
Mean Secure and Total Area	**67.9**	**58.7**	**-9.2**	**1,901.5**	**1,217.0**
Shoshone National Forest					
Carter	77.4	88.5	+11.1	261.1	167.1
Clark	70.9	70.2	-0.7	160.5	102.7
East Fork	73.4	73.2	-0.1	251.0	160.6
Fitzpatrick	99.1	98.4	-0.6	317.8	203.4
North Fork	77.7	78.0	+0.3	143.2	91.6
Wood River	84.3	84.7	+0.4	228.5	146.2
Warm Springs	30.2	30.7	+0.5	183.0	117.1
Mean Secure and Total Area	**76.0**	**77.8**	**+1.8**	**1,545.2**	**988.9**

[1]Lakes >1 square mile were excluded from secure habitat calculations and from total area of Bear Analysis Units (BAU).

[2] Data were unavailable to evaluate this BAU in 2003. This BAU is on the Deerlodge portion of the Beaverhead-Deerlodge National Forest which was not evaluated in the Amendment. The Forest has chosen to monitor secure habitat in the BAU as it is used by grizzly bears.

[3] GIS data layers were not available to complete this analysis for 2008. However, few actual on-the-ground changes in motorized access occurred during this time period.

Beaverhead-Deerlodge National Forest

The 2008 monitoring analysis for areas outside of the PCA used a route data layer developed for revision of the Beaverhead-Deerlodge Forest Plan, completed in 2009. This data layer was used to derive secure habitat values for BAUs for comparison with the 2003 data. The 2008 route data layer represents the most up-to-date

information on motorized routes on the Forest. Figure 10 displays secure habitat values for the 12 analysis units for the 2003 baseline and 13 analysis units for 2008 and future monitoring.

Note that Figure 10 identifies substantial differences in secure habitat values between 2003 and 2008. In 2003, the Beaverhead-Deerlodge NF trails layer had not yet been attributed with the motorized status of all individual routes, and consequently many were labeled "status unknown". Routes labeled "status unknown" were not included in the 2003 baseline data used in the Amendment analysis.

Since 2003, site specific information has been assembled for forest plan revision. Most motorized trails have been attributed with their appropriate motorized status. Trail attributing resulted in a large difference in secure habitat (as modeled in this effort) in some BAUs. For example, in the Pioneer Mountains, there were no routes in the West Pioneers WSA identified as 'motorized' in 2003. In 2008, nearly 81 miles of motorized trail were identified in the Pioneer Mountains WSA. For this report, each BAU was reviewed and all changes in secure habitat between 2003 and 2008 are a result of this updated data information, and not a result of a change in motorized access management. Motorized routes that are physically on the landscape in 2008 were also there in 2003, but were not identified as such in the 2003 baseline.

Figure 10 identifies an increase in secure habitat in the Bear Creek analysis unit of 22% between 2003 and 2008. In 2003, the Beaverhead-Deerlodge NF identified many routes as open to motorized use, when in actuality most motorized routes identified were closed restricted level-one roads.

Data from the Beaverhead-Deerlodge road accomplishment reports (the official reporting mechanism for road management activities) for FY2003 through FY2008 supports this. Figure 11 identifies new road construction (system roads) and decommissioning (system and unauthorized roads) during the 2003 through 2008 period for the entire Beaverhead-Deerlodge NF, not just that portion of the Forest monitored for changes in secure habitat.

Figure 11. Road construction and decommissioning on the Beaverhead-Deerlodge National Forest from 2003 through 2008.

Fiscal Year	New road construction (miles)	Decommissioning (miles)		
		System roads	Unauthorized roads	Total
2003	0.5	1.5	1.5	3.0
2004	0	0.9	9.5	10.4
2005	0	3.5	0	3.5
2006	0	0	0	0
2007	0	0	0.5	0.5
2008	0	3.0	0	3.0
Totals	***0.5***	***8.9***	***11.5***	***20.4***

Figure 11 identifies a net loss of system roads of 19.9 miles between 2003 and 2008. The new construction in FY03 was at administrative or recreation sites, specifically the Pintler Ranger Station parking lot (0.1 mi) in Philipsburg, MT, and Lemhi Pass (0.4 mi).

Substantial changes in motorized route densities are underway on the Beaverhead-Deerlodge NF. Revision of the Forest Plan is anticipated to lead to closure of approximately 295 miles of motorized routes forest-wide. Each of the 7 districts of the Beaverhead-Deerlodge NF are or will be completing an inventory of motorized routes that will lead to Motor Vehicle Use Maps (MVUM). The Madison RD, which includes the entire currently occupied grizzly bear habitat on the Beaverhead-Deerlodge NF, is expecting to complete a MVUM in 2009.

Completion of the MVUM process will likely lead to reduced motorized access Forest-wide, and when complete will provide a stable motorized route baseline for Outside PCA Secure Habitat Monitoring.

Bridger-Teton National Forest

There are 5 Bear Analysis Units (BAUs) on the BTNF. Secure habitat changes from the 2003 baseline in 3 of these BAUs were assessed in 2008 in conjunction with completion of an FEIS on an OHV Route Designation Project on the North Zone of the Forest. The analysis showed secure habitat increased in 2 BAUs and declined in 1 of the BAUs. The majority of this change was due to increased precision in mapping motorized access routes and correction of errors, particularly where roads were not included in the 2003 data. Secure habitat will change in 2009 in these 3 BAUs when the North Zone OHV Route Designation Project is implemented on the ground. Secure habitat will increase in all 3 BAUs above the values calculated for 2008 because of road, trail, and off-road area closures.

The other 2 BAUs occur primarily on the Pinedale RD. A new motor vehicle use map dated 09/30/2007 shows the National Forest System roads, trails, and the areas on the Pinedale Ranger District that are designated for motor vehicle use pursuant to 36 CFR 212.51. The map contains a list of those designated roads, trails, and areas that enumerate the types of vehicles allowed on each route and in each area and any seasonal restrictions that apply on those routes and in those areas. Changes to individual road and trail attributes and off-road travel areas and secure habitat from the 2003 baseline in the 3 BAUs affected by publication on this new map will be analyzed in 2009 simultaneous with the other 3 BAUs noted above. GIS data layers were not available to complete this analysis for 2008. However, few actual on-the-ground changes in motorized access occurred during this time period.

Caribou-Targhee National Forest

There are 7 Bear Analysis Units (BAUs) on the CTNF. Secure habitat changes from the 2003 in all 7 of these BAUs were assessed in 2008 in conjunction with updating the Infra data base for the Forest and mapping for the Motor Vehicle Use Map (MVUM). The analysis shows that secure habitat declined in all units. This decline is primarily related to the use of GPS and digital aerial photography to locate and get accurate road and trail lengths across the Forest. The 2003 layer was not created using this technology. No new roads were created during this time period. This mapping effort has significantly increased the accuracy of the Forest's GIS data base and we do not expect many changes in the future.

In the Centennial BAU several miles of designated ATV trail were created during this time period which reduced secure habitat. Also, in this unit approximately 15 miles of old temporary and system roads were decommissioned. The Bighole travel management plan in the Palisades BAU changed open ATV areas to a designated trail system increasing secure habitat on the ground.

Custer National Forest

Three Bear Analysis Units (BAUs) are present outside the PCA on the Custer National Forest, all on the Beartooth Ranger District. Analysis indicated a slight decrease in secure habitat from 2003 to 2008 in all three BAU's (Figure 10). There were actually very few changes in motorized access, and thus secure habitat, on the ground. The decrease is due mainly to correction of errors in the GIS motorized route layer. Corrections completed are the addition of motorized trails and roads that were present in 2003 but that were excluded from

the GIS layer and updating of routes to more accurately reflect their locations. Errors are still present in the GIS layer, including inaccurate locations of more routes that have not yet been corrected. In addition, the on-the-ground status of several routes is not clear and verification of them may slightly alter the acreage of secure habitat in future analyses.

The Beartooth Travel Management plan was completed in 2008. Implementation began in fall 2008 with sign installation, which will continue in 2009. Although site-specific gate installation and road decommissioning were not included in the travel plan decision, such projects may eventually be proposed. Thus, secure habitat outside the PCA may increase in future years if and when these projects are implemented.

Gallatin National Forest

The GIS layer of motorized access routes used in the Amendment analysis in 2003 was somewhat incomplete outside of the PCA. At that time, prior to travel management planning, the forest did not have a complete coverage of motorized routes. Motorized trails were not included at that time and are the major difference between secure habitat values in 2003 and 2008. Other reasons for changes between 2003 and 2008 for specific BAUs are discussed below. There are very few actual changes in motorized access on National Forest System Lands on the Forest and subsequent reductions in secure habitat between 2003 and 2008. The Forest has a new Travel Plan (2006) and changes in these BAUs are expected as the Travel Plan is implemented on the ground in subsequent years.

Much of the western side of the Bangtail mountain range (southeast part of Bridger BAU) is now private land whereas it was checkerboard ownership until about 10 years ago. Most of western part of the Gallatin BAU is the Lee Metcalf Wilderness Spanish Peaks Unit. The heavily motorized portion of the southwest part of the BAU is from the proliferation of motorized routes on the private land in the Big Sky area. Some of the changes in secure habitat on the east side of the Bozeman BAU along the Paradise Valley may be due to the checkerboard land ownership along the Forest boundary and increased motorized routes on private lands in these areas. Mining activity and minor increases in motorized access is responsible for some of the changes in secure habitat for the Boulder BMU.

Shoshone National Forest

Seven Bear Analysis Units (BAUs) on the Shoshone were analyzed for changes in secure habitat. Secure habitat changes between the 2003 baseline and the 2008 data were assessed. The analysis showed secure habitat declined in 3 of the BAUs, although by small amounts, and increased in 4 BAUs. The biggest percent change was in the Carter unit. This change is the result of a large road decommissioning project that occurred in conjunction with the Carter Mountain Timber sale in 2004. In the Warm Springs unit, several small roads or portions of roads have bee closed and there is 1 temporary road still open.

The small changes in the other BAUs was due to correcting errors in the 2003 data to reflect what is actually on the ground.

Literature Cited

Grand Teton National Park. 2007. Superintendents Compendium. 36 CFR 1.7 (b).

U.S. Fish and Wildlife Service. 2007. Final conservation strategy for the grizzly bear in the Greater Yellowstone Area. Available at http://www.fws.gov/mountain-prairie/species/mammals/grizzly/Final_Conservation_Strategy.pdf.

Mace, R., J.S. Waller, T. Manley, L.J. Lyon, and H. Zuuring. 1996. Relationships among grizzly bears, roads, and habitat in the Swan Mountains, Montana. Journal of Applied Ecology 33:1305–1404.

USDA Forest Service. 2006. Forest Plan Amendment for Grizzly Bear Conservation for the Greater Yellowstone Area National Forests. Record of Decision. 63 pp.

Yellowstone National Park. 2007. Superintendents Compendium. 36 CFR 1.7 (b) 1.2 (d).

Attachment A

Conservation Strategy Habitat Standards and Monitoring Requirements

Habitat Standards

References to appendices and baseline tables in the Strategy have been deleted. Tables presented in the body of this document represent the 1998 baseline and current situation.

Secure Habitat Standard

The percent of secure habitat within each bear management subunit must be maintained at or above levels that existed in 1998. Temporary and permanent changes are allowed under specific conditions identified below. Figure A-1 provides a summary of the secure area management rules. The rule set in Figure A-1 will be used in management and evaluation of projects and habitat management actions as appropriate under this Conservation Strategy.

Application Rules for Changes in Secure Habitat

Permanent changes to secure habitat. A project may permanently change secure habitat provided that replacement secure habitat of equivalent habitat quality (as measured by the Cumulative Effects Model (CEM) or equivalent technology) is provided in the same grizzly subunit. The replacement habitat must either be in place before project initiation or be provided concurrently with project development as an integral part of the project plan.

Temporary changes to secure habitat. Temporary reductions in secure habitat can occur to allow projects, if all of the following conditions are met:

• Only one project is active per grizzly subunit at any one time.

• Total acreage of active projects within a given BMU will not exceed 1% of the acreage in the largest subunit within that BMU. The acreage of a project that counts against the 1% limit is the acreage associated with the 500-meter buffer around any motorized access route that extends into secure habitat.

• Secure habitat is restored within one year after completion of the project.

Figure A-1. The rule set for secure habitat management in the Yellowstone Primary Conservation Area.

Criteria	Definition
Software, Database, and Calculation Parameters	ARC INFO using the moving window GIS technique (Mace et al. 1996), 30-meter pixel size, square mile window size, and density measured as miles/square mile. Motorized access features from the CEM GIS database
Motorized Access Routes in Database	All routes having motorized use or the potential for motorized use (restricted roads) including motorized trails, highways, and forest roads. Private roads and state and county highways counted.
Season Definitions	Season 1 – 1 March to 15 July. Season 2 – 16 July to 30 November. There are no access standards in the winter season (1 December to 28 February).
Habitat Considerations	Habitat quality not part of the standards but 1) Replacement secure habitat requires equal or greater habitat value 2) Road closures should consider seasonal habitat needs.
Project	An activity requiring construction of new roads, reconstructing or opening a restricted road or recurring helicopter flights at low elevations.
Secure Habitat	More than 500 meters from an open or gated motorized access route or reoccurring helicopter flight line. Must be greater than or equal to 10 acres in size. Replacement secure habitat created to mitigate for loss of existing secure habitat must be of equal or greater habitat value and remain in place for a minimum of 10 years. Large lakes not included in calculations.
Activities Allowed in Secure Habitat	Activities that do not require road construction, reconstruction, opening a restricted road, or reoccurring helicopter flights. Over the snow use allowed until further research identifies a concern.
Inclusions in Secure Habitat	Roads restricted with permanent barriers (not gates), decommissioned or obliterated roads, and/or non-motorized trails.
Temporary Reduction in Secure Habitat	One project per subunit is permitted that may temporarily reduce secure habitat. Total acreage of active projects in the BMU will not exceed 1% of the acreage in the largest subunit within the BMU. The acreage that counts against the 1% is the 500-meter buffer around open motorized access routes extending into secure habitat. Secure habitat is restored within one year after completion of the project.
Permanent Changes to Secure Habitat	A project may permanently change secure habitat provided that replacement secure habitat of equivalent habitat quality (as measured by CEM or equivalent technology) is provided in the same grizzly subunit. The replacement habitat either must be in place before project initiation or be provided as an integral part of the project plan.
Subunits with Planned Temporary Secure Habitat Reduction	Secure habitat for subunits Gallatin #3 and Hilgard #1 will temporarily decline below 1998 values due to the Gallatin Range Consolidation Act. Upon completion of the land exchange and associated timber sales, secure habitat in these subunits will be improved from the 1998 baseline.
Subunits with Potential for Improvement	Access values for Henry's Lake #2, Gallatin #3, and Madison #2 have the potential for improvement. The quantity and timing of the improvement will be determined by the Gallatin National Forest Travel Management Plan.
Proactive Improvement in Secure Habitat	A proactive increase in secure habitat may be used at a future date to mitigate for impacts of proposed projects of that administrative unit within that subunit.
Exceptions for Caribou-Targhee NF	When fully adopted and implemented the Standards and Guidelines in the 1997 revised Targhee Forest Plan met the intent of maintaining secure habitat levels.

Developed Site Standard
The number and capacity of developed sites within the PCA will be maintained at or below the 1998 level with the following exceptions: any proposed increase, expansion, or change of use of developed sites from the 1998 baseline in the PCA will be analyzed, and potential detrimental and positive impacts documented through biological evaluation or assessment by the action agency.

A developed site includes but is not limited to sites on public land developed or improved for human use or resource development such as campgrounds, trailheads, lodges, administrative sites, service stations, summer homes, restaurants, visitor centers, and permitted resource development sites such as oil and gas exploratory wells, production wells, plans of operation for mining activities, work camps, etc.

Application Rules
Mitigation of detrimental impacts will occur within the affected subunit and will be equivalent to the type and extent of impact. Mitigation measures will be in place before the initiation of the project or included as an integral part of the completion of the project.
• Consolidation and/or elimination of dispersed camping will be considered adequate mitigation for increases in human capacity at developed campgrounds if the new site capacity is equivalent to the dispersed camping eliminated.
• New sites will require mitigation within that subunit to offset any increases in human capacity, habitat loss, and increased access to surrounding habitats.
• Administrative site expansions are exempt from human capacity mitigation expansion if such developments are necessary for enhancement of management of public lands and other viable alternatives are not available. Temporary construction work camps for highway construction or other major maintenance projects are exempt from human capacity mitigation if other viable alternatives are not available. Food storage facilities and management must be in place to ensure food storage compliance, i.e., regulations established and enforced, camp monitors, etc. All other factors resulting in potential detrimental impacts to grizzly bears will be mitigated as identified for other developed sites.
• Land managers may improve the condition of developed sites for bears or reduce the number of sites. The improvements may then be used at a future date to mitigate equivalent impacts of proposed site development increase, expansion, or change of use for that administrative unit within that subunit.
• To the fullest extent of its regulatory authority, the Forest Service will minimize effects on grizzly habitat from activities based in statutory rights, such as the 1872 General Mining Law. In those expected few cases where the mitigated effects will result in an exceedance of the 1998 baseline that cannot be compensated for within that subunit, compensation, in the PCA, to levels at or below the 1998 baseline will be accomplished in adjacent subunits when possible, or the closest subunit if this is not possible, or in areas outside the PCA adjacent to the subunit impacted. Mitigation for Mining Law site impacts will follow standard developed site mitigation to offset any increases in human capacity, habitat loss, and increased access to surrounding habitats. Access impacts relating to Mining Law activities will be mitigated per the applications rules for changes in secure habitat.
• Developments on private land are not counted against this standard.

Livestock Allotment Standard
Inside the PCA, no new active commercial livestock grazing allotments will be created and there will be no increases in permitted sheep Animal Months (AMs) from the identified 1998 baseline. Existing sheep allotments will be monitored, evaluated, and phased out as the opportunity arises with willing permittees.

Application Rules
Allotments include both vacant and active commercial grazing allotments. Vacant allotments are those without an active permit, but may be used periodically by other permittees at the discretion of the land management agency to resolve resource issues or other concerns. Reissuance of permits for vacant cattle allotments may

result in an increase in the number of permitted cattle, but the number of allotments would remain the same as the 1998 baseline. Combining or dividing existing allotments would be allowed as long as acreage in allotments does not increase. Any such use of vacant cattle allotments resulting in an increase in permitted cattle numbers will be allowed only after an analysis by the action agency to evaluate impacts on grizzly bears. Where chronic conflicts occur on cattle allotments inside the PCA, and an opportunity exists with a willing permittee, one alternative for resolving the conflict may be to phase out cattle grazing or to move the cattle to a currently vacant allotment where there is less likelihood of conflict.

Habitat Monitoring

Habitat monitoring will focus on evaluation of adherence to the habitat standards identified in this Strategy. Monitoring of other important habitat parameters will provide additional information to evaluate fully the status of the habitat for supporting a recovered grizzly bear population and the effectiveness of habitat standards. Habitat standards and other habitat parameters will be monitored as follows.

Secure Habitat and Motorized Access Route Density - Monitoring Protocol

Secure habitat, open motorized access route density (OMARD) greater than one mile/square mile, and total motorized access route density (TMARD) greater than two miles/square mile will be monitored utilizing Yellowstone Grizzly Bear Cumulative Effects Model (CEM), Geographic Information System (GIS) databases, and reported annually within each subunit in the IGBST Annual Report. Protocols are established for an annual update of motorized access routes and other CEM GIS databases for the PCA. To provide evaluation of motorized access proposals relative to the 1998 baseline, automated GIS programs are available on each administrative unit.

Developed Sites - Monitoring Protocol

Monitoring numbers of developed sites can indirectly assess displacement from habitat, habituation to human activities, and increased grizzly mortality risk. Changes in the number and capacity of developed sites on public lands will be compiled annually and compared to the 1998 baseline. Developed sites are currently inventoried in existing GIS databases and are an input item to the CEM.

Livestock Grazing - Monitoring Protocol

To ensure no increase from the 1998 baseline, numbers of commercial livestock grazing allotments and numbers of sheep AMs within the PCA will be monitored and reported to the IGBST annually by the permitting agencies.

Habitat Effectiveness and Habitat Value - Monitoring Protocol

The agencies will measure changes in seasonal Habitat Effectiveness in each BMU and subunit by regular application of the CEM or the best available system, and compare outputs to the 1998 baseline. CEM databases will be reviewed annually and updated as needed. These databases include location, duration, and intensity of use for motorized access routes, non-motorized access routes, developed sites, and front country and backcountry dispersed uses. Emphasis and funding will continue to refine and verify CEM assumptions and to update databases.

Representative trails or access points, where risk of grizzly bear mortality is highest, will be monitored when funding is available. CEM databases will be updated to reflect any noted changes in intensity or duration of human use.

Attachment B

Habitat Standards and Monitoring Requirements in the Forest Plan Amendment for Grizzly Bear Habitat Conservation for the Greater Yellowstone Area Forests

Habitat Standards and Guidelines

Only habitat standards from the Amendment that are tied to monitoring requirements are listed here. References to appendices and baseline tables in the Amendment have been deleted here. Tables presented in the body of this document represent the 1998 baseline and current situation.

Grizzly bear habitat conservation standard for secure habitat
Inside the Primary Conservation Area, maintain the percent of secure habitat in Bear Management Unit subunits at or above 1998 levels. Projects that change secure habitat must follow the Application Rules.

Application Rules for changes in secure habitat
Permanent changes to secure habitat. A project may permanently change secure habitat if secure habitat of equivalent habitat quality (as measured by the Cumulative Effects Model or equivalent technology) is replaced in the same Bear Management Unit subunit. The replacement habitat must be maintained for a minimum of 10 years and be either in place before project implementation or concurrent with project development. Increases in secure habitat may be banked to offset the impacts of future projects of that administrative unit within that subunit.

Temporary changes to secure habitat. Projects can occur with temporary reductions in secure habitat if all the following conditions are met:

- Only one active project per Bear Management Unit subunit can occur at any one time.
- The total acreage of active projects within a given Bear Management Unit does not exceed 1 percent of the acreage in the largest subunit within that Bear Management Unit. The acreage of a project that counts against the 1 percent limit is the acreage associated with the 500-meter buffer around any gated or open motorized access route or recurring low level helicopter flight line, where the buffer extends into secure habitat.
- To qualify as a temporary project, implementation will last no longer than three years.
- Secure habitat must be restored within one year after completion of the project.
- Project activities should be concentrated in time and space to the extent feasible.
- ***Acceptable activities in secure habitat.*** Activities that do not require road construction, reconstruction, opening a permanently restricted road, or recurring helicopter flight lines at low elevation do not detract from secure habitat. Examples of such activities include thinning, tree planting, prescribed fire, trail maintenance, and administrative studies/monitoring. Activities should be concentrated in time and space to the extent feasible to minimize disturbance. Effects of such projects will be analyzed in the National Environmental Policy Act process. Helicopter use for short-term activities such as prescribed fire ignition/management, periodic administrative flights, fire suppression, search and rescue, and other similar activities do not constitute a project and do not detract from secure habitat.
- Motorized access routes with permanent barriers, decommissioned or obliterated roads, non-motorized trails, winter snow machine trails, and other motorized winter activities do not count against secure habitat.
- Project activities occurring between December 1 and February 28 do not count against secure habitat.
- Minimize effects on grizzly habitat from activities based in statutory rights, such as access to private lands under the Alaska National Interest Lands Conservation Act and the 1872 General Mining Law.

Where the mitigated effects exceed the 1998 baseline within the affected subunit, compensate secure habitat to levels at or above the 1998 baseline, in this order: 1) in adjacent subunits, or 2) nearest subunits, or 3) in areas outside the Primary Conservation Area adjacent to the subunit impacted.

- Honor existing oil and gas and other mineral leases. Proposed Applications for Permit to Drill and operating plans within those leases should meet the Application Rules for changes in secure habitat. New leases, Applications for Permit to Drill, and operating plans must meet the secure habitat and developed site standards.

Grizzly bear habitat conservation standard for developed sites

Inside the Primary Conservation Area, maintain the number and capacity of developed sites at or below 1998 levels, with the following exceptions: any proposed increase, expansion, or change of use of developed sites from the 1998 baseline in the Primary Conservation Area will be analyzed and potential detrimental and positive impacts on grizzly bears will be documented through biological evaluation or assessment. Projects that change the number or capacity of developed sites must follow the Application Rules.

Application Rules for developed sites

Mitigation of detrimental impacts must occur within the affected subunit and be equivalent to the type and extent of impact. Mitigation measures must be in place before implementation of the project or included as an integral part of the completion of the project.

- New sites must be mitigated within that subunit to offset any increases in human capacity, habitat loss, and increased access to surrounding habitats. Consolidation and/or elimination of dispersed campsites is adequate mitigation for increases in human capacity at developed campgrounds if the new site capacity is equivalent to the dispersed camping eliminated.
- Administrative site expansions are exempt from human capacity mitigation expansion if such developments are necessary for enhancement of management of public lands and other viable alternatives are not available. Temporary construction work camps for highway construction or other major maintenance projects are exempt from human capacity mitigation if other viable alternatives are not available. Food storage facilities and management, including camp monitors, must be in place to ensure food storage compliance. All other factors resulting in potential detrimental impacts to grizzly bears must be mitigated as identified for other developed sites.
- To benefit the grizzly bear, capacity, season of use, and access to surrounding habitats of existing developed sites may be adjusted. The improvements may then be banked to mitigate equivalent impacts of future developed sites within that subunit.
- Minimize effects on grizzly habitat from activities based in statutory rights, such as the 1872 General Mining Law. Where the mitigated effects exceed the 1998 baseline within that subunit, provide mitigation to levels at or below the 1998 baseline in this order: 1) adjacent subunits, or 2) the nearest subunit, or 3) in areas outside the Primary Conservation Area adjacent to the subunit impacted. Mitigation for Mining Law site impacts must follow standard developed site mitigation to offset any increases in human capacity, habitat loss, and increased access to surrounding habitats.
- Honor existing oil and gas and other mineral leases. Proposed Applications for Permit to Drill and operating plans within those leases should meet the developed site standard. New leases, Applications for Permit to Drill, and operating plans must meet the developed site standard.
- Developments on private land are not counted against this standard.

Grizzly bear habitat conservation standard for livestock grazing

Inside the Primary Conservation Area, do not create new active commercial livestock grazing allotments, do not increase permitted sheep animal months from the 1998 baseline, and phase out existing sheep allotments as opportunities arise with willing permittees.

Application Rule for livestock grazing standard
Allotments include both vacant and active commercial grazing allotments. Reissuance of permits for vacant cattle allotments may result in an increase in the number of permitted cattle, but the number of allotments must remain at or below the 1998 baseline. Allow combining or dividing existing allotments as long as acreage in allotments does not increase. Any such use of vacant cattle allotments resulting in an increase in permitted cattle numbers could be allowed only after an analysis to evaluate impacts on grizzly bears.

Grizzly bear habitat conservation guideline for livestock grazing
Inside the Primary Conservation Area, cattle allotments or portions of cattle allotments with recurring conflicts that cannot be resolved through modification of grazing practices may be retired as opportunities arise with willing permittees. Outside the Primary Conservation Area in areas identified in state management plans as biologically suitable and socially acceptable for grizzly bear occupancy, livestock allotments or portions of allotments with recurring conflicts that cannot be resolved through modification of grazing practices may be retired as opportunities arise with willing permittees.

Application Rule for livestock grazing guideline
Permittees with allotments with recurring conflicts will be given the opportunity to place livestock in a vacant allotment outside the Primary Conservation Area where there is less likelihood for conflicts with grizzly bears as these allotments become available.

Grizzly bear habitat conservation guideline for food sources
Inside and outside the Primary Conservation Area in areas identified in state management plans as biologically suitable and socially acceptable for grizzly bear occupancy, maintain the productivity, to the extent feasible, of the four key grizzly bear food sources as identified in the Conservation Strategy. Emphasize maintaining and restoring whitebark pine stands inside and outside the Primary Conservation Area.

Habitat Monitoring

Grizzly bear habitat conservation monitoring for secure habitat and motorized access
Inside the Primary Conservation Area, monitor, compare to the 1998 baseline, and annually submit for inclusion in the Interagency Grizzly Bear Study Team Annual Report: secure habitat, open motorized access route density (OMARD) greater than one mile per square mile, and total motorized access route density (TMARD) greater than two miles per square mile in each subunit on the national forest.
Outside the Primary Conservation Area in areas identified in state management plans as biologically suitable and socially acceptable for grizzly bear occupancy, monitor, and submit for inclusion in the Interagency Grizzly Bear Study Team Annual Report: changes in secure habitat by national forest every two years.

Grizzly bear habitat conservation monitoring for developed sites
Inside the Primary Conservation Area, monitor, and annually submit for inclusion in the Interagency Grizzly Bear Study Team Annual Report: changes in the number and capacity of developed sites on the national forest, and compare with the 1998 baseline.

Grizzly bear habitat conservation monitoring for livestock grazing
Inside the Primary Conservation Area, monitor, compare to the 1998 baseline, and annually submit for inclusion in the Interagency Grizzly Bear Study Team Annual Report: the number of commercial livestock grazing allotments on the national forest and the number of permitted domestic sheep animal months. Inside and outside the Primary Conservation Area, monitor and evaluate allotments for recurring conflicts with grizzly bears.

Grizzly bear habitat conservation monitoring for habitat effectiveness
Inside the Primary Conservation Area, monitor, and every five years submit for inclusion in the Interagency Grizzly Bear Study Team Annual Report: changes in seasonal habitat effectiveness in each Bear Management Unit and subunit on the national forest through the application of the Cumulative Effects Model or the best available system and compare outputs to the 1998 baseline. Annually review Cumulative Effects Model databases and update as needed. When funding is available, monitor representative non-motorized trails or access points where risk of grizzly bear mortality is highest.

Grizzly bear habitat conservation monitoring for whitebark pine
Monitor whitebark pine occurrence, productivity, and health inside and outside the Primary Conservation Area in cooperation with other agencies. Annually submit for inclusion in the Interagency Grizzly Bear Study Team Annual Report: results of whitebark pine cone production from transects or other appropriate methods, and results of other whitebark pine monitoring.

Figure B-1. Criteria and definitions used in the Amendment ROD.

Criteria	Definition
Motorized access routes	Motorized access routes are all routes having motorized use or the potential for motorized use (restricted roads) including motorized trails, highways, and forest roads. Private roads and state and county highways are counted.
Restricted road	A restricted road is a road on which motorized vehicle use is restricted seasonally or yearlong. The road requires effective physical obstruction, generally gated.
Permanently restricted road	A permanently restricted road is a road restricted with a permanent barrier and not a gate. A permanently restricted road is acceptable within secure habitat.
Decommissioned or obliterated or reclaimed road	A decommissioned or obliterated or reclaimed road refers to a route which is managed with the long-term intent for no motorized use, and has been treated in such a manner to no longer function as a road. An effective means to accomplish this is through one or a combination of several means including recontouring to original slope, placement of logging or forest debris, planting of shrubs or trees, etc.
Secure habitat	Secure habitat is more than 500 meters from an open or gated motorized access route or recurring helicopter flight line. Secure habitat must be greater than or equal to 10 acres in size[1]. Large lakes (greater than one square mile) are not included in the calculations.
Project	A project is an activity requiring construction of new roads, reconstructing or opening a permanently restricted road, or recurring helicopter flights at low elevations. Opening a gated road for public or administrative use is not considered a project as the area behind locked, gated roads is not considered secure habitat.
Temporary project	To qualify as a temporary project under the Application Rules, project implementation will last no longer than three years.
Opening a permanently restricted road	Removing permanent barriers such that the road is accessible to motorized vehicles.
Permanent barrier	A permanent barrier refers to such features as earthen berms or ripped road surfaces to create a permanent closure.
Removing motorized routes	To result in an increase in secure habitat, motorized routes must either be decommissioned or restricted with permanent barriers, not gates. Non-motorized use is permissible.
Seasonal periods	Season 1 – March 1 through July 15 Season 2 – July 16 through November 30 Project activities occurring between December 1 and February 28 do not count against secure habitat.
Developed site	A developed site includes but is not limited to sites on public land developed or improved for human use or resource development such as campgrounds, trailheads, improved parking areas, lodges (permitted resorts), administrative sites, service stations, summer homes (permitted recreation residences), restaurants, visitor centers, and permitted resource development sites such as oil and gas exploratory wells, production wells, Plans of Operation for mining activities, work camps, etc.
Vacant allotments	Vacant allotments are livestock grazing allotments without an active permit, but could be restocked or used periodically by other permittees at the discretion of the land management agency to resolve resource issues or other concerns.
Recurring conflicts	Recurring grizzly bear/human or grizzly bear/livestock conflicts are defined as three or more years of recorded conflicts during the most recent five-year period.

[1] Secure habitat in this amendment does not include areas open to cross country off-highway vehicle (OHV) travel.