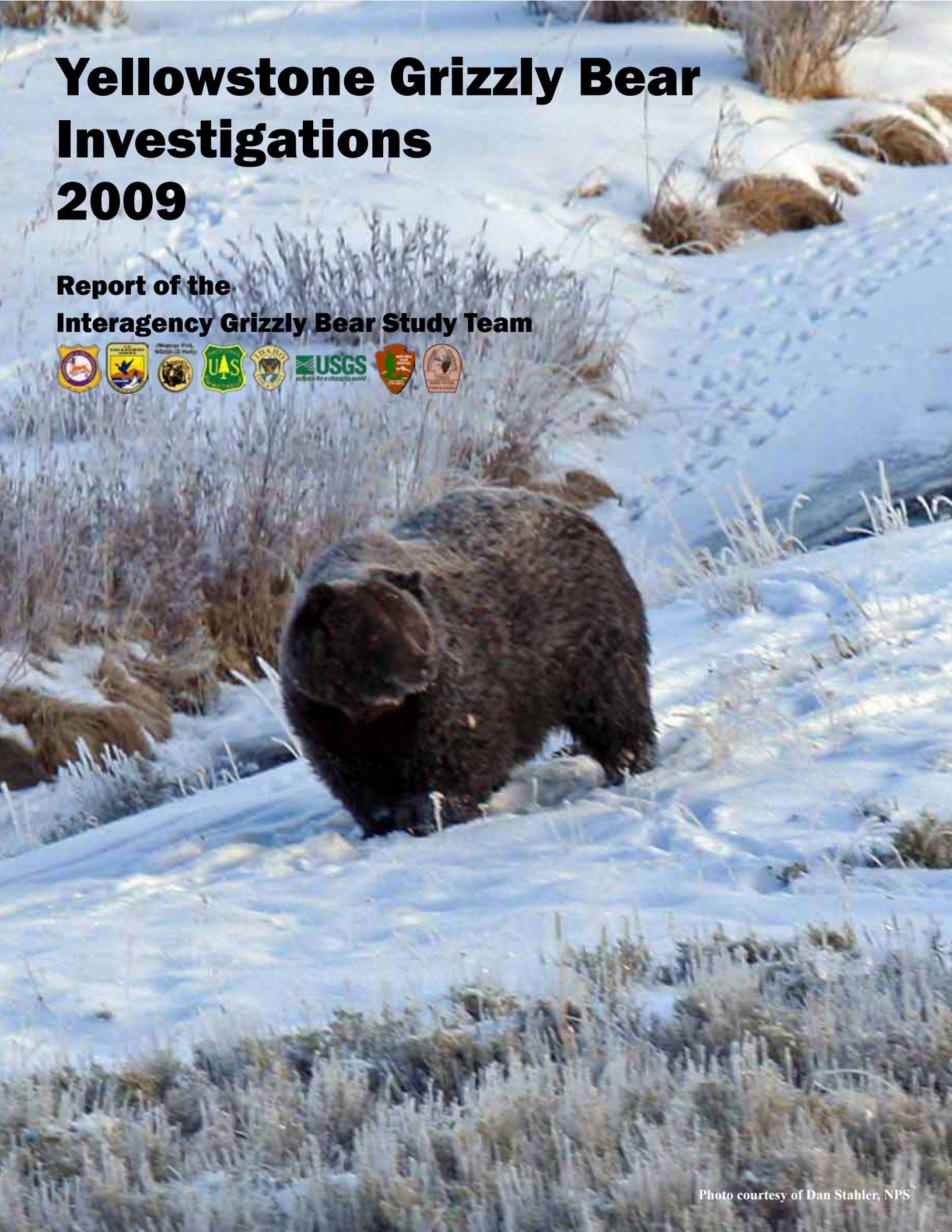
Yellowstone Grizzly Bear Investigations 2009

Report of the Interagency Grizzly Bear Study Team



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Cover: Fat grizzly bear in Gardner's Hole, Nov 2009. Photo courtesy of Dan Stahler/NPS.

YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

Annual Report of the Interagency Grizzly Bear Study Team

2009

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
Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department

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

U.S. Department of the Interior
U.S. Geological Survey
2010

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Introduction

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

This Report

The contents of this Annual Report summarize results of monitoring and research from the 2009 field season. The report also contains a summary of nuisance grizzly bear (*Ursus arctos horribilis*) management actions.

The Interageny 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:Appendix F). 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 provided funding for this project. There were some unanticipated delays in getting all the money transferred and as a result we did not get the project started in early 2009 as anticipated. However, the project is now active and we anticipate results to be available by sometime in 2010.

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*) but relisted by court order in 2009. Although the status changed, we continue to follow monitoring protocols established 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 will continue 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).
- Calculating a total population estimate for the entire GYA based on the model averaged Choa2 estimate of females with COY.
- 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 Recovery Zone (RZ) 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 females and males (≥2 years old) 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 probably 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 foods have been monitored 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 2009 monitoring is also presented (Appendix D). The protocol has been modified to document mortality rate in whitebark pine from all causes, including mountain pine beetle (*Dendroctonus ponderosae*).

Although monitoring requirements under the Conservation Strategy (USFWS 2007*c*) do not apply since the bear was relisted, the Forest Service will continue to report on items identified in the Strategy including changes in secure habitat, livestock allotments, and developed sites from the 1998 baseline levels in each BMU subunit. This year, the third

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 RZ, 2) changes in number and capacity of developed sites inside the RZ, 3) changes in number of commercial livestock allotments and changes in the number of permitted domestic sheep animal months inside the RZ, and livestock allotments with grizzly bear conflicts during the last 5 years (see Appendix In preparation).

Results of DNA hair snaring work conducted on Yellowstone Lake (Haroldson et al. 2005) from 1997–2000 showed a decline in fish 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 and field work was complete in 2009. There were 2 graduate students and several field technicians working on the program. A summary of the 2009 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 document the presence of grizzly bears on the periphery of their distribution. 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 U.S. Geological Survey (USGS), National Park Service, U.S. Forest Service, USFWS, and the States of Idaho, Montana, and Wyoming. 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 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 Yellowstone National Park 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/science/igbst/pubs) 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 USGS: J. Ball, N. Counsell, P. Cross, R. Fitzpatrick, C. Lindbeck, S. McKenzie, K. Miller, M. O'Reilly, T. Rosen, S. Schmitz, J. Teisberg, S. Thompson, C. Whitman, C. Wickhem; NPS: H. Bosserman, A. Bramblett, M. Bretzke, A. Byron, T. Coleman, S. Consolo-Murphy, C. Daigle-Berg, T. Davis, S. Dewey, L. Felicetti, L. Frattaroli, B. Gafney, S. Gunther, B. Hamblin, L. Haynes, B. Jones, D. Smith, D. Stahler, A. Tallian, P.J. White, S. Wolff, B. Wyman; MTFWP: N. Anderson, L. Hanauska-Brown, J. Smith, J. Smolczynski, S. Stewart; WYGF: G. Anderson, T. Achterhof, S. Becker, M. Boyce, D. Brimeyer, G. Brown, J. Clapp, D. Clause, B. DeBolt, D. Ditolla, L. Ellsbury, T. Fagan, G. Fralick, H. Haley, S. Hegg, A. Johnson, N. Johnson, J. Kettley, L. Knox, B. Kroger, M. Ladd, S. Lockwood, L. Lofgren, J. Longobardi, P. Luepke, D. McWhirter, K. Millls, B. Nesvik, C. Queen, R. Roemmich, C. Sax, D. Thompson, B. Trebelcock, Z. Turnbull; IDFG: C. Anderson, S. Grigg, J. Hansen, T. Imthum, R. Knight, J. Koontz, G. Losinski, H. Miyasaki, S. Roberts, J. Rydalch; USFS: M. Cherry, B. Davis, T. Hershey, M. Hinschberger, L. Otto, A. Pils, C. Pinegar, D. Probasco; Shoshone and Arapaho Tribes: B. Makeshine, K. Smith, R. St. Clair, W. Thayer, B. Warren; USFWS: P. Hnilicka, D. Skates; Pilots/Observers: C. Anderson, B. Ard, S. Ard, B. Brannon, N. Cadwell, R. Danielson, D. Ford, K. Hamlin, H. Leach, J. Martin, K. Overfield, M. Packila, T. Schell, D. Stinson, D. Stradley, R. Stradley; WS: G. McDougal, J. Rost; and MSU: S. Cherry 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.

Grizzly bear near trap site on Yellowstone Lake, 24 Jun 2009. Photo courtesy of Gary White.

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 2009 field season, 79 individual grizzly bears were captured on 97 occasions (Table 1), including 20 females (12 adult), 57 males (38 adult), and 2 yearlings that were released without handling and whose sex was unknown. Fifty-three individuals were new bears not previously marked.

We conducted research trapping efforts for 929 trap days (1 trap day = 1 trap set for 1 day) in the GYE. During research trapping operations we had 63 captures of 48 (10 female, 38 male) individual grizzly bears for a trapping success rate of 1 grizzly capture every 14.7 trap days.

There were 34 management captures of 32 individual bears in the GYE during 2009 (Tables 1 and 2), including 10 females (5 adult), 20 males (12 adult), and 2 yearlings that were released without handling and were not sexed. Twenty-two individual bears (8 females, 14 males), were relocated due to conflict situations (Table 1). There were 7 (2 females, 5 males) management removals, which included 1 female that had been relocated on 2 previous occasions. Four bears captured in management situations were release on site. Two of these were non-target captures during separate management capture efforts at cattle depredations (1 by wolves, 1 by bear), and 2 were yearlings released when an attempt to capture their mother at a conflict site was unsuccessful. Additionally, 1 adult male initially management trapped and relocated was subsequently caught at a research trap site near an active management trapping effort and was transported away from the vicinity of the conflict. Another subadult male caught at a research trap sites was relocated because of his recent conflict history and close proximity to human developments.

We radio-monitored 91 individual grizzly bears during the 2009 field season, including 29 adult females (Tables 2 and 3). Forty-two grizzly bears entered their winter dens wearing active transmitters. One additional bear not located since September is considered missing (Table 3). Since 1975, 626 individual grizzly bears have been radiomarked in the GYE.

Table 1. Grizzly bears captured in the Greater Yellowstone Ecosystem during 2009.

Bear[a]	Sex	Age	Date	General location[b]	Capture type	Release site[b]	Agency[c]
603	male	adult	04/30/09	E Fork Wind River, Pr-WY	management	Mormon Cr, SNF	WYGF
604	male	adult	05/03/09	S Fork Shoshone River, Pr-WY	management	Lake Cr, SNF	WYGF
			05/17/09	Gravelbar Cr, SNF	research	Pilot Cr, SNF	WYGF
G135	male	adult	05/12/09	Buffalo Fork, Pr-WY	management	removed	WYGF
605	female	subadult	05/15/09	Sunlight Cr, SNF	research	on site	WYGF
G136	male	subadult	05/15/09	Sunlight Cr, SNF	research	on site	WYGF
606	male	adult	05/19/09	Sunlight Cr, SNF	research	on site	WYGF
607	male	adult	05/20/09	Sunlight Cr, SNF	research	on site	WYGF
			06/06/09	Gravelbar Cr, SNF	research	on site	WYGF
G137	male	adult	05/21/09	Sunlight Cr, SNF	research	on site	WYGF
G138	male	adult	05/23/09	Sunlight Cr, SNF	research	on site	WYGF
G139	male	subadult	05/23/09	Wind River, Pr-WY	management	Sheffield Cr, BTNF	WYGF
553	male	adult	05/30/09	Pilot Cr, SNF	research	on site	WYGF
554	female	subadult	05/30/09	West Painter Cr, SNF	research	on site	WYGF
			06/19/09	Reef Cr, SNF	research	on site	WYGF
550	male	adult	06/01/09	Sunlight Cr, SNF	research	on site	WYGF
G140	male	subadult	06/04/09	Pilot Cr, SNF	research	on site	WYGF
			06/12/09	Ghost Cr, SNF	research	on site	WYGF

Table 1. Continued.

Bear[a]	Sex	Age	Date	General location[b]	Capture type	Release site[b]	Agency[c]
G141	male	subadult	06/07/09	Clark, Pr-WY	management	Boone Cr, CTNF	WYGF
Unm	unknown	subadult	06/07/09	Bennett Cr, Pr-WY	management	on site	WYGF
Unm	unknown	subadult	06/07/09	Bennett Cr, Pr-WY	management	on site	WYGF
608	male	adult	06/09/09	Ghost Cr, SNF	research	on site	WYGF
201	male	adult	06/10/09	Chipmunk Cr, YNP	research	on site	IGBST
			06/26/09	Chipmunk Cr, YNP	research	on site	IGBST
515	male	adult	06/11/09	Cub Cr, YNP	research	on site	IGBST
			07/22/09	Bridge Cr, YNP	research	on site	IGBST
G142	male	subadult	06/11/09	Blaine Cr, Pr-WY	management	removed	WYGF
G143	male	subadult	06/11/09	Deadman Cr, SNF	research	on site	WYGF
609	male	subadult	06/13/09	Antelope Cr, YNP	research	on site	IGBST
204	male	adult	06/15/09	Cub Cr, YNP	research	on site	IGBST
			06/18/09	Alluvium Cr, YNP	research	on site	IGBST
G144	male	adult	06/15/09	Pilot Cr, SNF	research	on site	WYGF
Unm	male	adult	06/24/09	Chipmunk Cr, YNP	research	on site	IGBST
596	female	adult	06/25/09	Bennett Cr, Pr-WY	management	Blackrock Cr, BTNF	WYGF
			08/23/09	Bill Cr, SNF	management	Blackrock Cr, BTNF	WYGF
			11/10/09	Shoshone River, ST-WY	management	removed	WYGF
610	female	adult	06/26/09	Cottonwood Cr, GTNP	research	on site	GTNP
			10/04/09	Snake River, GTNP	research	on site	IGBST
G145	male	subadult	06/28/09	S Fork Shoshone River, Pr-WY	management	Pilot Cr, SNF	WYGF
434	male	adult	06/28/09	Sunlight Cr, Pr-WY	management	Cascade Cr, CTNF	WYGF
568	male	adult	06/29/09	Cub Cr, YNP	research	on site	IGBST
570	male	adult	06/29/09	Flat Mountain Cr, YNP	research	on site	IGBST
448	female	adult	07/09/09	Bridge Cr, YNP	research	on site	IGBST
			07/10/09	Arnica Cr, YNP	research	on site	IGBST
			07/14/09	Arnica Cr, YNP	research	on site	IGBST
			07/23/09	Arnica Cr, YNP	research	on site	IGBST
611	male	adult	07/09/09	Elk Cr, CTNF	management	Thirsty Cr, CTNF	IDFG
G133	male	subadult	07/17/09	Cottonwood Cr, GTNP	research	Glade Cr, JDRMP	GTNP
Unm	female	subadult	07/19/09	Line Cr, BLM-WY	management	removed	WYGF
Unm	male	subadult	07/19/09	Line Cr, BLM-WY	management	removed	WYGF
Unm	male	subadult	07/19/09	Line Cr, BLM-WY	management	removed	WYGF
612	female	adult	07/20/09	Snowshoe Cr, SNF	management	Mormon Cr, SNF	WYGF
589	male	adult	07/22/09	Arnica Cr, YNP	research	on site	IGBST
338	male	adult	07/22/09	Arnica Cr, YNP	research	on site	IGBST
			07/28/09	Bridge Cr, YNP	research	on site	IGBST
481	female	adult	07/23/09	Bridge Cr, YNP	research	on site	IGBST
613	female	adult	07/24/09	Rock Cr, BTNF	management	Fox Cr, SNF	WYGF
614	female	adult	07/26/09	Elk Cr, CTNF	management	on site	IDFG
615	female	subadult	07/28/09	Cottonwood Cr, GTNP	research	on site	GTNP
616	female	adult	07/29/09	Yellowstone River, YNP	research	on site	IGBST

Table 1. Continued.

Bear[a]	Sex	Age	Date	General location[b]	Capture type	Release site[b]	Agency[c]
617	male	subadult	08/02/09	Fish Cr, BNTF	management	Mormon Cr, SNF	WYGF
Unm	male	subadult	08/08/09	Snowshoe Cr, SNF	management	on site	WS/WYGF
G146	male	adult	08/11/09	Rock Cr, BTNF	management	Mormon Cr, SNF	WYGF
618	male	subadult	08/13/09	Colley Cr, GNF	research	on site	IGBST
333	male	adult	08/20/09	S Fork Shoshone River, SNF	management	Boone Cr, CTNF	WYGF
547	male	adult	08/20/09	N Antelope Springs, CTNF	research	on site	IDFG/IGBST
			08/23/09	N Antelope Springs, CTNF	research	on site	IDFG/IGBST
619	male	subadult	08/20/09	Bootjack Cr, CTNF	research	on site	IDFG/IGBST
620	female	adult	08/25/09	Bootjack Cr, CTNF	research	on site	IDFG/IGBST
621	male	adult	08/26/09	N Antelope Springs, CTNF	research	on site	IDFG/IGBST
622	male	subadult	09/11/09	Vass Cr, BLM-WY	research	on site	WYGF
			09/18/09	Vass Cr, BLM-WY	research	on site	WYGF
623	male	subadult	09/12/09	Vass Cr, BLM-WY	research	on site	WYGF
624	male	adult	09/14/09	Owl Cr, Pr-WY	research	on site	WYGF
G147	male	subadult	09/15/09	Vass Cr, BLM-WY	research	on site	WYGF
625	male	adult	09/18/09	Wagon Cr, BTNF	management	Mormon Cr, SNF	WYGF
626	female	adult	09/19/09	S Fork Owl Cr, BLM-WY	research	on site	WYGF
627	female	adult	09/23/09	Snake River, JDRMP	research	on site	IGBST
424	male	adult	10/01/09	Gardner River, YNP	research	on site	IGBST
526	male	adult	10/02/09	Snake River, GTNP	research	on site	IGBST
G148	male	subadult	10/02/09	Pacific Cr, GTNP	research	on site	IGBST
569	female	adult	10/02/09	Whit Cr, Pr-WY	management	Cascade Cr, CTNF	WYGF
G149	female	subadult	10/02/09	Whit Cr, Pr-WY	management	Cascade Cr, CTNF	WYGF
G150	female	subadult	10/02/09	Whit Cr, Pr-WY	management	Cascade Cr, CTNF	WYGF
G114	male	adult	10/04/09	Pacific Cr, GTNP	research	on site	IGBST
			10/07/09	Snake River, GTNP	research	on site	IGBST
Unm	male	adult	10/06/09	Pacific Cr, BTNF	management	removed	WYGF
260	male	adult	10/07/09	Antelope Cr, YNP	research	on site	IGBST
628	female	subadult	10/12/09	S Fork Shoshone River, Pr-WY	management	Clarks Fork River, SNF	WYGF
629	male	adult	10/12/09	N Fork Shoshone River, Pr-WY	management	Grassy Cr, CTNF	WYGF
630	male	adult	10/14/09	Stephens Cr, YNP	research	on site	IGBST
631	female	subadult	10/14/09	S Fork Shoshone River, Pr-WY	management	Long Cr, SNF	WYGF
228	male	adult	10/15/09	Stephens Cr, YNP	research	on site	IGBST
227	male	adult	10/21/09	Gibbon River, YNP	research	on site	IGBST
			10/28/09	Gibbon River, YNP	research	on site	IGBST
632	male	adult	10/30/09	Twin Cr, Pr-WY	management	Bailey Cr, BTNF	WYGF
633	male	adult	11/03/09	Davis Cr, Pr-MT	management	Trapper Cr, GNF	WS/MTFWP

[a] Unm = unmarked.
[b] BLM = Bureau of Land Management; BTNF = Bridger-Teton National Forest, CTNF = Caribou-Targhee National Forest, GNF = Gallatin National Forest, GTNP = Grand Teton National Park; JDRMP = John D. Rockefeller Memorial Parkway; SNF = Shoshone National Forest, ST = state land; YNP = Yellowstone National Park, Pr = private.
[c] GTNP = Grand Teton National Park; IDFG = Idaho Fish and Game; IGBST = Interagency Grizzly Bear Study Team, USGS; MTFWP = Montana Fish, Wildlife and Parks; WS = Wildlife Services; WYGF = Wyoming Game and Fish.

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
2009	97	79	63	34	25

Table 3. Grizzly bears radio monitored in the Greater Yellowstone Ecosystem during 2009.

Bear	Sex	Age	Offspring[a]	Monitored		Current Status
				Out of den	Into den	
179	F	adult	2 yearlings	yes	no	cast
201	M	adult		no	no	cast
204	M	adult		yes	no	cast
211	M	adult		yes	no	cast
227	M	adult		no	yes	active
246	F	adult	not seen	yes	no	cast
260	M	adult		no	yes	active
279	F	adult	4 COY, lost 1	yes	yes	active
289	F	adult	1 yearling, lost	yes	yes	active
295	F	adult	not seen	no	no	cast
302	M	adult		yes	yes	active
333	M	adult		no	yes	active
338	M	adult		no	no	cast
360	F	adult	2 COY	yes	yes	active
363	M	adult		yes	no	cast
373	M	adult		yes	no	cast
400	M	adult		yes	no	cast
434	M	adult		no	yes	active
443	M	adult		yes	no	cast
448	F	adult	None	yes	yes	active
450	M	adult		yes	yes	active
481	F	adult	None	no	no	cast
492	F	adult	None	yes	no	cast
499	F	adult	2 COY	yes	no	cast
500	F	adult	2 yearlings	yes	no	cast
514	M	adult		no	no	cast
515	M	adult		no	yes	active
520	M	adult		yes	no	cast
525	F	adult	None	yes	yes	active
526	M	adult		no	yes	active
531	F	adult	None	yes	no	cast
532	M	adult		yes	no	cast
533	F	adult	3 COY	yes	yes	active
537	F	adult	3 COY	yes	yes	active
541	F	adult	None	yes	no	cast
547	M	adult		no	no	cast
551	F	adult	None	yes	no	cast
553	M	adult		no	no	cast

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored: Out of den	Monitored: Into den	Current Status
554	F	subadult		yes	no	killed
556	M	adult		yes	yes	active
565	M	adult		yes	no	cast
567	M	adult		yes	no	cast
568	M	adult		no	no	unresolved
569	F	adult	2 COY	yes	yes	active
570	M	adult		no	yes	active
574	M	adult		yes	no	unresolved
576	F	adult	2 COY, lost 1	yes	no	cast
577	F	adult	None	yes	yes	active
584	M	adult		yes	yes	active
589	M	adult		yes	no	cast
590	F	subadult		yes	yes	active
591	F	subadult		yes	no	cast
592	M	adult		yes	yes	active
593	M	subadult		yes	no	cast
594	M	subadult		yes	no	cast
596	F	adult	None	yes	no	removed
599	M	adult		yes	yes	active
600	M	subadult		yes	no	cast
601	F	subadult		yes	no	battery
602	F	subadult		yes	no	battery
603	M	adult		no	no	cast
604	M	adult		no	yes	active
605	F	subadult		no	yes	active
606	M	adult		no	no	unresolved
607	M	adult		no	no	cast

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored: Out of den	Monitored: Into den	Current Status
608	M	adult		no	no	cast
609	M	subadult		no	no	cast
610	F	adult		no	yes	active
611	M	adult		no	yes	active
612	F	adult	None	no	no	cast
613	F	adult	None	no	no	missing
614	F	adult	None	no	no	cast
615	F	subadult		no	no	dead
616	F	adult	None	no	no	cast
617	M	subadult		no	yes	active
618	M	subadult		no	yes	active
619	M	subadult		no	yes	active
620	F	adult	None	no	yes	active
621	M	adult		no	no	dead
622	M	subadult		no	yes	active
623	M	subadult		no	yes	active
624	M	adult		no	yes	active
625	M	adult		no	yes	active
626	F	adult	1 yearling	no	yes	active
627	F	adult	3 COY	no	yes	active
628	F	subadult		no	yes	active
629	M	adult		no	no	dead
630	M	adult		no	yes	active
631	F	subadult		no	yes	active
632	M	adult		no	yes	active
633	M	adult		no	yes	active

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

Bear #201 captured on 10 Jun 2009. Photos courtesy of Jonathan Ball.

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

Methods

Under the Revised Demographic Recovery Criteria (USFWS 2007*b*) of the Grizzly Bear Recovery Plan (USFWS 1993), IGBST is tasked with estimating the number of females with COY, determining trend in this segment of the population, and estimating size of specific population segments to assess sustainability of annual mortalities. The area within which the revised criteria apply for counting females with COY and mortalities is referenced in Figure 1 of the Revised Demographic Recovery Criteria (USFWS 2007*b*). However, the area referenced in this figure is incorrect on its western and northern boundaries in Montana and will be corrected with an erratum (Chris Servheen, USFWS Grizzly Bear Recovery Coordinator, personal communication). Specific procedures used to accomplish the above mentioned tasks are presented in IGBST (2005, 2006) and Harris et al. (2007). Briefly, the Knight et al. (1995) rule set is used to differentiate an estimate for 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 trend. 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

$$\hat{N}_{males\ 2+} = \hat{N}_{females\ 2+} * 0.63513,$$

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).

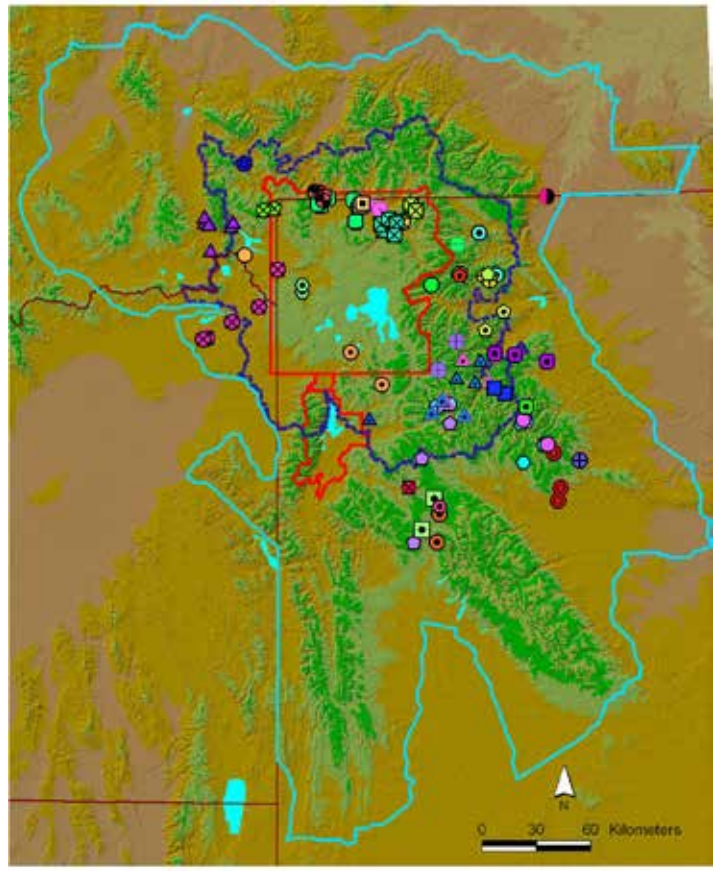

Fig. 1. Distribution of 117 observations of 42 (indicated by unique symbols) unduplicated female grizzly bears with cubs-of-the-year (COY) in the Greater Yellowstone Ecosystem during 2009. The outer light blue line represents the boundary within which females with COY are counted for estimation of trend and population size and mortalities are counted for evaluation of sustainability. The inner dark blue and red boundaries indicate the Yellowstone grizzly bear Recovery Zone and National Park Services lands, respectively.

2009 Results

We documented 117 verified sightings of females with COY during 2009 within the area where the Revised Demographic Criteria apply (Fig. 1). This was very similar to the 118 sightings obtained during 2008. Observations were almost evenly split between ground (53%) and aerial (47%) observers (Table 4). Thirty-two percent of the observations occurred within the boundary of Yellowstone National Park. From the 117 sightings we were able to differentiate 42

Table 4. Method of observation for female grizzly bears with cubs-of-the-year sighted in the Greater Yellowstone Ecosystem during 2009.

Method of observation	Frequency	Percent	Cumulative percent
Fixed wing – other researcher	4	3.4	3.4
Fixed wing – observation	34	29.1	32.5
Fixed wing - telemetry	16	13.7	46.2
Ground sighting	62	53.0	99.1
Helicopter – other research	1	0.9	100.0
Trap	0	0.0	100.0
Total	117	100	

Table 5. Number of unduplicated females with cubs-of-the-year ($\hat{N}_{Obs}$), litter frequencies, total number of cubs, and average litter size at initial observation for the years 1973–2009 in the Greater Yellowstone Ecosystem.

Year	$\hat{N}_{Obs}$	Total sightings	Litter sizes				Total # cubs	Mean litter size
			1 cub	2 cubs	3 cubs	4 cubs		
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
2009	42	117	10	19	11	2	89	2.12

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

unduplicated females using the rule set described by Knight et al. (1995). Total number of COY observed during initial sightings was 89 and mean litter size was 2.12 (Table 5). There were 10 single cub litters, 19 litters of twins, 11 litters of triplets, and 2 quadruplet litters seen during initial observations (Table 5). Four-cub litters have been observed previously in the GYE but are uncommon (Table 5). There is a possibility that these litters were the result of adoptions (see Haroldson et al. 2008) or mixed age litters (Swenson and Haroldson 2008). However, these possibilities seem unlikely in one of these events that involved a radio-collared female. Female #279 was observed once with 4 small, similar sized COY early in the active season (1 Jun 2009). Thus there would be limited opportunity for adoption to have occurred. Subsequent observation of female #279 in July and August indicated she had lost 1 of her COY. The other female observed with 4 COY was only observed once on 4 August 2009.

One-hundred observations of 39 families were obtained without telemetry (Table 6). Using the sighting frequencies associated with these families our 2009 $\hat{N}_{Chao2}$ = 44 (Table 6). Annual $\hat{N}_{Chao2}$ for the period 1983–2009 (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 the linear model was the better fit for the period, with 63% of the AICc weight. The estimated quadratic effect (β_2 = -0.00105, SE = 0.00083) was not significant (P = 0. 21715), with quadratic model receiving 37% of the AICc weight. Thus, the linear model continues to be better supported (USFWS 2007*b*), indicating an increasing trend. However, evidence for a slowing in the rate of change increased over that observed in 2008 (Haroldson 2009) as indicated by greater weight on the quadratic model (37% in 2009 vs. 26% in 2008). Using the linear model our estimate of $\hat{\lambda}$ for 1983–2009 is 1.04248 (95% CI 1.02999–1.055512). The model averaged point estimate ($\hat{N}_{MAFC}$) is 55 (95% CI 45–67) and exceeds the demographic objective of 48 specified in the demographic criteria for the GYE (USFWS 2007*b*). Our estimated population size for 2009 derived from $\hat{}_{MAFC}$ is 582 (Table 8).

Bear #360 with 2 cubs-of-the-year, 9 Aug 2009. Photo courtesy of Steve Ard.

Table 6. Annual estimates for the numbers of females with cubs-of-the-year in the Greater Yellowstone Ecosystem grizzly bear population, 1983–2009. 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 estimates 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
2009	42	39	11	11	44	100	2.3

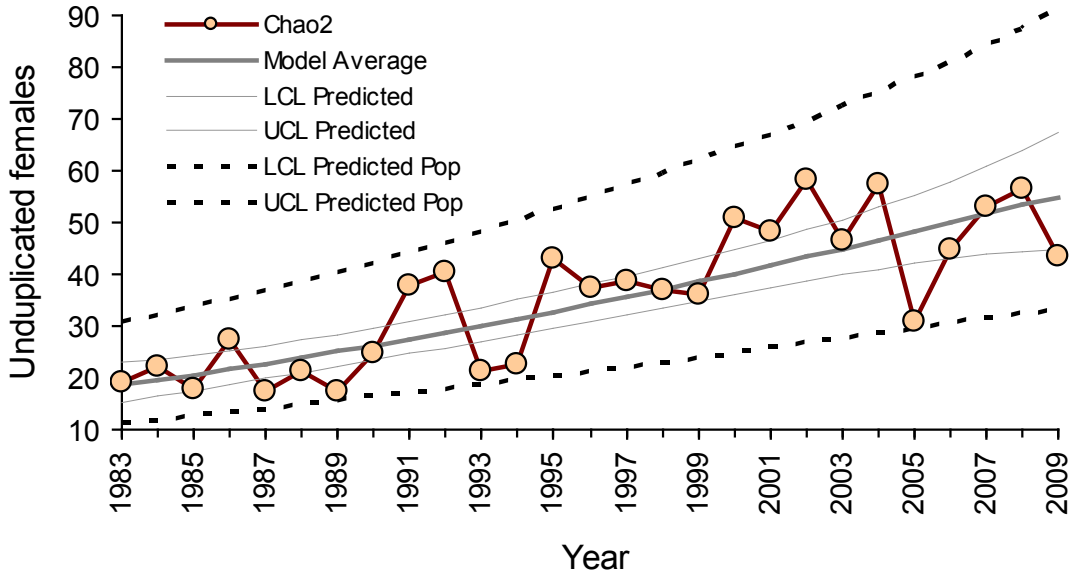

Fig. 2. Model-averaged estimates for the number of unduplicated female grizzly bears with cubs-of-the-year in the Greater Yellowstone Ecosystem for the period 1983–2009, where the linear and quadratic models of $Ln(\hat{N}_{Chao2})$ were fitted. The inner set of light solid lines represents a 95% confidence interval on the predicted population size for unduplicated females, 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 1983–2009.

Model	Parameter	Estimate	Standard error	*t* value	Pr(>*t*)
Linear					
	β_0	2.92658	0.09375	31.21624	<0.0001
	β_1	0.04160	0.00585	7.10880	<0.0001
	SSE	1.40231			
	AICc	-72.81480			
	AICc weight	0.62544			
Quadratic					
	β_0	2.78392	0.14577	19.09740	<0.0001
	β_1	0.07112	0.02399	2.96381	0.00676
	β_2	-0.00105	0.00083	-1.26746	0.21715
	SSE	1.31434			
	AICc	-71.78943			
	AICc weight	0.37456			

Table 8. Estimates and 95% confidence intervals (CI) for population segments and total grizzly bear population size for 2009 in the Greater Yellowstone Ecosystem.

			95% CI	
	Estimate	Variance	Lower	Upper
Independent females	245	461.2	203	287
Independent males	156	333.5	120	191
Dependent young	181	103.9	162	201
Total	582	898.2	523	641

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 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 2009 (Table 9). Eighteen of 18 BMUs contained verified observations of females with young in at least 4 years of the last 6-year (2004–2009) period.

Table 9. Bear Management Units (BMUs) 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, 2004–2009.

Bear Management Unit	2004	2005	2006	2007	2008	2009	Number of years occupied 2004–2009
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	X	5
12) Henry's Lake	X	X	X	X	X	X	6
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
Annual count of occupied BMUs	16	18	16	17	18	18	

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

Two rounds of observation flights were conducted during 2009. Forty-seven Bear Observation Areas (BOAs; Fig. 3) were surveyed during each round (Round 1: 26 May–17 Jul; Round 2: 8 Jul–27 Aug). Observation time was 90 hours for Round 1 and 94 hours for Round 2; average duration of flights for both rounds combined was 2.0 hours (Table 10). Three hundred bear sightings, excluding dependent young, were recorded during observation flights. This included 3 radio-marked bears, 243 solitary unmarked bears, and 54 unmarked females with young (Table 10). Observation rate was 1.63 bears/hour for all bears. Ninety-eight young (55 COY, 31 yearlings, and 12 2-year-olds) were observed (Table 11). Observation rates were 0.29 females with young/hour and 0.15 females with COY/hour (Table 10).

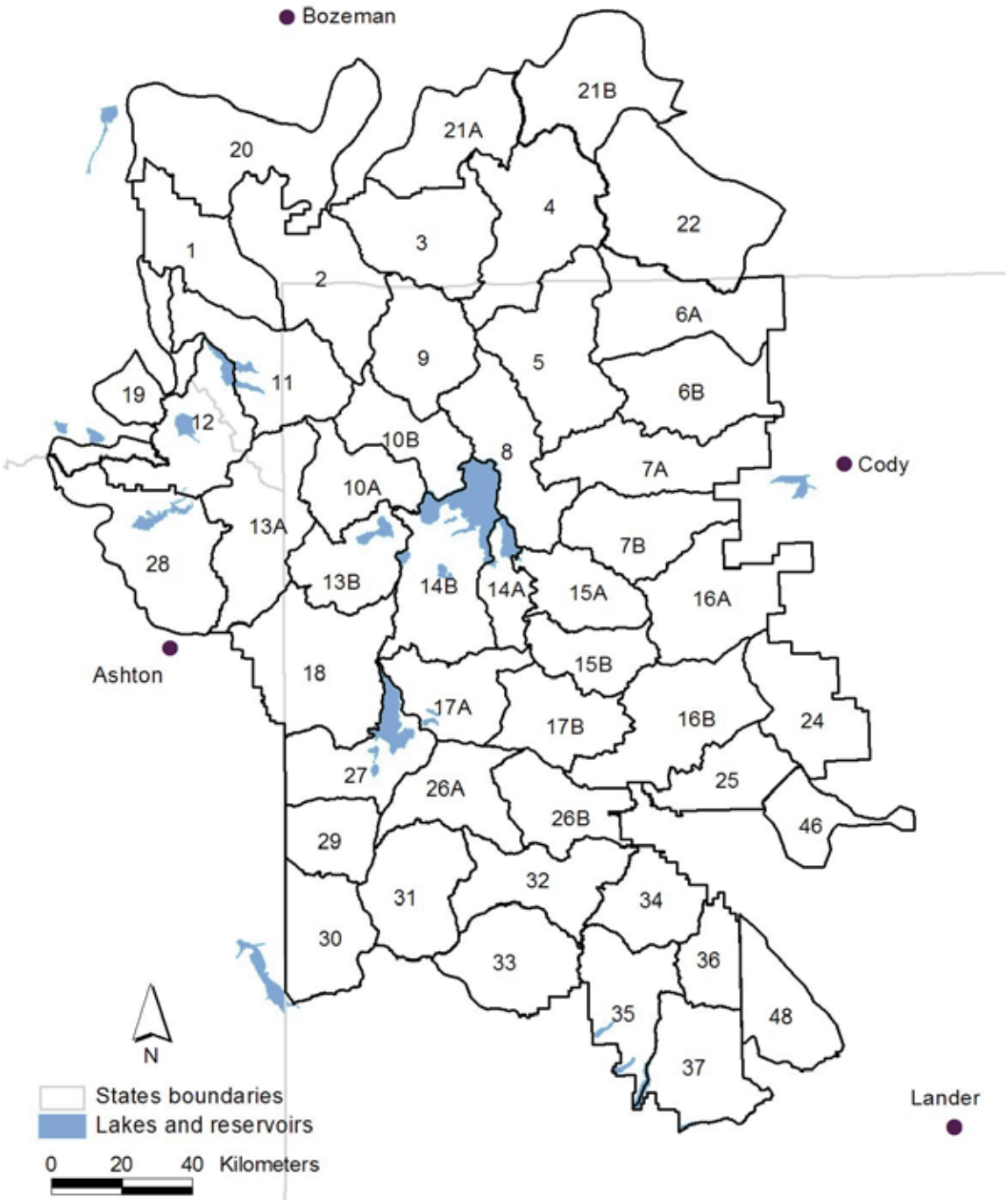

Fig. 3. Observation flight areas within the Greater Yellowstone Ecosystem, 2009. The numbers represent the 38 Bear Observation Areas. Those units too large to search during a single flight were further subdivided into 2 units. Consequently, there were 48 search areas.

Table 10. Annual summary statistics for observation flights conducted in the Greater Yellowstone Ecosystem, 1997–2009.

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
2009[b]	Round 1	90.3	47	1.9	1	0	86	20	107	1.19		
	Round 2	93.6	47	2.0	2	0	157	34	193	2.06		
	Total	183.9	94	2.0	3	0	243	54	300	1.63	0.29	0.15

[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–31 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–26 Jul, 1 Jul–23 Aug); 2009 (26 May–17 Jul, 8 Jul–27 Aug).

Table 11. Size and age composition of family groups seen during observation flights in the Greater Yellowstone Ecosystem, 1998–2009.

	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
2009[a]									
Round 1	0	6	4	2	3	1	3	1	0
Round 2	6	11	1	3	7	1	4	1	1
Total	6	17	5	5	10	2	7	1	1

[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–31 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–26 Jul, 1 Jul–23 Aug); 2009 (26 May–17 Jul, 8 Jul–27 Aug).

[b] Includes 1 female with 4 yearlings.

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

Ninety-six telemetry relocation flights were conducted during 2009, resulting in 335.5 hours of search time (ferry time to and from airports excluded) (Table 12). Flights were conducted at least once during all months, with 80% occurring May-November. During telemetry flights, 804 locations of bears equipped with radio transmitters were collected, 78 (10%) of which included a visual sighting. Twenty-five sightings of unmarked bears were also obtained during telemetry flights, including 23 solitary bears, 1 female with a COY, and 1 female with a yearling. Rate of observation for all unmarked bears during telemetry flights was 0.07 bears/hour. Rate of observing females with COY was 0.003/hour, which was considerably less than during observation flights (0.15/hour) in 2009.

In addition to the regular telemetry relocation flights, IGBST conducted weekly flights primarily to locate grizzly and black bears fitted with Global Positioning System collars equipped with spread-spectrum technology (SST) (see *Appendix A*). These flights are not included as routine telemetry because of the additional time required to interrogate collars and download data. From these 17 flights, we collected 60 locations (13 included a visual sighting) from 9 grizzly bears that were part of our regular monitoring sample and 146 locations (11 with a visual sighting) from 13 grizzly bears that were part of the SST project.

Bear 543 swimming in South Arm, Yellowstone Lake, 12 Oct 2006. Photo courtesy of Steve Ard.

Table 12. Summary statistics for radio-telemetry relocation flights in the Greater Yellowstone Ecosystem, 2009.

				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	10.99	3	3.66	49	0	0.00	0	0	0	0	---	---
February	9.18	3	3.06	47	0	0.00	0	0	0	0	---	---
March	13.39	4	3.35	59	1	0.07	0	0	0	0	---	---
April	18.07	5	3.61	54	11	0.61	4	0	0	0	0.22	0.000
May	36.87	11	3.35	77	21	0.57	2	0	0	0	0.05	0.000
June	47.30	15	3.15	78	23	0.49	8	0	0	0	0.17	0.000
July	38.91	11	3.54	68	5	0.13	4	1	1	0	0.15	0.026
August	32.24	10	3.22	71	11	0.34	5	0	0	0	0.16	0.000
September	40.09	10	4.01	80	0	0.00	0	0	0	0	---	---
October	31.12	8	3.89	85	3	0.10	0	0	0	0	---	---
November	43.76	12	3.65	106	3	0.07	0	0	0	0	---	---
December	13.55	4	3.39	30	0	0.00	0	0	0	0	---	---
Total	335.47	96	3.49	804	78	0.23	23	1	1	0	0.07	0.003

[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)*

Under the Revised Demographic Recovery Criteria (USFWS 2007*b*) of the Grizzly Bear Recovery Plan (USFWS 1993), IGBST is tasked with evaluating the sustainability of annual grizzly bear mortalities that occur within the boundary shown in Fig. 1 (see *Assessing trend and estimating population size from counts of unduplicated females*). 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 Chao2 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).

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).

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*b*).

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.

<u>2009 Mortality Results</u>

We documented 31 known and probable mortalities in the GYE during 2009, 24 were attributable to human causes (Table 13) and 6 of the reported losses remain under investigation by USFWS and state law enforcement agencies. Specific information related to these 6 mortalities is not provided because of on going investigations. However, these events are included in the following summary. Thirteen (45%) of the human-caused losses were hunting related; including 3 mistaken

identity kills by black bear hunters and 6 losses from self-defense kills, 2 of which were adult females accompanied by 4 COY. One of the alleged self-defense kills involving a subadult female bear was ruled unwarranted and was subsequently considered an illegal mortality. The remaining human-caused losses were management removals (n = 4), road kills (n = 2), and self-defense (n = 2). One of the bears killed in self-defense was a female with 3 COY. The COY were subsequently captured and sent to the Memphis Zoo. We also documented 4 natural mortalities and 3 from undetermined causes (Table 13). The natural mortalities included 2 individuals killed by other bears and 2 probable COY losses from radioed females (Table 13).

Among known and probable losses for independent aged female bears there was 1 management removal, 2 deaths of radio-marked bears, and 7 other reported losses (Table 14). The management removal of bear #596 (Table 13, Unique 200928) occurred outside the boundary for counting mortalities under the Revised Demographic Criteria and as such was not counted against the 2009 mortality threshold for independent females. We documented 3 management removals, 2 radio-marked losses, and 6 reported losses for independent aged males (Table 2). 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), estimates of total mortality of independent females and males were within sustainable limits for 2009, as were human-caused mortalities of dependent young (Table 14).

Table 13. Grizzly bear mortalities documented in the Greater Yellowstone Ecosystem during 2009.

Unique	Bear[a]	Sex[b]	Age[c]	Date	Location[d]	Certainty	Cause
200901	G135	M	adult	5/12/2009	Buffalo Fork, Pr-WY	Known	Human-caused, management removal for nuisance activity in subdivision
200902	Unm	M	subadult	5/24/2009	Newton Cr, SNF, WY	Known	Human-caused, mistaken identity kill by black bear hunter
200903	G142	M	adult	6/11/2009	Blaine Cr, Pr-WY	Known	Human-caused, management removal for repeated cattle depredation.
200904	Unm	M	adult	6/10/2009	N Fork Shoshone River, SNF	Known	Natural, likely killed by another bear
200905	Unm	M	subadult	5/26/2009	Big Thumb Cr, YNP, WY	Known	Natural, died of wounds from fight with another bear
200906	Unm	M	COY	6/9/2009	S Fork Shoshone River, Pr-WY	Known	Human-caused, road kill, mother and 1 sibling COY not injured
200907	Unm	F	adult	6/15/2009	Moose Cr, GNF, MT	Known	Human-caused, defense of life while black bear hunting
200908	270	F	adult	7/19/2009	Line Cr, BLM, WY	Known	Human-caused, self defense kill, human-injuries, 3 COY that accompanied female were captured and removed
200909	Unm	F	COY	7/19/2009	Line Cr, BLM, WY	Known	Human-caused, live removal of female COY of bear #270
200910	Unm	M	COY	7/19/2009	Line Cr, BLM, WY	Known	Human-caused, live removal of male COY of bear #270
200911	Unm	M	COY	7/19/2009	Line Cr, BLM, WY	Known	Human-caused, live removal of male COY of bear #270
200912	475	M	adult	July 2009	Yellowstone River, MT	Known	Undetermined cause, fisherman reported reading ear tags which identified bear #475 on a dead bear observed floating in the Yellowstone River. Carcass was found and recovered on 9/25
200913	Unm	F	subadult	7/25/2009	Twilight Cr, SNF, WY	Known	Human-caused, defense of life

Table 13. Continued.

Unique	Bear[a]	Sex[b]	Age[c]	Date	Location[d]	Certainty	Cause
200914	Unm	F	adult	2009	SNF, WY	Known	Human-caused, under investigation, 2 COY at side
200915	Unm	U	COY	2009	SNF, WY	Probable	Human-caused, COY of female killed, under investigation
200916	Unm	U	COY	2009	SNF, WY	Probable	Human-caused, COY of female killed, under investigation
200917	554	F	subadult	8/26/2009	Deadman Cr, SNF, WY	Known	Human-caused, mistaken identity kill by black bear archery hunter.
200918	Unm	M	adult	9/1/2009	Cedar Cr, Pr-MT	Known	Human-caused, road kill
200919	615	F	subadult	9/19/2009	Ditch Cr, BTNF, WY	Known	Human-caused, unwarranted kill by hunter
200920	Unm	M	adult	9/22/2009	E Fork Pilgrim Cr, BTNF, WY	Known	Human-caused, self-defense kill by hunter
200921	Unm	M	adult	10/6/2009	Pacific Cr, BTNF, WY	Known	Human-caused, management removal for property damage and food rewards
200922	621	M	adult	10/10/2009	Clark's Fork River, GNF, MT	Known	Human-caused, self-defense by hunters
200923	Unm	F	adult	10/14/2009	Jones Cr, SNF, WY	Known	Human-caused, self-defense kill by hunter retireveing harvested elk carcass, 2 COY at side
200924	Unm	U	COY	10/14/2009	Jones Cr, SNF, WY	Probable	Human-caused, COY of female killed by hunter retrieving elk
200925	Unm	U	COY	10/14/2009	Jones Cr, SNF, WY	Probable	Human-caused, COY of female killed by hunter retrieving elk
200926	629	M	adult	2009	CTNF, ID	Known	Human-caused, under investigation
200927	Unm	F	subadult	2009	SNF, WY	Known	Undetermined cause, under investigation
200928	596	F	adult	11/10/2009	Shoshone River, BR-WY	Known	Human-caused, management removal for continued close association to residential area and previous conflict history
200929	Unm	F	adult	2009	SNF, WY	Known	Undetermined cause, under investigation
200930	Unm	U	COY	6/10/2009	Stephens Cr, YNP, MT	Probable	Natural. Radioed female grizzly bear #576 lost 1 of 2 COY between 6/5 and 6/15. Location and mortality date are approximated
200931	Unm	U	COY	7/13/2009	Sheridan Cr, SNF	Probable	Natural. Radioed female grizzly bear #279 lost 1 of 4 COY between 6/1 and 8/25. Location and mortality date are approximated

[a] Unm = unmarked bear; number indicates bear number.
[b] U = sex unknown.
[c] COY = cub-of-the-year, Unk = unknown age.
[d] BLM = Bureau of Land Management, BR = Bureau of Reclamation, BTNF = Bridger-Teton National Forest, CTNF = Caribou-Targhee National Forest, GNF = Gallatin National Forest, GTNP = Grand Teton National Park, SNF = Shoshone National Forest, 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 2009 within the boundaries specified in an erratum for the Revised Demographic Criteria (see *Assessing trend and estimating population size from counts of unduplicated females*). Established mortality thresholds (USFWS 2007) 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	181	8						16	Under
Independent females[e]	245	8	0	2	7	18	20	22	Under
Independent males[f]	156	8	3	2	6	15	20	24	Under

[a] Term A in equation 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 equation 1and 2 is the annual count of loss for independent aged bears wearing active telemetry except those removed through management actions.
[c] Term B in equation 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 equation 1 and 2, the estimated total mortality, 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 females bears are indicated by subscript F in equation 1.
[f] Mortality counts and estimates for independent aged males bears are indicated by subscript M in equation 2.

In Jul 2009, a dead grizzly bear was observed floating in the Yellowstone River. Ear tags identified it as bear #475. The carcss was found and recovered in Sep 2009. Photo courtesy of Montana Fish, Wildlife and Parks.

Key Foods Monitoring

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

It is well documented that grizzly bears use ungulates as carrion (Mealey 1980, Henry and Mattson 1988, Green 1994, Blanchard and Knight 1996, Mattson 1997) in Yellowstone National Park. 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 Yellowstone National Park. In 2009, 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.

In 2009, we recorded 53 ungulate carcasses for a total of 0.21 carcasses/km surveyed (Fig. 5).

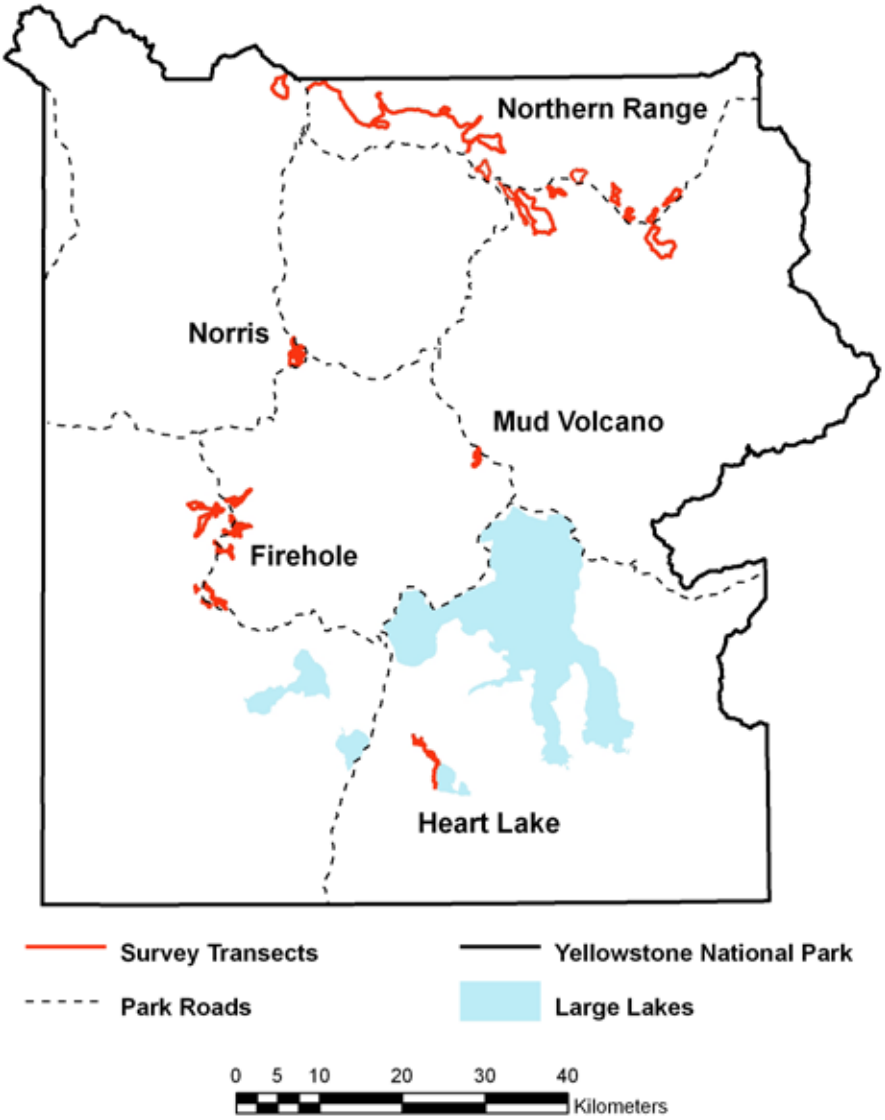

Fig. 4. Spring ungulate carcass survey transects in 5 areas of Yellowstone National Park.

Northern Range

We surveyed 12 routes on Yellowstone's Northern Range totaling 140.6 km traveled. One route was not surveyed to avoid disturbing an active wolf den. We used a GPS to more accurately measure the actual distance traveled on most of the routes. We counted 45 carcasses, including 1 mule deer, 38 elk, 4 bison, and 2 pronghorn, which equated to 0.32 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 1 bison carcass. Evidence of use by wolves was found at 2 elk carcasses. Grizzly bear sign (e.g., tracks, scats, daybeds, or feeding activity) was observed along 8 of the routes. Crews logged sightings of a female with yearlings and 2 other individual grizzlies during the surveys. A black

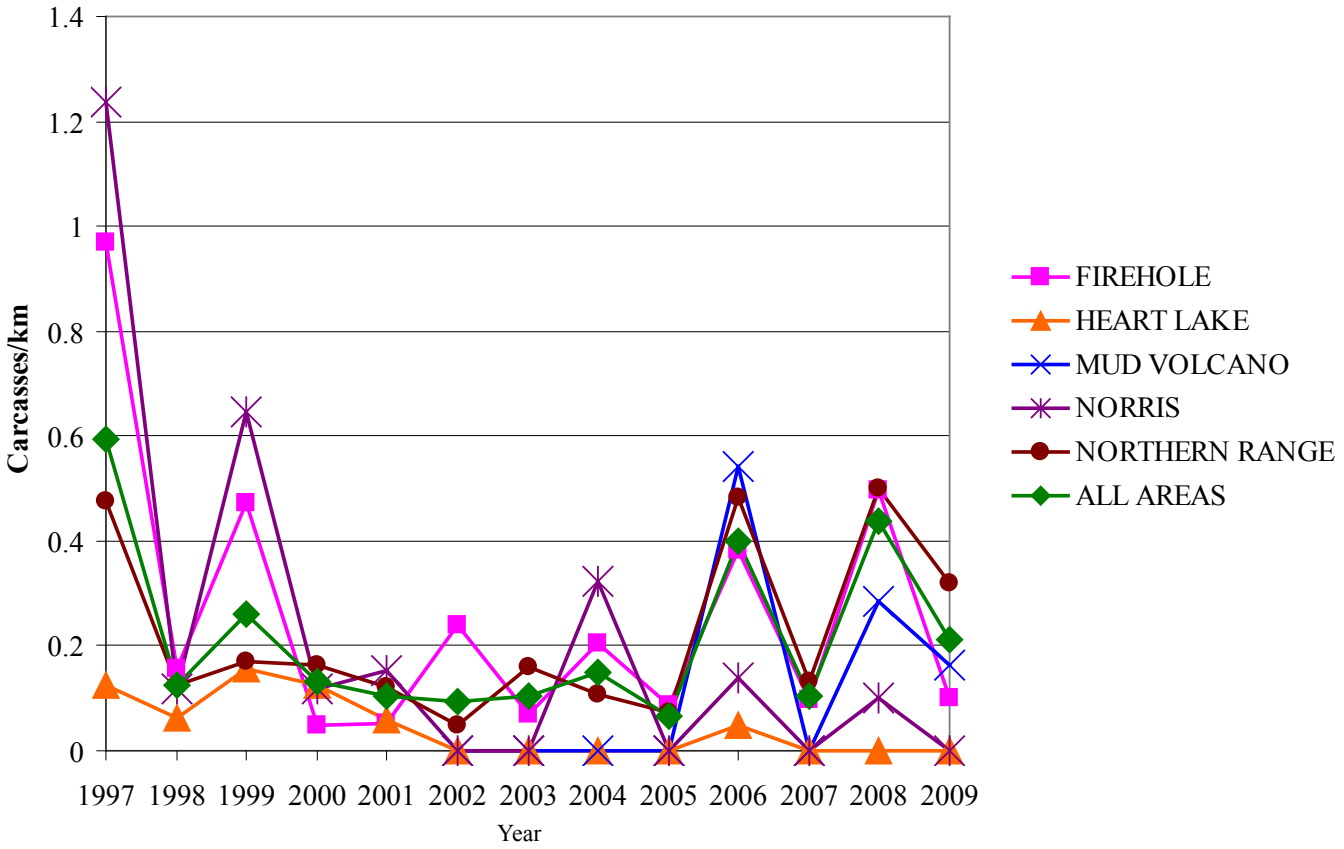

Fig. 5. Annual ungulate carcasses/km found on spring survey routes in winter ranges of Yellowstone National Park, 1997–2009.

bear (*Ursus americanus*) was observed during the Specimen Ridge survey and evidence of black bear use was seen along 3 other routes. The carcass of 1 coyote was also found near an elk carcass.

Firehole River Area

We surveyed 8 routes in the Firehole drainage totaling 69.4 km. We found the remains of 6 bison and 1 elk, which equated to 0.1 carcasses/km traveled (Table 15). Definitive evidence of use by grizzly bears was found at 2 bison carcasses. Grizzly bear sign was also found along all of the routes, and 1 small grizzly was observed. Wolf sign was found at 1 bison carcass

Norris Geyser Basin

We surveyed 4 routes in the Norris Geyser Basin totaling 19.8 km traveled. We observed no carcasses on these transect, but grizzly bear sign was observed along all 4 routes.

Heart Lake

We surveyed 3 routes in the Heart Lake thermal basin covering 13.4 km. We observed no carcasses. Grizzly bear sign, including tracks, scats, and other feeding activities, was observed on all 3 routes. Two individual grizzlies were observed grazing.

Mud Volcano

We surveyed a single route in the Mud Volcano area covering 6.1 km. One bison carcass was observed this spring (0.2 carcasses/km), and tracks and evidence of feeding by at least 1 grizzly bear was found at the carcass. Consumption of mineral soil by grizzly bears was again documented along the route.

Table 15. Ungulate carcasses found and visitation of carcasses by bears, wolves, and unknown large scavengers along surveyed routes in Yellowstone National Park during spring 2009.

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)	38	6	2	29	4	2	0	1	0.32[a]
Firehole (8)	1	0	0	1	6	3	1	4	0.10
Norris (4)	0	0	0	0	0	0	0	0	0.00
Heart Lake (3)	0	0	0	0	0	0	0	0	0.00
Mud Volcano (1)	0	0	0	0	1	1	0	0	0.20

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

Table 16. Age classes and sex of elk and bison carcasses found, by area, along surveyed routes in Yellowstone National Park during spring 2009.

	Elk (n = 39)						Bison (n = 11)					
	Northern Range	Firehole	Norris	Heart Lake	Mud Volcano	Total	Northern Range	Firehole	Norris	Heart Lake	Mud Volcano	Total
Age												
Adult	32	1	0	0	0	33	4	3	0	0	1	8
Yearling	3	0	0	0	0	3	0	0	0	0	0	0
Calf	0	0	0	0	0	0	0	2	0	0	0	2
Unknown	3	0	0	0	0	3	0	1	0	0	0	1
Sex												
Male	15	0	0	0	0	15	2	1	0	0	1	4
Female	15	1	0	0	0	16	2	2	0	0	0	4
Unknown	8	0	0	0	0	8	0	3	0	0	0	3

Spawning Cutthroat Trout *(Kerry A. Gunther, Todd M. Koel, Patrick Perrotti, and Eric Reinertson, Yellowstone National Park)*

In the past, spawning cutthroat trout were commonly consumed by grizzly bears that had home ranges adjacent to Yellowstone Lake (Mealey 1975, Reinhart and Mattson 1990, Haroldson et al. 2005). The availability of cutthroat trout around the lake influenced the distribution of bears over a large geographic area (Mattson and Reinhart 1995). In the 1970s and 1980s, grizzly bears were known to prey on cutthroat trout in at least 36 different tributary streams of the lake (Hoskins 1975, Reinhart and Mattson 1990). Haroldson et al. (2005) estimated that approximately 68 grizzly bears likely visited the vicinity of Yellowstone Lake tributary streams annually during the late 1990s. 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 the park.

Non-native lake trout (*Salvelinus namaycush*) and whirling disease caused by an exotic parasite (*Myxobolus cerebralis*) have significantly reduced the native cutthroat trout population and associated bear fishing activity (Koel et al. 2005*a*, Koel et al. 2006). Drought may also be contributing to the decline of the Yellowstone Lake cutthroat trout population (Koel et al. 2005*b*). Due to the past use of cutthroat trout as a food source by grizzly bears, and the population decline caused by 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 2007c). The cutthroat trout population is monitored annually using counts at a fish trap located on Clear Creek on the east shore of Yellowstone Lake, and through visual stream surveys conducted along North Shore and West Thumb tributaries of the lake (Koel et al. 2005*a*, USFWS 2007c). 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 most years from a weir with a fish trap located 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. In 2008, unusually high spring run-off damaged the Clear Creek weir and necessitated its removal, preventing operation of the weir and obtaining an accurate fish count that year. The weir has not yet been reconstructed, so a count of the number of spawning cutthroat trout ascending Clear Creek was not obtained in 2009. Prior to removal of the weir in 2008, the number of trout ascending Clear Creek had declined to very low levels (Fig. 6).

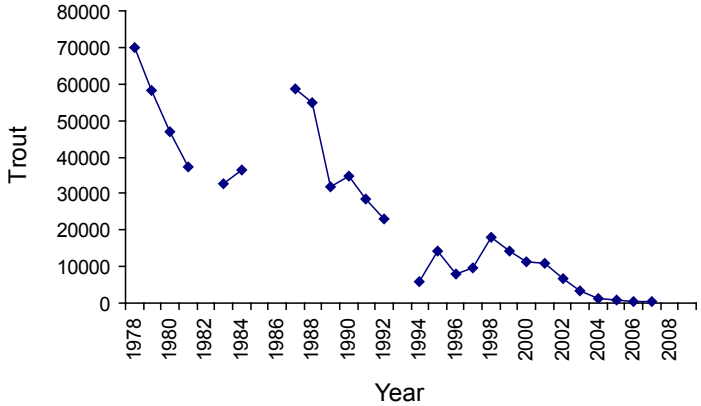

Fig. 6. Number of spawning cutthroat trout counted at the Clear Creek fish trap on the east shore of Yellowstone Lake, Yellowstone National Park, 1978–2009.

Visual 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 2009 continued to show low numbers of spawning cutthroat trout in North Shore and West Thumb streams (Table 17). In North Shore streams, only 13 spawning cutthroat trout were counted. Ten spawning trout were counted in Bridge Creek and 3 in Lodge Creek. No spawning cutthroat trout were observed in Hatchery Creek, Incinerator Creek, or Wells Creek. On West Thumb streams, only 62 spawning cutthroat trout were counted including 60 in Little Thumb Creek and 2 in Sandy Creek. No spawning cutthroat trout were observed in Sewer Creek or #1167 Creek. The number of spawning cutthroat trout counted in the North Shore and West Thumb streams has 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 2009.

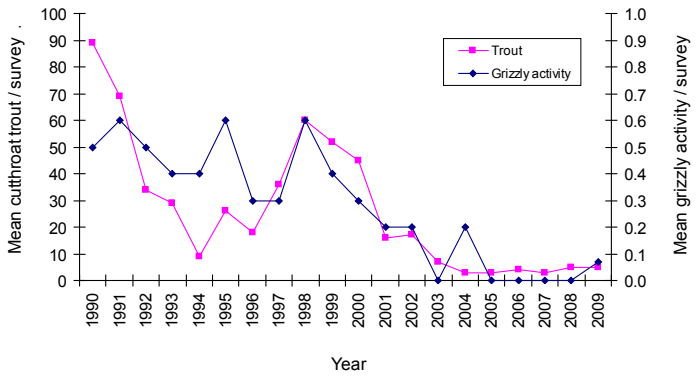

Fig. 7. Mean number of spawning cutthroat trout and mean activity by grizzly bears observed during weekly visual surveys of 5 North Shore and 4 West Thumb spawning streams tributary to Yellowstone Lake, Yellowstone National Park, 1990–2009.

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, 2009.

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	6/9	6/30	22	4	3	0.75
Hotel Creek			Not surveyed			
Hatchery Creek			No spawn		0	
Incinerator Creek			No spawn		0	
Wells Creek			No spawn		0	
Bridge Creek	5/26	6/15	21	4	10	2.5
Weasel Creek			Not surveyed			
Sand Point Creek			Not surveyed			
West Thumb Streams						
1167 Creek			No spawn			
Sandy Creek	6/1	6/1	1	1	2	2
Sewer Creek			No spawn			
Little Thumb Creek	6/1	6/30	30	5	60	12
Total (Yellowstone Lake)				14	75	5.4
Northern Range Stream						
Trout Lake Inlet	6/29	7/22	24	4	977	244

Trout Lake

Visual 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 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 2009, the first movement of spawning trout from Trout Lake into the inlet creek was observed on 29 June. The spawn lasted approximately 24 days with the last spawning trout being observed in the inlet creek on 22 July. During the once per week visual surveys, 977 spawning cutthroat (and/or cutthroat trout x rainbow trout hybrids) were counted, an average of 244 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 grizzly bears or black bears, bear sign, or evidence of bear fishing activity was observed along the inlet creek during the surveys.

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, 1999–2009.

Cutthroat Trout Outlook.—As part of management efforts to protect the native cutthroat trout population, park fisheries biologists and private-sector (contracted) netters caught and removed 100,758 lake trout from Yellowstone Lake in 2009 (Koel et al. In press). Catch rates are increasing suggesting that lake trout population growth is outpacing the current effort to remove them. The catch per effort of cutthroat trout (unintentional by-catch) in smaller mesh size gillnets used to target juvenile lake trout has more than doubled from the early years of the lake trout removal program, indicating a possible increase in cutthroat trout recruitment in recent years.

Above: Cutthroat trout consumed by lake trout, Lake Trout Removal Program, 2007. Right: Lake trout caught in Yellowstone Lake as part of the Lake Trout Removal Program in 2009. NPS photos.

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 from year to year 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 1997–99, 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 2009 actively feeding grizzly bears were observed on 2 sites classified as possible in past years. Therefore, these sites were reclassified to confirmed and analysis was done back to 1986. Observations of grizzly bears actively feeding in 2 new areas resulted in the classification of 2 new possible insect aggregation sites. The reclassified sites and new possible sites produced 37 confirmed sites and 15 possible sites for 2009.

The percentage of confirmed sites with documented use by bears varies from year to year, 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 decreased by 3% in 2009 (Fig. 9). The number of observations or telemetry relocations at sites decreased from 2008, as well (Table 18). The number of insect aggregation sites used by bears in 2009 decreased by 1 site to 25 (Table 18) and was slightly higher than the 5-year average of 22.0 sites/year from 2004–2008.

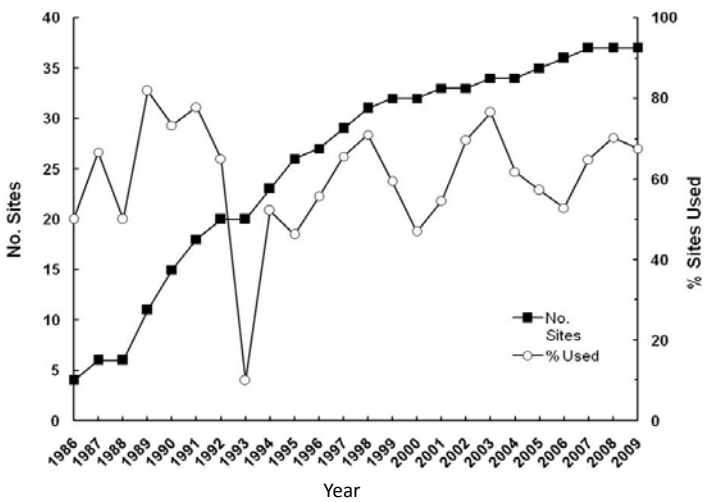

Fig. 9. Annual number of confirmed insect aggregation sites and percent of those sites at which either telemetry relocations of marked bears or visual observations of unmarked bears were recorded, Greater Yellowstone Ecosystem, 1986–2009.

The IGBST maintains an annual list of unduplicated females observed with COY (see Table 4). Since 1986, 768 initial sightings of unduplicated females with COY have been recorded, of which 213 (27%) have occurred at (within 500 m, n = 197) or near (within 1,500 m, n = 16) insect aggregation sites (Table 19). In 2009, 6 of the 42 (14.3%) initial sightings of unduplicated females with COY were observed at insect aggregation sites, a decrease of 5 from 2008 (Table 19) and lower than the 5-year average of 28.8% from 2004–2008.

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 sites during 1986–2009.

Year	Number of confirmed moth sites[a]	Number of sites used[b]	Number of aerial telemetry relocations	Number of ground or aerial observations
1986	4	2	5	5
1987	6	4	7	8
1988	6	3	12	31
1989	11	9	11	41
1990	15	11	9	75
1991	18	14	11	165
1992	20	13	5	99
1993	20	2	1	1
1994	23	12	1	28
1995	26	12	7	37
1996	27	15	21	66
1997	29	19	17	80
1998	31	22	11	173
1999	32	19	25	155
2000	32	15	39	89
2001	33	18	24	119
2002	33	23	36	238
2003	34	26	10	161
2004	34	21	2	130
2005	35	20	15	175
2006	36	19	19	176
2007	37	24	13	173
2008	37	26	20	212
2009	37	25	8	178
Total			329	2,615

[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, 1986–2009.

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	8	12	50.0	14	58.3
1992	25	5	7	28.0	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	7	7	21.2	7	21.2
1997	31	8	11	35.5	11	35.5
1998	35	10	13	37.1	13	37.1
1999	33	3	6	18.2	7	21.2
2000	37	6	8	21.6	10	27.0
2001	42	6	12	28.6	13	31.0
2002	52	11	17	32.7	17	32.7
2003	38	11	19	50.0	20	52.6
2004	49	11	16	32.7	16	32.7
2005	31	5	7	22.6	9	29.0
2006	47	11	14	29.8	15	31.9
2007	50	10	17	34.0	17	34.0
2008	44	7	11	25.0	14	31.8
2009	42	4	6	14.3	6	14.3
Total	768		197		213	
Mean	32.0	5.6	8.2	23.0	8.9	25.0

[a] Initial sightings of unduplicated females with COY; see Table 4.
[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 an insect aggregation site for this analysis, since some observations could be made of bears traveling to and from insect aggregation sites.

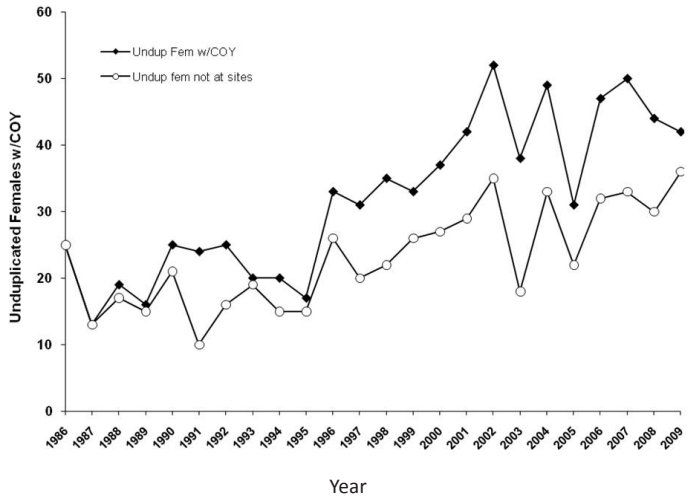

Fig. 10. The total number of unduplicated females with COY observed annually in the Greater Yellowstone Ecosystem and the number of unduplicated females with cubs-of-the-year (COY) not found within 1,500 m of known insect aggregation sites, 1986–2009.

Female with 2 cubs-of-the-year on a moth site, 6 Aug 2004. Photo courtesy of Josh Westerhold.

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

Whitebark pine surveys on established transects showed generally good to excellent cone production during 2009 (Fig. 11). Twenty-three transects were read. Overall, mean cones/tree was 46.5 (Table 20, Fig. 12). All trees on transect R were dead and suitable replacement trees could not be found within the stand. This transect will be retired along with 3 that were retired in 2008 (F1, H, and T; Table 21). The best cone production occurred on new transects established during 2007 (CSA-CAG, Fig. 11 and Table 21). Although cones were abundant on most transects, there was a difference (*Student's t* = -4.027, P < 0.0001) in production between old (*n* = 129 trees, mean cone/tree = 27.8) and new (*n* = 63 trees, mean cones/tree = 84.8) transects.

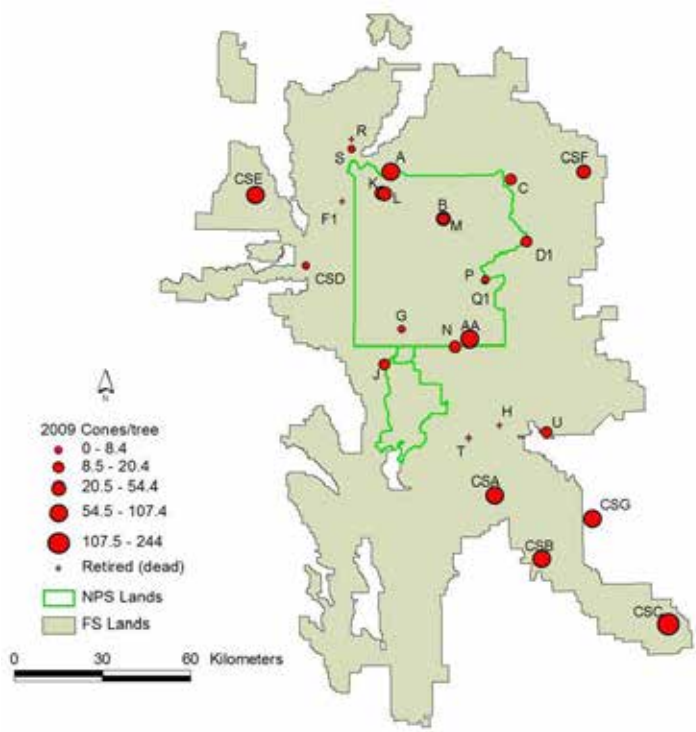

Fig. 11. Locations and mean cones/tree for 26 whitebark pine (*Pinus albicaulis*) cone production transects surveyed in the Greater Yellowstone Ecosystem during 2009.

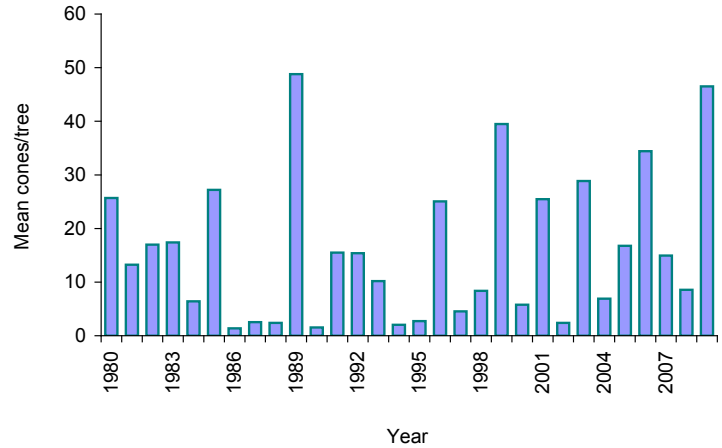

Fig. 12. Annual mean cones/tree on whitebark pine (*Pinus albicaulis*) cone production transects surveyed in the Greater Yellowstone Ecosystem during 1980–2009.

Mountain pine beetle activity continues at high levels on our original 19 transects. We observed additional mortality among trees originally surveyed since 2002. Total mortality on transect trees read since 2002 is 69.5% (132/190) and 94.7% (18/19) of 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, numbers of grizzly bear-human conflicts and management actions tend to decrease during years with good cone availability. However, extensive areas of beetle-killed whitebark pine may reduce cone abundance and availability locally and may dampen or modify this trend. During August-October 2009, 10 management captures of bears 2-years of age or older (independent) resulted in 9 transports and 1 removal. This result was near the overall average of 9 management actions for August-October, 1980–2008. The number of August-October bear mortalities from self-defense kills by hunters was high (*n* = 6, for independent aged bears (see *Estimating sustainability of annual grizzly bear mortalities*).

Table 20. Summary statistics for whitebark pine (*Pinus albicaulis*) cone production transects surveyed during 2009 in the Greater Yellowstone Ecosystem.

Total			Trees				Transect			
Cones	Trees	Transects	Mean cones	SD	Min	Max	Mean cones	SD	Min	Max
8,928	192	22	46.5	81.7	0	630	405.8	485.2	16	2.193

Table 21. Whitebark pine (*Pinus albicaulis*) cone production transect results for 2009.

Transect	Cones	Trees	Mean	SD
A	704	10	70.4	196.9
B	486	10	48.6	22.5
C	176	9	19.6	11.5
D1	58	5	11.6	7.3
F1		Dead (retired)		
G	53	10	5.3	5.7
H		Dead (retired)		
J	198	10	19.8	22.3
K	403	10	40.3	31.0
L	385	10	38.5	32.4
M	203	10	20.3	15.4
N	112	10	11.2	15.0
P	34	10	3.4	3.1
Q1	30	10	3.0	6.1
R		Dead (retired)		
S	25	3	8.3	3.8
T		Dead (retired)		
U	21	2	10.5	12.0
AA	699	10	69.9	43.0
CSA	964	9	107.1	79.5
CSB	723	10	72.3	67.4
CSC	2,193	9	243.7	164.9
CSD	16	10	1.6	2.7
CSE	274	5	54.8	56.7
CSF	345	10	34.5	24.8
CSG	826	10	82.6	35.9

Basin Creek Lake. Photo courtesy of Shannon Podruzny.

Lightning-struck whitebark pine. Photo courtesy of Jonathan Ball.

Habitat Monitoring

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

In 2009, total visitation in Grand Teton National Park was 3,845,838 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 2,580,081. Backcountry user nights totaled 30,731. 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 2009.

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	2,497,847	30,049

[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.

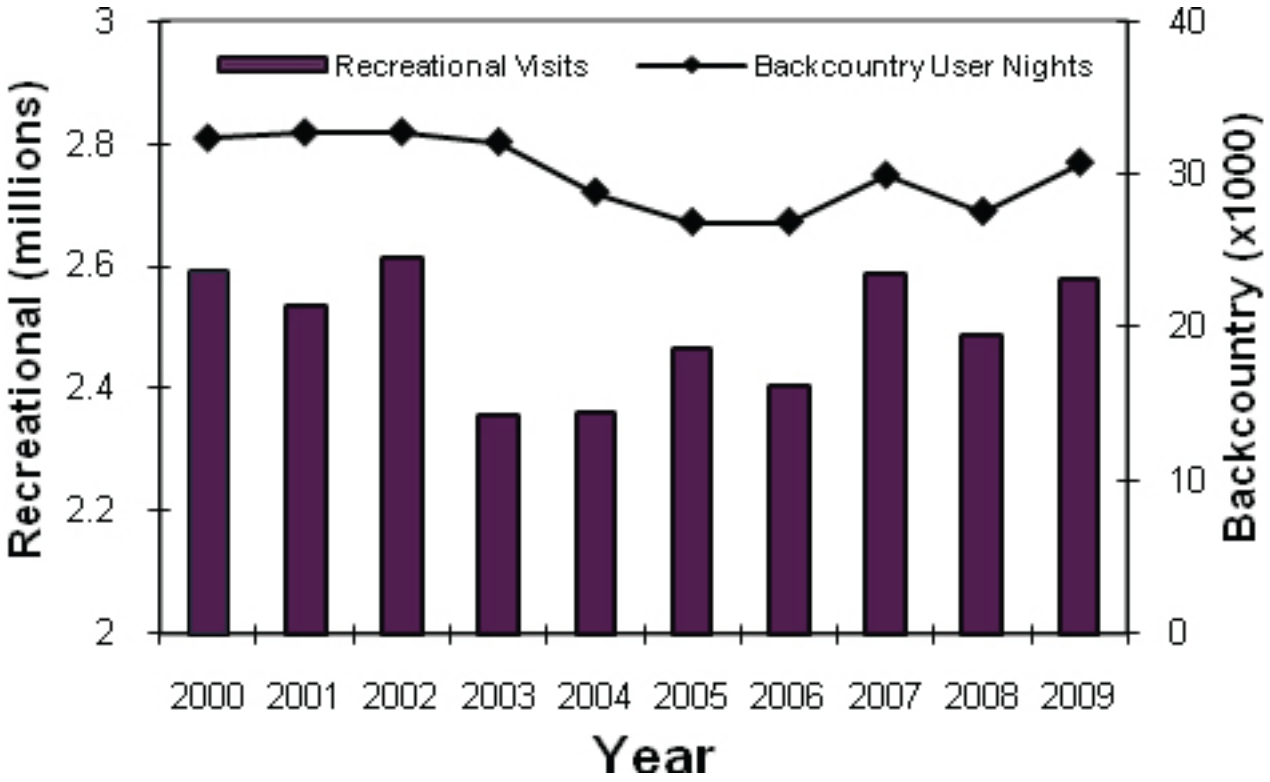

Fig. 13. Trends in recreational visitation and backcountry user nights in Grand Teton National Park during 2000–2009.

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

In 2009, total visitation to Yellowstone National Park was 4,152,923 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 3,295,186 a new record high for visitation in one year. These visitors spent 671,000 user nights camping in developed area roadside campgrounds and 39,714 user nights camping in backcountry campsites. The bulk of Yellowstone National Park's visitation occurs from May through September. In 2009 there were 3,048,543 recreational visitors during that time period, an average of 19,925 visitors per 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 since 2000, to an average of 2,967,718 visitors/year. The decade of 2000 through 2009 was the first in the history of the park that visitation did not increase from the previous decade. 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 2009.

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	2,967,718[g]	624,450[g]	40,362[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 2000–2009.

Tourists and bears; JP Clum Lantern; 1910. NPS photo.

Trends in Elk Hunter Numbers within the Grizzly Bear Recovery Zone 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 RZ plus the 10-mile perimeter area. Because some hunt area boundaries do not conform exactly to the RZ and 10-mile perimeter area, regional biologists familiar with each hunt area were queried to estimate hunter numbers within the RZ 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 RZ 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 1999 to 2009 (Table 24). Complete data does 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.

There has been a downward trend in hunter numbers in Idaho, Montana, and Wyoming since 1999 (Fig. 14). Until 2008, most of the decrease occurred in Wyoming and Montana. The majority of the decrease has occurred in Wyoming with over 7,000 fewer hunters. Montana has also experienced a significant decline in hunter numbers in the last 10 years, >3,700. Both Montana and Wyoming began to decrease the harvest of females in the early 2000s as elk herds approached their population objective. Idaho drastically reduced harvest objectives for females in 2008, which accounts for the decrease in hunter numbers in 2008 and presumably 2009.

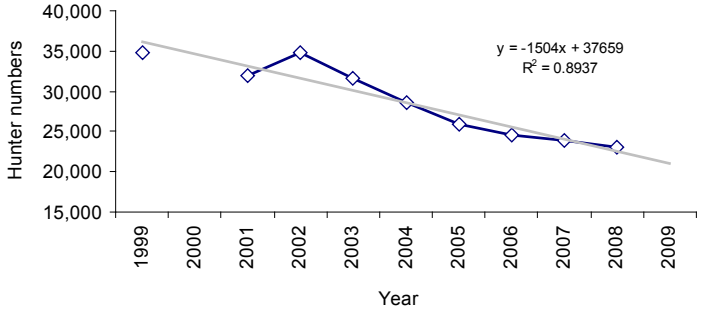

Fig. 14. Trend in elk hunter numbers within the Recovery Zone plus a 10-mile perimeter in Idaho, Montana, and Wyoming, 1999–2009.

Table 24. Estimated numbers of elk hunters within the Recovery Zone plus a 10-mile perimeter in Idaho, Montana, and Wyoming, for the years 1999–2009.

	Year										
State	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Idaho	2,883	[a]	2,914	3,262	3,285	3,454	3,619	3,016	2,592	1,763	[a]
Montana	16,254	17,329	15,407	17,908	16,489	14,320	12,365	12,211	12,635	12,470	[a]
Wyoming	15,727	12,812	13,591	13,709	11,771	10,828	9,888	9,346	8,716	8,792	8,440
Total	34,864		31,912	34,879	31,545	28,602	25,872	24,573	23,943	23,025	

[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 for 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 (2007–2009), 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 independently of the availability of natural bear foods (Gunther et al. 2004). In 2009, the availability of high-quality, concentrated bear foods was above average during the spring season, average during estrus and early hyperphagia, and above average during late hyperphagia. During spring, the number winter-killed ungulate carcasses on the Northern Ungulate Winter Range were approximately equal to the long-term average (see *Spring Ungulate Availability)*. During estrus, very few spawning cutthroat trout were observed in monitored tributary streams of Yellowstone Lake (see *Spawning Cutthroat Trout*). However, predation on newborn elk calves was frequently observed during the estrus season. During early-hyperphagia many grizzly bears were observed at high elevation army cutworm moth aggregation sites (see *Grizzly Bear Use of Insect Aggregation Sites*), and abundant berry crops attracted bears in Grand Teton National Park. During late hyperphagia, whitebark pine seed production was considered good to excellent throughout most of the ecosystem (see *Whitebark Pine Cone Production*).

There were 148 grizzly bear-human conflicts reported in the GYE in 2009 (Table 25, Fig. 15). These incidents included bears killing livestock (49%, $n = 72$), damaging property while obtaining anthropogenic foods (27%, $n = 40$), damaging property without obtaining anthropogenic foods (11%, $n = 16$), obtaining vegetables and fruit from gardens and orchards (10%, $n = 14$), and injuring people (4%, $n = 6$). Conflicts were relatively evenly distributed between public and private lands. Fifty-one percent ($n = 75$) of the conflicts occurred on public land administered by the U.S. Forest Service (49%, $n = 73$), Bureau of Land Management (1%, $n = 1$), and National Park Service (1%, $n = 1$). Forty-nine percent ($n = 73$) of the conflicts occurred on private land in the states of Wyoming (33%, $n = 49$) and Montana (16%, $n = 24$). There were no conflicts reported on private land in Idaho. Most (72%, $n = 107$) of the bear-human conflicts in 2009 occurred outside of the Grizzly Bear Recovery Zone. Only 28% ($n = 41$) of the bear-human conflicts occurred within the Recovery Zone. The number of incidents of grizzly bears damaging property, obtaining anthropogenic foods, damaging beehives, and injuring people in 2009, were similar to the long-term averages recorded from 1992–2008 (Table 26). Livestock depredations and incidents of bears eating apples and damaging apple trees were slightly higher than the long-term average. Apple trees at private residences throughout the GYE produced abundant apple crops in 2009.

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 411 (76%) of the 539 conflicts that occurred from 2007–2009. The 5 areas where most conflicts occurred over the last 3 years included: 1) the area encompassing Cooke City, Montana, the Clarks Fork River, Crandall Creek, Sunlight Creek, and the North and South Forks of the Shoshone River (152 conflicts); 2) the Green River and Dunoir Creek drainages (134 conflicts); 3) the Gardiner Basin (64 conflicts), 4) the area encompassing West Yellowstone, Montana, and Island Park, Idaho (47 conflicts); and 5) the area encompassing the Wood River, Cottonwood Creek, and Grass Creek drainages (14 conflicts). 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 types of ownership and land management mandates each had predominately different types of bear-human conflicts in 2009. On private land, incidents of bears damaging property and obtaining anthropogenic foods (garbage, grain, bird seed, dog food, garden vegetables, apples) were the most common type (69%, 50 of 73) of grizzly bear-human conflict reported. On lands managed by the U.S. Forest Service, cattle and sheep depredations were the most common (77%, 56 of 73) type of conflict. There was only 1 conflict on lands under Bureau of Land Management jurisdiction, a bear-inflicted human injury. On lands under National Park Service jurisdiction, there was also only 1 conflict of any type, a property damage, but habituation of bears to people was a significant

Table 25. Number of incidents of grizzly bear-human conflicts reported within different land ownership areas in the Greater Yellowstone Ecosystem, 2009.

Land owner[a]	Property damages	Anthropogenic foods	Human injury	Gardens/ Orchards	Beehives	Livestock depredations	Total Conflicts
ID-private	0	0	0	0	0	0	0
ID-state	0	0	0	0	0	0	0
MT-private	2	19	0	2	0	1	24
MT-state	0	0	0	0	0	0	0
WY-private	5	17	0	12	0	15	49
WY-state	0	0	0	0	0	0	0
BLM	0	0	1	0	0	0	1
BDNF	0	0	0	0	0	0	0
BTNF	1	3	1	0	0	37	42
CNF	0	0	0	0	0	0	0
CTNF	0	0	1	0	0	5	6
GNF	1	1	3	0	0	0	5
SNF	6	0	0	0	0	14	20
GTNP/JDR	0	0	0	0	0	0	0
YNP	1	0	0	0	0	0	1
Total	16	40	6	14	0	72	148

[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..

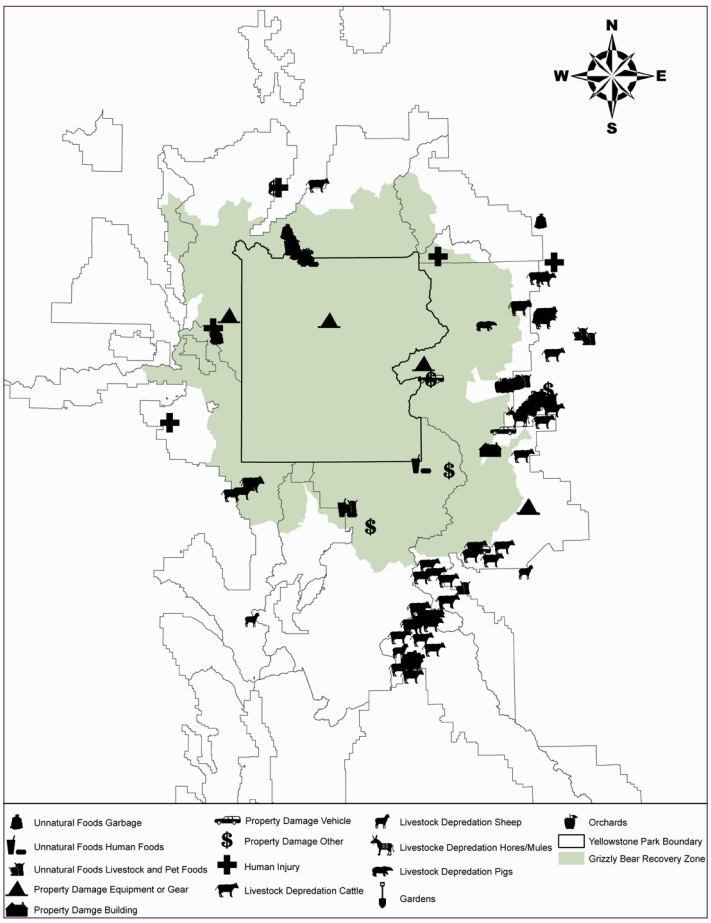

Fig. 15. Locations of different types of grizzly bear-human conflicts reported in the Greater Yellowstone Ecosystem in 2009. The shaded area represents the Yellowstone Grizzly Bear Recovery Zone.

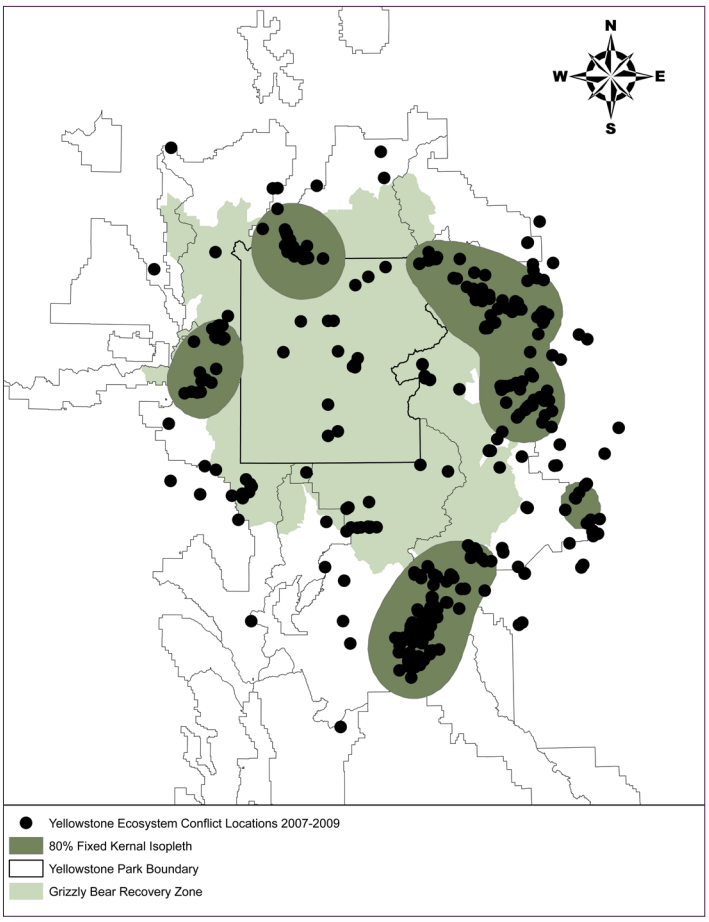

Fig. 16. Concentrations (dark shaded polygons) of grizzly bear-human conflicts that occurred from 2007–2009, identified using the 80% fixed kernel isopleth. The lightly shaded background area represents the Yellowstone Grizzly Bear Recovery Zone.

Table 26. Comparison between the number of incidents of different types of grizzly bear-human conflicts in 2009 and the average annual number of conflicts recorded from 1992–2008 in the Greater Yellowstone Ecosystem.

Type of conflict	1992–2008 Average ± SD	2009
Human injury	5 ± 3	6
Property damage	21 ± 12	16
Anthropogenic foods	57 ± 38	40
Gardens/orchards	6 ± 5	14
Beehives	3 ± 4	0
Livestock depredations	52 ± 18	72
Total conflicts	142 ± 55	148

management challenge. In Grand Teton National Park (GTNP), the number of incidents where habituated grizzly bears frequented roadside meadows and the outskirts of developments continued to increase in 2009. GTNP staff managed visitors and bears at 129 roadside grizzly bear-jams. In Yellowstone National Park (YNP), the number of bear-jams was among the highest recorded since prohibitions against hand feeding of bears were enforced in 1970. There were 314 grizzly bear-jams reported in YNP in 2009. 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. No conflicts involving roadside habituated bears occurred in either park.

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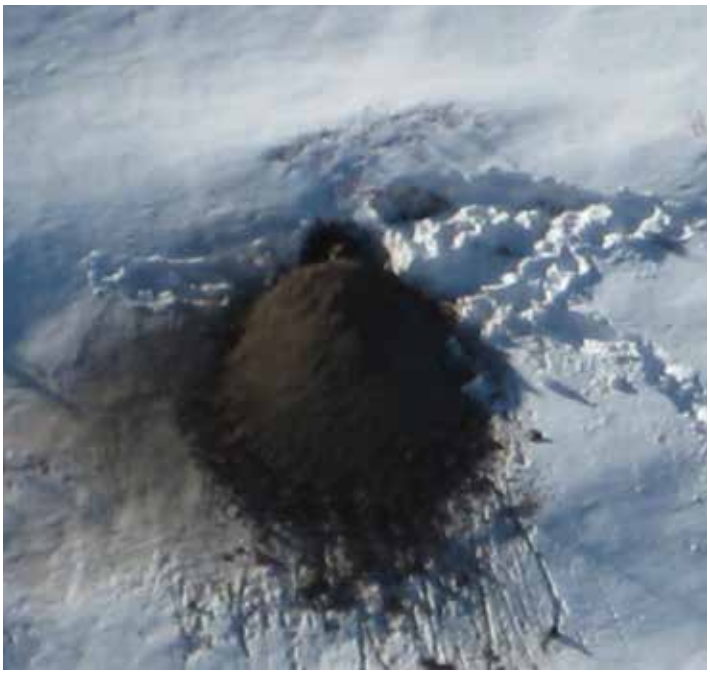

Grizzly bear at den entrance, Nov 2009. This bear emerged from the den in Apr 2010 with 1 cub-of-the-year. Photo courtesy of Brian DeBolt/Wyoming Game and Fish.

2009 Annual Progress Report

Jennifer Fortin
Justin Teisberg
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 and black bears 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 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.

Capture and collaring: Bears were trapped around Yellowstone Lake during the fall of 2006, early summer and fall of both 2007 and 2008, and early summer of 2009. Twenty-one grizzly bears (8 females and 13 males) and 6 male black bears have been captured and fitted with Spread Spectrum Technology (SST) Global Positioning System (GPS) collars.

Telemetry results: Thirteen grizzly bears (5 female and 8 male) and 4 male black bears were radio tracked during this year's field season (11 May–9 Oct). Approximately 47,173 GPS locations were recorded by these collars during the 2009 field season. Six collars were dropped prematurely: 22512 on 8/29, 567 on 5/12, 204 on 9/23, 589 between 8/17 and 8/24, 363 on 8/16, and 448 on 6/16. The GPS portion of 589's collar failed on 8/9 prior to being dropped. Female grizzly bear 448 was recollared on 7/9 and the collar is scheduled to remain on until 6/15/10 to see if she produces cubs. Ten (492, 541, 22513, 22515, 201, 568, 338, 481, 616, and 22511) of the remaining 11 collars were dropped on schedule. All collars except 568 were retrieved, it will be retrieved during the spring 2010 when snow conditions allow for access. Bear 515 retained his collar through denning and continues to wear it at the time of this writing. None of these collared grizzly bears had cubs during the 2009 field season.

Site visits: Four 2-person crews (2 graduate students along with 6 volunteers) were employed for the 2009 field season. The field crews visited GPS locations to record bear activity, including habitat and dietary item use. We visited 1,258 GPS locations at which we collected 126 hair samples, 475 fecal samples, and forage samples. Of these sites, 429 were Level 1 only in their analysis, 829 continued to Level 2 analysis, and 253 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 whitebark pine (*Pinus albicaulis*) nuts. Carcasses consisted of 19 elk (*Cervus elaphus*), 1 bison (*Bison bison*), and 1 mule deer (*Odocoileus hemionus*). Insect sites consisted of 36 ant hills or log tears and 14 other insect and/or earthworms sites. Roots were mainly yampa (*Perideridia gairdneri*) at 39 sites with 21 biscuitroot (*Lomatium* spp.), 5 licorice root (*Osmorhiza spp.*), 3 onion grass (*Melica* spp.), and 2 glacier lily (*Erythronium grandiflorum*) also used. There were 111 whitebark pine nut middens, 15 rodent caches, 12 fungi sites (*Rhizopogon* spp.), and 7 cambium scrapes. It was a good whitebark pine cone year with counts in YNP averaging 46.5 cones/tree.

Level 3 foraging or grazing sites were highly composed of all three categories: graminoids, forbs, and berries. Graminoid site visits included: 10 bluegrass (*Poa* spp.), 7 sedge (*Carex* spp.), 2 wheatgrass (*Agropyron* spp.), and 1 timothy (*Phleum* spp.). The dominant forbs at site visits were dandelion (*Taraxacum* spp.) at 57, 31 clover (*Trifolium* spp.), and 27 fireweed (*Epilobium* spp.). Other forbs used were: 17 elk thistle (*Cirsium scariosum*), 15 fern-leaved lovage (*Ligusticum filicinum*), 12 sticky geranium (*Geranium viscosissimum*), 7 cow parsnip (*Heracleum maximum*), 5 of both *Aster* spp. and lousewort (*Pedicularis* spp.), 4 of both mountain bluebells (*Mertensia ciliata*) and paintbrush (*Castilleja* spp.), 3 of both buckwheat (*Eriogonum* spp.) and bistort root (*Polygonum* spp.), and 1 each of *Agoseris* spp., wild chives (*Allium* spp.), angelica (*Angelica* spp.), and horsetail (*Equisetum arvense*). Berry production was decent in 2009 with use composed

of: 23 grouse whortleberry (*Vaccinium scoparium*), 6 each of elderberry (*Sambucus racemosa*) and globe huckleberry (*Vaccinium globulare*), 5 raspberry (*Rubus* spp.), 4 gooseberry (*Ribes* spp.), and 1 each of buffaloberry (*Sheperdia canadensis*) and strawberry (*Fragaria* 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 355 hair samples were collected. Stream surveys for spawning cutthroat trout were conducted in conjunction with hair snare visits. Of the 35 streams surveyed, 21 contained spawning cutthroat and 19 contained fry and/or fingerlings during at least one stream survey. Maximum number of cutthroat trout spawners seen during one stream survey was 25. Fry and/or fingerling counts were often estimated to be several hundred. All data was entered into an Access database.

Hair Snare Results: As part of a project to understand current use of cutthroat trout by both black and grizzly bears, we collected 355 hair samples at hair snag corrals (n = 48) placed along tributary streams of Yellowstone Lake during the historic spawning period of 2009. We sent 195 of these samples to Wildlife Genetics International for genetic analyses; the lab identified 30 grizzly bears (17 male, 13 female) and 12 black bears (6 male, 6 female). Over the course of the project (2007–2009), we collected 1,535 hair samples under the same design. We sent 877 of these samples off for genetic analysis. Seven hundred forty-six (85%) samples were assigned to individual bears using a suite of 7 microsatellite loci (observed heterozygosity across 7 loci: 0.672 for grizzlies and 0.650 for black bears). From this assignment, we now know at least 63 grizzly bears (42 male, 21 female) and 27 black bears (17 male, 10 female) visited tributary stream courses during this time. Of these, 8 male and 7 female black bears (15 in total; 56% of total number identified) and 12 male and 8 female grizzly bears (20 in total; 32% of total number identified) visited streams located near human development (front-country). Only 9 (18%) grizzly bears visited these areas during a period between 1997 and 2000 (Haroldson et al. 2005).

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Adult male black bear captured visiting a hair snare corral with a remote digital camera. Corrals were placed along tributary streams to Yellowstone Lake that had an historical cutthroat trout spawning run.

2009 Wyoming Bear Wise Community Project Update

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Introduction

The Bear Wise Community program is a 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 2009. Progress and past accomplishments are reported in the 2008 annual report of the Interagency Grizzly Bear Study Team (IGBST) (Hodges and Boyce 2009).

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 as part of this initiative. 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 four 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 Bear Wise Community Project Update

The Wapiti Bear Wise Community program is at the end of the fourth year since implementation. Thus far, the program has utilized radio, television and print media, 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 educational initiatives, the program 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 2009 are as follows:

Ongoing Efforts:

1. In 2007 and 2008, 140 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 sold and are in use in Park County. Because of increased consumer demand and cooperation from local sanitation companies, the remaining cart inventory will be transferred to local sanitation providers in the Cody area in 2010.

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

3. A "Bear Aware" billboard, "Bear Use Area" highway signs, and educational kiosks remain posted throughout Wapiti and the Crandall/Sunlight area north of Cody. Kiosk message boards are updated three times during the non-denning season with seasonally appropriate conflict prevention information.

4. Public libraries across northwest Wyoming continue to offer *Staying Safe in Bear Country* and *Living in Bear Country* DVD's 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 continue to be included in the local Wapiti School calendar. 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 "Welcome Wagon" gift bags assembled by local businesses for new residents.

7. The Carcass Management program continues to provide a domestic livestock carcass removal service for livestock producers located in occupied grizzly bear habitat within Park County, Wyoming. The program is mirrored after an existing program utilized by landowners in the Blackfoot River watershed in western Montana and is paid for with funds from the Park County Predator Management District and the Wyoming Animal Damage Management Board. The program provides producers with an alternative to the use of on-site carcass dumps, which are a significant bear attractant and indirectly contribute to numerous human-bear conflicts. To date, 81 domestic livestock carcasses have been removed from private land with 20 participating landowners.

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 seven new developments within Park County.

New Initiatives and Accomplishments:

1. A "Bear Identification for Black Bear Hunters" educational card was designed and printed. Cards were distributed to individuals and to local sporting goods stores in the Cody, Jackson, Pinedale, and Lander regions and mailed to black bear hunters who registered bait sites with the Wyoming Game and Fish Department in areas surrounding the GYA.

2. 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, Boy Scouts, 4H, Park County Commissioners, residents attending Arbor Day, Clark and Meeteetse community residents, Bow Hunters of Wyoming, Wyoming Outfitters and Guides Association, and Trout Unlimited.

3. Provided Park County, Wyoming with estimates and options for bear-resistant recycling trailers for use in rural sections of the County. The Coordinator is seeking potential funding sources to offset the cost of bear-resistant recycling containers.

4. Worked with the Big Horn Basin chapter of Sportsman for Fish and Wildlife (SFW) to produce and air two public service announcements (PSAs) titled "Hunting Safely in Bear Country" and "Bear ID Tips for Black Bear Hunters". PSAs were aired on

three local radio stations for three weeks in September 2009 immediately before the opening of the elk rifle season and during the spring and fall black bear season. SFW paid for half of fall airtime cost.

5. A second "Hunting in Bear Country" public service announcement that was recorded in 2008 in cooperation with the Wild Sheep Foundation, ran for two weeks in September 2009.

6. A public service announcement regarding proper attractant management recorded by Wapiti school students aired for two weeks on three local radio stations in October 2009.

7. Worked with the Big Horn Basin chapter of Sportsman for Fish and Wildlife to develop and place a print ad encouraging hunters to carry bear spray. The 6"x8" ad was printed in *The Hunting Guide* published by the Cody Enterprise. The Big Horn Basin chapter of Sportsman for Fish and Wildlife paid for the ad entirely.

8. An article titled "Feeding Birds, not Bears" was included in a monthly publication produced by the local chapter of the Audubon Society.

9. A mailing containing information regarding human-bear conflict prevention and the availability of local resources was delivered to Wapiti residents. A refrigerator magnet featuring tips about proper attractant management was included in each mailing.

Objectives for 2010 include expansion of the program into the other areas of the state where human-bear conflicts are chronic, finalization and production of an interactive Bear Aware traveling display for use by educational institutions and libraries across northwest Wyoming, and the continuation of current educational and outreach efforts.

The Wapiti Bear Wise Community program faces the ongoing challenges of: 1) the absence of ordinances or laws prohibiting the feeding of bears; 2) limited educational opportunities and contact with portions of the community due to a large number of summer-only residents and the lack of organized community groups; and 3) complacency by some residents due to the relatively low occurrence of residential human-bear conflict in 2008 and 2009. The future success of the Bear Wise program lies in continued community interest and individual participation in proper attractant management.

Bear Wise Jackson Hole Project Update

In 2009, the Bear Wise Jackson Hole program focused public outreach efforts on education, signage, distribution of informational pamphlets, personal contacts, distribution of bear-resistant garbage carts, and implementation of the recently adopted Teton County "Bear Conflict Mitigation and Prevention" Land Development Regulation (LDR).

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 bird foods unavailable to bears. Sections of Teton County in phase one were required to comply by 1 July 2009 and other areas of the county in phase two must comply by 1 July 2010.

2009 Accomplishments:

1. A considerable amount of time was spent supporting Teton County and local waste management companies with the implementation of the first phase of the bear conflict mitigation and prevention LDR with various projects including: informational mailings, feature newspaper articles, public service announcements (PSAs), radio interviews and a full page color newspaper advertisement.

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, 90 carts have been placed. The remaining cart inventory has been liquidated to local waste management companies and has been distributed to their customers.

3. Recommendations were made to several businesses in Jackson to sell bear-resistant garbage carts locally. Ace Hardware in Jackson now carries a large inventory of bear-resistant garbage carts. They have been selling these carts to the public since July 2009.

4. Public service announcements were broadcast on four local radio stations for a total of eight weeks in the spring and fall of 2009. These announcements focused on storing attractants unavailable to bears and hunting safely in bear country.

5. Numerous educational talks were presented to various groups including homeowners associations, guest ranches, youth camps, Jackson residents, tourists, Backcountry Horsemen, Boy Scouts, and school groups.

6. Spanish language bear informational pamphlets were produced and distributed to Spanish speaking people in Teton County with the help of the Teton County Latino Resource Center and the Jackson Visitor Center.

7. Bear educational posters have been placed inside of Jackson's public buses for a one year period.

8. Restroom posters with information about attractant storage were placed in ten different restaurants in Teton County for a six month period.

9. A full page color ad was placed in the Jackson Hole News and Guide for two weeks starting on September 15. This ad contained information about hunting safely in bear country.

10. An educational "Bear Aware" display was set up in the lobby at the Wyoming Game and Fish Department Jackson office.

11. 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.

12. A booth containing information on bear identification, attractant storage, hunting and recreating safely in bear country and the proper use of bear spray was staffed at the Jackson Hole Antler Auction.

13. Assisted three 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.

14. Signage detailing information on hunting safely in bear country, bear identification, recent bear activity, and proper attractant storage were placed at U.S. Forest Service trailheads and in private residential areas throughout Teton County.

15. 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.

16. Bear Aware educational materials were distributed to campground hosts in the Caribou-Targhee National Forest, hunters, and numerous residents in Teton County.

Objectives for the Bear Wise Jackson Hole program in 2010 will focus on supporting Teton County and local waste management companies with projects that will help disseminate information and achieve compliance with the second phase 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 Bear Conflict Mitigation and Prevention LDR.

2. Placing ads in the Jackson Hole News and Guide detailing how to comply with the LDR.

3. Posting signage detailing the LDR. Signage will be placed in key residential locations throughout Teton County.

4. Develop and air public service announcements on local radio and television media outlets.

The recent implementation of the Teton County Bear Conflict Mitigation and Prevention LDR has greatly reduced 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 implementing the second phase of this regulation in the southern parts of Teton County and achieving full compliance. 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.

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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) April 7, 2004.

2009 Hoback Grizzly Bear Camera Report

Wyoming Game and Fish Department

Trophy Game Section – Management/Research Branch

R. F. Trebelcock, L. Lofgren, D. D. Bjornlie, D. J. Thompson, and D. S. Moody

January 8, 2010

INTRODUCTION

Documenting the occurrence of grizzly bears (*Ursus arctos*) on the periphery of their known or suspected distribution in Wyoming is important in determining areas of expansion and relative densities of grizzly bears as they recolonize new areas within the Greater Yellowstone Area (GYA). Accurate information on grizzly bear distribution will be valuable in efficiently allocating state resources and responsibilities for grizzly bear management. Within the past several years there have been sporadic sightings and conflicts with grizzly bears in this portion of the GYA. However, most of the sightings were associated with conflict situations where bears were either relocated or killed. The objective of this study was to document to what extent grizzly bears inhabit the southern fringe of their distribution in Wyoming (Schwartz et al. 2006).

STUDY AREA

The study area was located in western Wyoming northeast of the Wyoming Range and includes portions of the Hoback and Green River drainages (Figure 1). All camera sites were located on the Bridger-Teton National Forest in the Jackson and Big Piney Ranger Districts. Elevation of camera sites ranged from 2,058 meters (6,751 feet) to 2,804 meters (9,198 feet) with an average elevation of 2,291 meters (7,517 feet). Vegetation on the study area consisted primarily of aspen (*Populus tremuloides*), lodgepole pine (*Pinus contorta*), Douglas-fir (*Pseudotsuga menziesii*), Englemann spruce (*Picea englemannii*) and sub-alpine fir (*Abies lasiocarpa*). Whitebark pine (*Pinus albicaulis*), a preferred grizzly seasonal food source (Haroldson and Podruzny 2008, Kendall 1983, Blanchard 1990, Mattson and Reinhart 1997), was not observed in any of the camera grids but is present at higher elevations in western and northern portions of the study area. Adjacent meadow complexes were dominated by various species of sagebrush (*Artemesia* spp.) and included other forb and grass species.

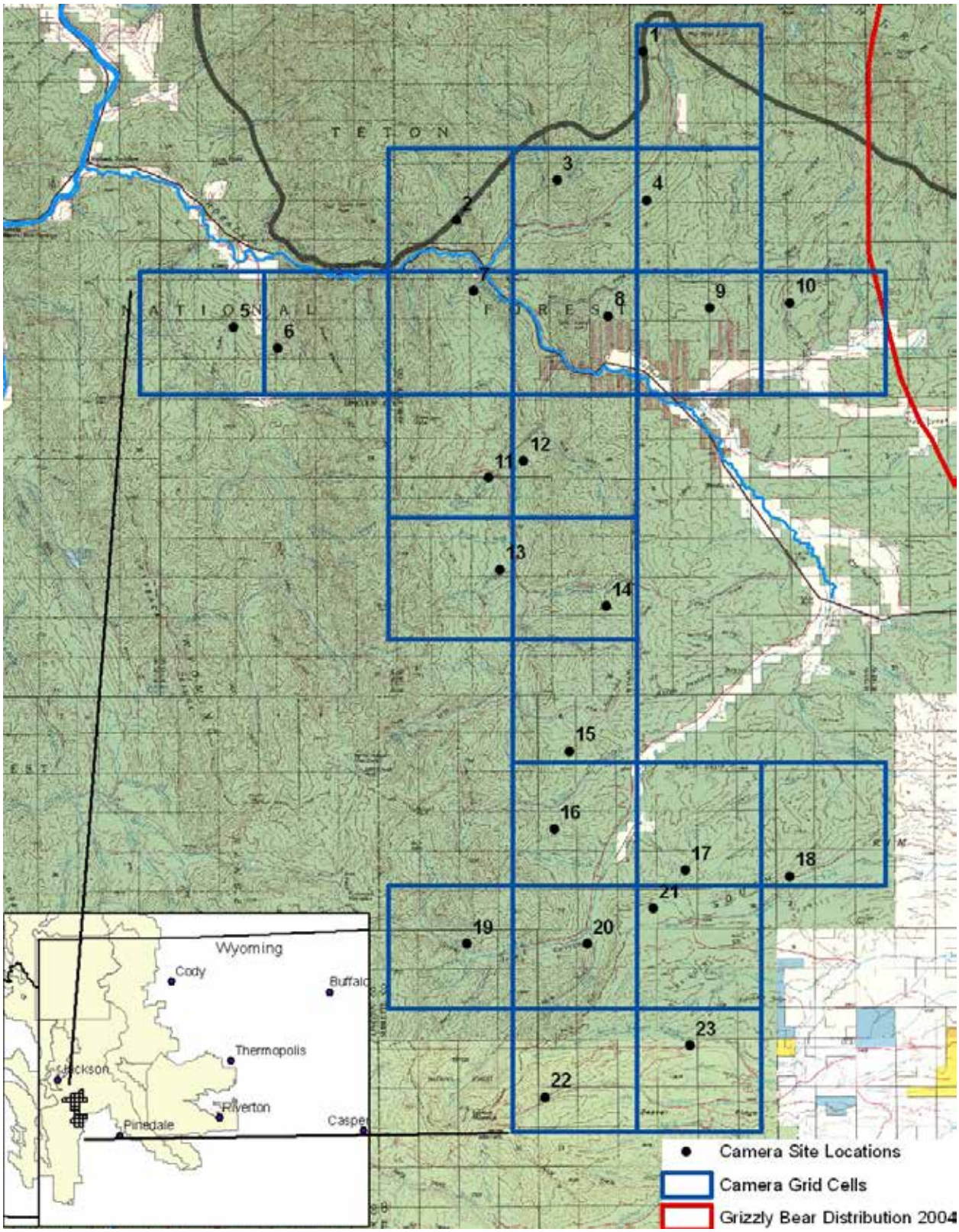

Figure 1. Location of study area including camera grid and camera sites, 2009

METHODS

Motion activated infra-red cameras were deployed in a systematic grid to document presence of grizzly bears in this portion of the ecosystem. The Department has used remote camera techniques since 2006 when first tested in the Black Rock area of Wyoming (Barr et al. 2007). Two Reconyx Professional Model PM35 (Reconyx, LLP, Holmen, WI, USA) cameras were attached to trees 1 to 2 meters above ground at each site. The cameras were positioned 90° to one another and directed at a focal point located under a scent lure, with one camera closer to the lure and the second further away to provide close-up and wide angle views for identification purposes. Distances from the lure ranged from 2.5 to 11 meters. The cameras were programmed to take 10 black and white photographs at 1-second intervals with a 30-second interval between sets of photos until movement stopped or the animal left the camera's field of view. Cameras were equipped with non-deterring, infrared flashes to facilitate nocturnal photos and were programmed to record date, time, photo number and ambient temperature on each photo.

The camera grid was comprised of 23 contiguous 5 km x 5 km cells (Wyoming Game and Fish Department [WGFD] 2008) encompassing 575 km^2 (Figure 1). Cell locations were selected based on ease of access with the requirement that they be contiguous. One camera site was established in each cell. Efforts were made to maximize the distance between each camera site and those in neighboring cells while maintaining accessibility. Sites near system roads and trails and developed areas were avoided to minimize human disturbances. If game trails were present, sites were located on or near the trail.

The scent lure consisted of putrefied livestock blood mixed with the anticoagulant, sodium citrate (http://www.nrmsc.usgs.gov/research/NCDElure.htm). Lure was placed in plastic jugs with a hole cut in the upper portion to allow for sent dispersal. The jugs were suspended with a rope 3–4.5 m above ground to prevent bears from accessing the lure. A small amount of lure was spilled on a small stump or chunks of wood placed on the ground immediately under the lure to attract bears to a focal point directly in front of the cameras where accurate identification was more probable. Two to four warning signs were attached to prominent trees within 100 meters of each site to warn people that bears may be nearby. UTM location, elevation, date, and time were recorded (Table 1).

Camera sites were visited weekly to inspect camera operation and alignment, change Compact Flash (CF) memory cards, and refresh scent lure, as needed.

An individual bear or family group detected by the cameras was counted as one event. Bears with obvious physical differences or a minimum two hour delay between photographic events were classified as separate events.

RESULTS AND DISCUSSION

Cameras were deployed between 6/26/09 and 7/2/09 and removed between 8/24/09 and 8/27/09. Cameras were in place for an average of 56.2 days per site. There was some variation in camera days among sites due to malfunction, extremely high livestock activity, and operator error. In all, 2,541 camera days were logged during the study period (Table 1).

Table 1. Hoback camera site summary data.

Site #	Elevation (m)	Elevation (ft)	Days Cameras in Place	Total Camera Days	Total Bear Events
1	2220	7284	57	114	12
2	2058	6751	57	114	5
3	2084	6838	57	114	0
4	2142	7026	57	114	5
5	2195	7201	55	110	4
6	2178	7144	54	108	3
7	2196	7204	55	110	2
8	2170	7119	55	110	6
9	2209	7248	56	112	4
10	2232	7322	56	112	2
11	2221	7287	57	114	0
12	2078	6817	57	114	2
13	2181	7155	57	114	1
14	2251	7386	57	114	2
15	2401	7877	54	108	5
16	2376	7796	55	81	3
17	2377	7797	56	112	5
18	2425	7955	55	110	1
19	2454	8052	56	98	3
20	2341	7681	56	112	1
21	2537	8324	55	110	0
22	2804	9198	59	118	0
23	2574	8445	59	118	0
Total			**1292**	**2541**	**66**

Sixty-six black bear *(Ursus americanas)* events and no grizzly bear events were recorded. Cameras detected from 1 to 12 events at the 18 sites visited by bears (Table 1). Of the 66 black bear events, 10 were of family groups; 1 female was accompanied by 3 cubs, 7 accompanied by 2 cubs, and 2 accompanied by 1 cub. The sex and age of all other bears could not be accurately determined. Black bear events were recorded during all hours of the day except for the nocturnal period from 2300–0400 hrs. Similar to previous WGFD camera studies (WGFD 2008, Lockwood et al. 2008), black bear visitation was highest during crepuscular hours (Figure 2). Unlike results of previous studies, the number of bear events in 2009 had two distinct peaks; two weeks into the study period and again at slightly over 4 weeks before tapering off (Figure 3).

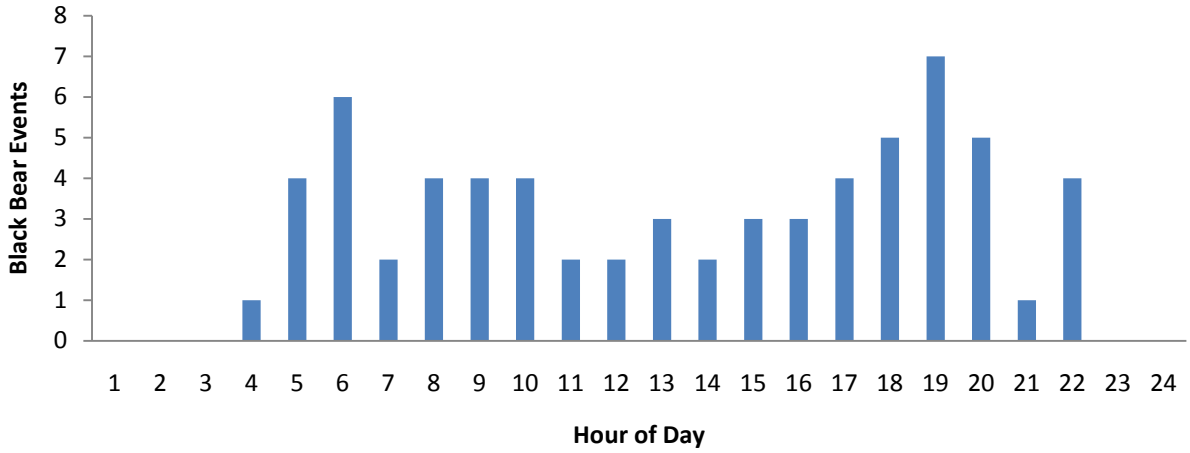

Figure 2. Black bear detection events by hour of the day.

Since elevations of camera sites ranged from 2,058 meters (6,751 feet) to 2804 meters (9,198 feet), sites were grouped into one of four, one thousand foot elevation ranges for analyses (6,000–6,999 ft., 7,000–7,999 ft., 8,000–8,999 ft., and 9,000–9,999 ft). There were 3 camera sites in the 6,000 ft. range, 16 in the 7,000 ft. range, 3 in the 8,000 ft. range and 1 in the 9,000 ft. range. The average number of black bear events per camera site within each of the four elevation ranges is illustrated in Figure 4. These results differ from previous studies (WGFD 2008, Lockwood et al. 2008) where black bears showed an affinity for habitats above 8,776 ft. and 9,200 ft., respectively. However, it should be noted that in 2009 only 1 camera grid was located above 9,000 ft. due to limited access. Approximately 85% (56/66) of the events occurred in the 7,000 ft. range, while 70% (16/23) of the camera sites were in this elevational range, which suggests that use was greater than expected. Black bear use at the 6,000 ft. range appears to be approximately equal to availability, while use at the 8,000 ft. and 9,000 ft. ranges was less than expected.

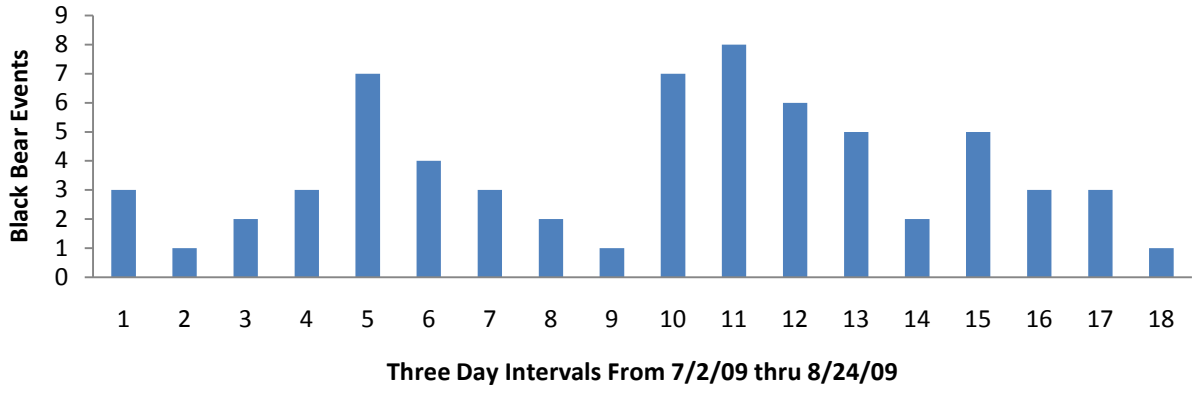

Figure 3. Black bear detection events broken down by three day intervals from 7/2/09 through 8/24/09.

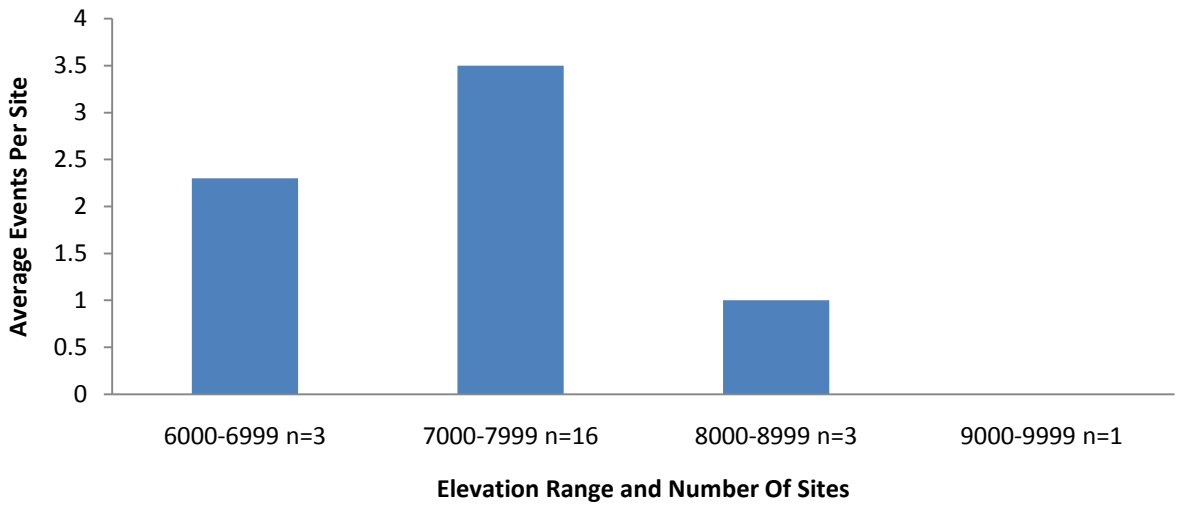

Figure 4. Average number of black bear detection events per site by elevation range.

In addition to black bear events, there were many other wildlife observations recorded including 941 mule deer (*Odocoileus hemionus*), 98 American marten (*Martes americana*), 60 moose (*Alces alces*), 40 snowshoe hare (*Lepus americanus*), 26 elk (*Cervus elaphus*), 14 coyote (*Canis latrans*), 2 gray wolves (*Canis lupus*), 1 American badger (*Taxidea taxus)*, 6 red fox (*Vulpes vulpes*), 4 North American porcupine (*Erethizon dorsatum*), 2 northern flying squirrel (*Glaycomys sabrinas*), 3 grouse (species undetermined), and several photos of other nongame bird and mammal species. Many of the photos undoubtedly were of individuals who visited the sites on multiple occasions. The counts represent the total number of individuals counted in photos regardless of the number of visits.

MANAGEMENT IMPLICATIONS

Systematic sampling is generally more representative and precise than random sampling (Mace et al. 1990, Morrison et al. 2001). Use of systematic sampling grids increases probability of detection of all bears in the area, not just bears frequenting specific attractants. It also allows for the development of detection probabilities, occupancy rates and, at times, density estimates. Systematic sampling is also more beneficial when used with long-term monitoring studies (Morrison et al. 2001) such as current grizzly bear research throughout the Greater Yellowstone Ecosystem. The 56 day study period would have been adequate to detect grizzly activity in the study area.

We did not document grizzly bear activity in the study area. Although there have been verified sightings and sign of grizzly bears documented in and around the study area in previous years, it is quite possible these sightings/sign were from transient animals or represent grizzly bears that are no longer alive. There may be seasonal movements occurring by grizzly bears that would not have been documented by our study (i.e., grizzly bear movement pre/post camera deployment). Previous research has documented that a 5 km x 5 km grid is optimal to document grizzly bear presence in occupied grizzly bear habitat (Mace et al. 1994, WGFD 2008, Lockwood et al.

2008). It is possible that grizzly bears were at higher elevations during the study period and therefore not documented on some of the peripheral camera sites of the grid. Although we did not document resident grizzly bears in the study area, it is valuable to discern that grizzlies are not using these habitats in the Hoback and Green River drainages regularly during July and August. It is likely that as grizzly bears expand their distribution, this area will be used with higher frequency, but our study suggests that currently grizzly bears do not use the study area during summer months.

Acknowledgments: We would like to thank Justin Clapp and Sam Lockwood for their assistance with data collection on this project. Game Wardens Adam Hymas and Herb Haley graciously assisted with orientation and obtaining permission from landowners to access their land. Finally, we would like to thank the Forest Service and private land owners that assisted with the study.

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2009 Annual Report

Greater Yellowstone Whitebark Pine Monitoring Working Group

Monitoring Whitebark Pine in the Greater Yellowstone Ecosystem

Introduction

Whitebark pine (*Pinus albicaulis)* is a high-elevation tree of the Northern Rocky Mountains, forming open woodlands on relatively xeric slopes (Arno and Hammerly 1977). In the conifer forests of eastern Idaho and western Wyoming, whitebark pine forest habitat types extend downslope from upper timberline on dry exposed ridges on sites too severe for subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*). On less severe sites, whitebark pine extends further downslope and is a minor seral species in subalpine fir, Douglas fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*) habitat types (Steele et al. 1983).

In the Greater Yellowstone Ecosystem (GYE), whitebark pine, in mixed or dominant stands, occupies just over 2 million acres of the 24 million acres that comprise the area (Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee [GYCCWPS] 2010). While its relative inaccessibility and sometimes crooked growth form lead to low commercial value as timber, it is a highly valuable species ecologically and is often referred to as a "keystone" species (Tomback et al. 2001). Whitebark pine is considered a foundation species capable of changing forest structure and ecosystem dynamics (Ellison et al. 2005) in the subalpine zone. The relatively large seeds serve as an important high-energy food source for a variety of wildlife species, including red squirrels (*Tamiascurus hudsonicus*), Clark's nutcrackers (*Nucifraga columbiana*), and grizzly bears (*Ursus arctos horribilis*).

Whitebark pine has exhibited extensive declines over the past 50 years throughout major parts of its range (Kendall and Keane 2001). White pine blister rust (*Cronartium ribicola*) has already devastated the tree in parts of the Pacific Northwest (Kendall and Keane 2001, Koteen 2002) and the disease is well established throughout the Greater Yellowstone Ecosystem (Greater Yellowstone Whitebark Pine Monitoring Working Group [GYWPMWG] 2008). Mountain pine beetles (*Dendroctonus ponderosae*) are normally present at low population levels (Brown 1975, Baker and Veblen 1990), but periodic outbreaks have caused dramatic mortality events in the northern Rocky Mountains over the past century (Arno and Hoff 1990) including Yellowstone National Park in the 1970s (Despain 1990) and throughout the interior west more recently (Gibson 2006, Gibson et al. 2008).

Interagency Whitebark Pine Monitoring Program

Given the ecological importance of whitebark pine in the GYE and concerns over the long-term persistence of the tree species, the National Park Service Inventory & Monitoring program and others in the GYE collaborate on a long-term interagency monitoring program unified through the Greater Yellowstone Coordinating Committee. A monitoring working group of the Whitebark Pine Subcommittee works to integrate common interests, goals and resources of each agency into one unified monitoring program for the GYE. The Greater Yellowstone Whitebark Pine Monitoring Working Group consists of representatives from the U.S. Forest Service (USFS), National Park Service (NPS), U.S. Geological Survey (USGS), and Montana State University (MSU). This report is a summary of the monitoring data collected between 2004 and 2009 from this long-term monitoring project.

Monitoring objectives

The focus of the monitoring program is to detect how rates of blister rust infection change and to track the survival and regeneration of whitebark pine 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 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/subproducts/14/72.

Our monitoring 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.

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 effects of blister rust infection rates and severity, mountain pine beetle activity, fire and other damaging agents.

This monitoring effort provides critical information on the status of whitebark pine on a regional scale — that of the Greater Yellowstone Ecosystem. Monitoring results will help tell us whether whitebark pine is persisting as a functional part of the ecosystem and monitoring data can be used to justify and guide restoration and protection efforts.

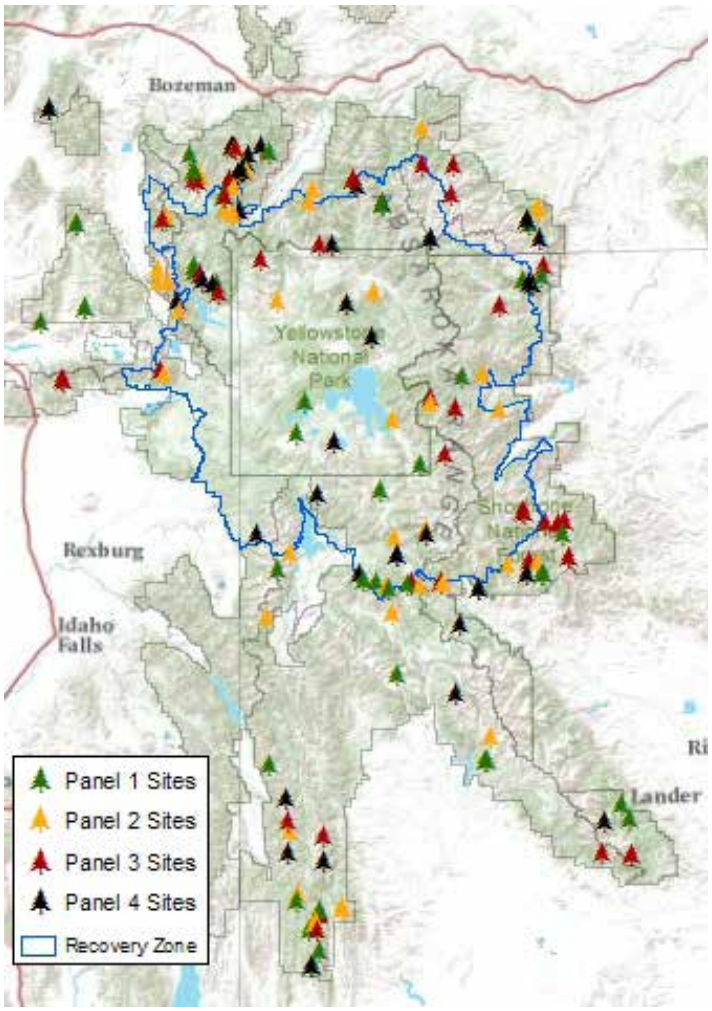

Figure 1. Location of whitebark pine survey transects, Greater Yellowstone Ecosystem. Panel 1 and 2 had a full resurvey for white pine blister rust infection in 2008 and 2009, respectively. Tree survival and indicators of mountain pine beetle were recorded on all but one transect.

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. The sample frame includes stands of whitebark pine approximately 2.5 ha or greater within the grizzly bear Recovery Zone and was derived from the cumulative effects model for grizzly bears (Dixon 1997). Outside the Recovery Zone, 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.

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*, 2008, and 2009). 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. The sample of 176 transects is a probabilistic sample that provides statistical inference to the GYE.

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 live trees >1.4 m tall were permanently marked to estimate changes in white pine blister rust infection and survival rates over an extended period. In addition, the diameter at breast height, tree height class and indicators of mountain pine beetle were recorded for standing dead whitebark pine within the transects at the time of transect establishment. Dead trees were recorded as *recently dead* if the tree had persistent non-green needles.

In response to the current outbreak of mountain pine beetle, we doubled our monitoring efforts and resurveyed 175 transects between 2008 and 2009 to determine the survival

of the permanently tagged trees and to record indicators of mountain pine beetle. Eighty-five transects were resurveyed in 2008 and another 90 in 2009 by two, 2-person crews. One crew was led by the NPS Greater Yellowstone Inventory & Monitoring Network; the other was led by the USGS Interagency Grizzly Bear Study Team. Half of all the permanent transects, essentially all the transects in panels 1 and 2, were resurveyed for changes in white pine blister rust infection in 2008 and 2009, respectively.

White Pine Blister Rust

For each live tree in panels 1 and 2, 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 are 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

For each live tree in panels 1though 4, pitch tubes and boring dust were recorded as evidence that the tree had been invaded with mountain pine beetle. Pitch tubes are small, popcorn-shaped resin masses produced by a tree as a means to stave off a mountain pine beetle attack. Boring dust is created during a mountain pine beetle attack and can be found in bark crevices and around the base of an infested tree. We checked beneath the bark of dead trees to look for J-shaped galleries where adult mountain pine beetle and their larvae live and feed.

Recruitment

At each 2 x 50 m belt transect, we count the number and determine the status of blister rust infection on all live trees <1.4 m tall. Recruitment that has grown to or above the 1.4m threshold are permanently tagged and added to our live tree database.

Analysis Methods

The proportion of trees infected with white pine blister rust is calculated using a design-based ratio estimator that accounts for the total number of mapped stands within and outside the grizzly bear Recovery Zone.

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*). We periodically examine the consistency between observers and correct problems through improved training and retention of trained and experienced observers. If the observer variability is found to be a large contributor to the standard error for our estimated parameters, we will assess this in our data analysis.

Results

Status of tree survival and presence of mountain pine beetle

There is currently widespread mortality of whitebark pine in the GYE associated with the current mountain pine beetle outbreak. Large diameter trees are the hardest hit during a mountain pine beetle outbreak as beetles preferentially attack large trees over small trees (Gibson et al. 2008).

We examined all permanently tagged trees >1.4 m tall in panels 1 through 4 to determine the living status of each tree. Out of the 4,748 whitebark pine trees examined, 10% (n = 492) had died. We looked for J-shaped galleries beneath the bark of each dead tree for evidence of mountain pine beetle infestation and found that 60% (n = 294) of the dead trees had J-shaped galleries. Consistent with mountain pine beetle preference for larger sized trees, tree mortality since 2004 was much greater in the large tree size class. Of the 429 trees >30 cm at DBH, we found 36% (n = 156) had died, whereas of the 4,317 trees ≤30 cm at DBH, only 8% (n = 335) had died during the same time period.

Based on these data, we calculate the survival of whitebark pine in our sample population at 90%. Field crews also recorded fading crowns, pitch tubes and boring dust, as indicators of mountain pine beetle attack on living trees. Eight percent of the living trees had pitch tubes indicative of mountain pine beetle infestation.

We added the standing dead trees that still had persistent non-green needles at the time of transect establishment to calculate the proportion of live and dead trees >1.4 m tall by size class shown in Figure 2. This same dataset was used to recalculate the percent of dead trees >30 cm or ≤30 cm at DBH that have died over approximately the last 10 years. Cumulatively, of the 475 standing trees >30 cm at DBH, 43% (n = 202) have died, whereas of the 4,468 trees ≤30 cm at DBH, 11% (n = 486) have died. Among all 688 standing dead trees believed to have died in the last decade, 57% (n = 395) had J-shaped galleries beneath the bark.

In a summary of mountain pine beetle impacts in high elevation five-needle pines, Gibson et al. (2008) state that they "anticipate beetle populations to remain high as long as weather conditions are conducive to beetle survival and/or until most mature host trees have been killed." Tree size is an important measure of host susceptibility. Furniss and Carolin (1977) report that trees from 10 to 12.5 cm in diameter up to those of the largest size may be attacked by mountain pine beetle. Waring and Six (2005) report that trees <5.08 cm (2") DBH are considered too small to support bark beetles. We found 3 trees <13.2 cm DBH with J-shaped galleries, with the smallest being 6.9 cm, however J-shaped galleries began to increase on trees ≥12 cm DBH. Based on tree size alone, 38% of the remaining live whitebark pine trees in our monitoring study are in the size class (≥12 cm) most susceptible to mountain pine beetle attack.

Besides mountain pine beetle, fire burned 4 of our monitoring transects and 13% (n = 66) of the dead trees had been scorched by fire.

An important distinction between this monitoring and that of Aerial Detection Survey (ADS) methods is that we use ground based search efforts to detect trees of all size

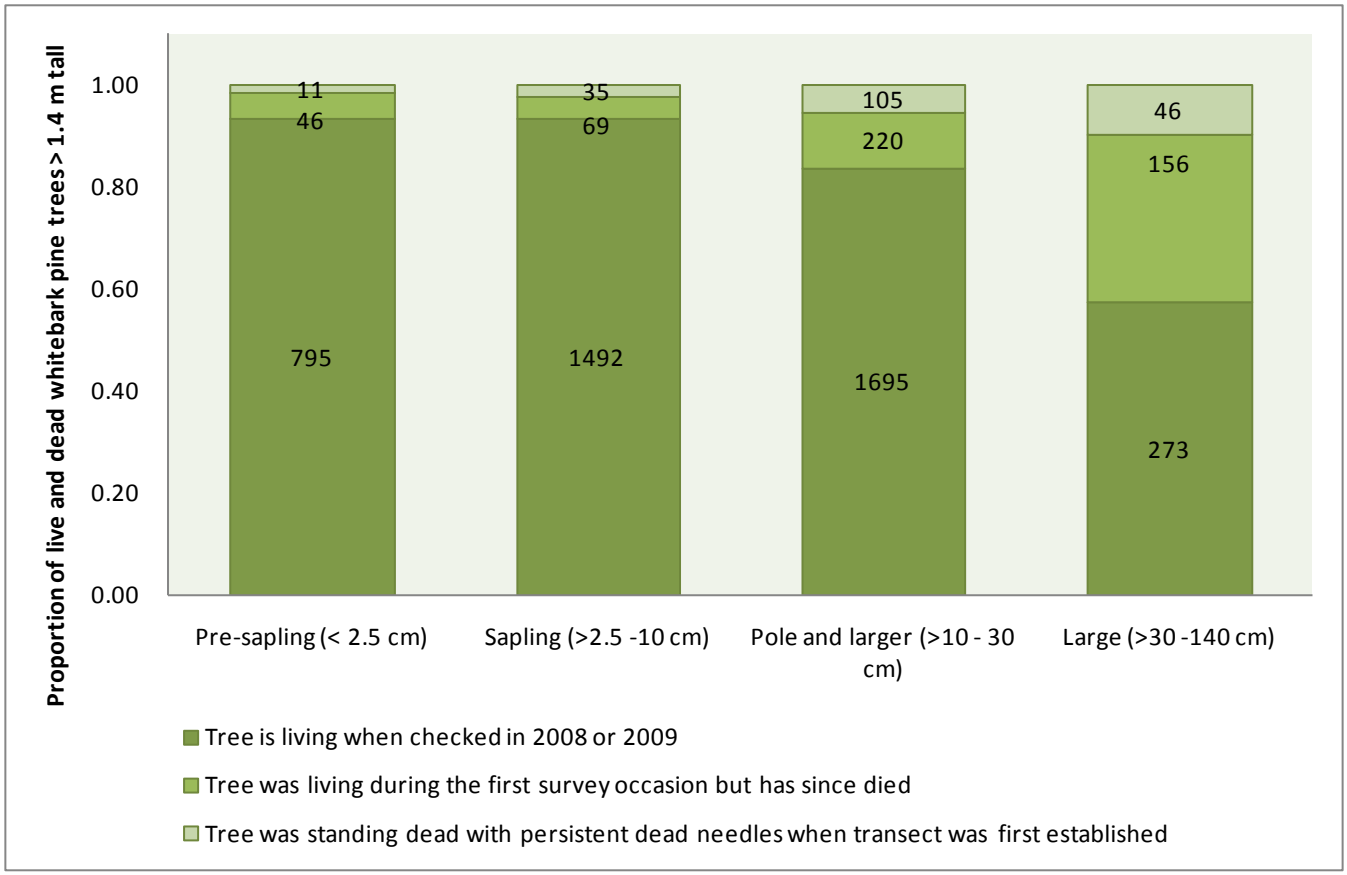

Figure 2. Proportion of living, dead and recently dead whitebark pine trees >1.4 m tall by size class. Categories show the status of trees that were alive and permanently tagged when transects were established and trees that were recently dead during the first survey. Transects were established between 2004 and 2007. A recently dead tree has persistent non-green needles and a dead tree has shed all its needles.

classes whereas ADS and other remote sensing methods use airborne platforms to search for and/or measure changes in the forest canopy. This distinction explains why our mortality estimates differ from aerial detection surveys and mortality assessments recently completed by the USDA Forest Service (Gibson 2006, Gibson et al. 2008), the Forest Service Remote Sensing Application Center (Goetz et al. 2009), and a more recent aerial detection of mountain pine beetle-caused mortality effort completed by Macfarlane et al. (2010).

Status of White Pine Blister Rust

The 2007 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 4-year period between 2004 and 2007 after all transects and tree records were established. We report here in Table 1 estimates of the proportion of whitebark pine trees infected with white pine blister rust based on the resurveys of panels 1 and 2, conducted in 2008 and 2009, respectively (Figure 3). We are presenting the results from each panel separately until after 2011 when all panels have been resurveyed at least once and we can combine data for trend analysis.

Changes in the count of infected trees by transect over time and its variability is shown in Figure 3. Blister rust infection has increased in some transects and decreased in others. In some transects, decreases in blister rust infection can be explained by the death of infected trees either by wildfire or after having been infested with mountain pine beetle. Increases in blister rust infection can only be explained by the increased number of trees with evidence of blister rust infection however we cannot say exactly when the increase took place. Burns et al. (2008) explain that increases in blister rust infection generally occur when cool temperatures and high relative humidity favor disease spread and intensification. As such the incidence of pine infection may increase substantially during years when optimum environmental conditions coincide with spore production dissemination, germination, and infection. They refer to these events as "wave years" (Burns et al.

Table 1. Design based ratio estimates for the proportion of infected whitebark pine >1.4 m tall in panel 1 and 2 and other summary information (Irvine 2010).

2008 [Panel 1]			
Location	**Within Recovery Zone**	**Outside Recovery Zone**	**Total for GYE**
Total number of mapped polygons/stands	2,362	8,408	10,770
Number of stands	15	22	37
Number of transects	15	27	42
Number of unique trees sampled	323	661	984
Proportion of transects infected	13 of 15	19 of 27	32 of 42
CI for proportion of trees infected in 2008	[0.018 , 0.255]	[0.205 , 0.357]	[0.186 , 0.312]
Proportion of trees infected in 2008	0.137 (se = 0.055)	0.28 (se = 0.036)	0.249 (se = 0.031)
2009 [Panel 2]			
Location	**Within Recovery Zone**	**Outside Recovery Zone**	**Total for GYE**
Total number of mapped polygons/stands	2,362	8,408	10,770
Number of stands	16	21	37
Number of transects	16	28	44
Number of unique trees sampled	295	684	979
Proportion of transects infected	13 of 16	26 of 28	39 of 44
CI for proportion of trees infected in 2009	[0.0184 , 0.301]	[0.3436, 0.595]	[0.295 , 0.501]
Proportion of trees infected in 2009	0.159 (se = 0.066)	0.465 (se = 0.062)	0.398 (se = 0.051)

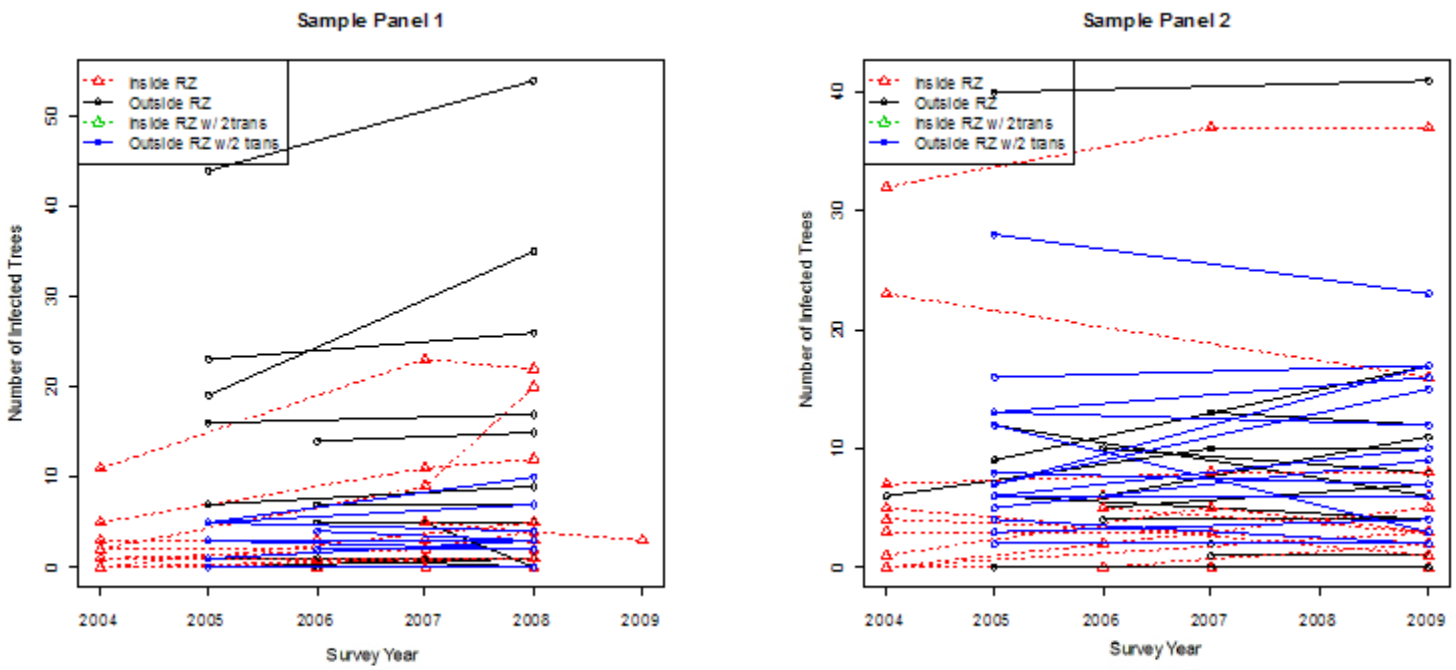

Figure 3. The count of live trees >1.4 m tall infected with white pine blister rust by transect on each survey occasion. Sample panels 1 and 2 are shown separately. Some transects inside the Recovery Zone have been resurveyed 3 times (Irvine 2010).

2008). Our ability to detect blister rust infection soon after an infection event, such as a wave year, is confounded by the year or more that it takes for the aecia to break through the infected bark and our revisit schedule for resurveying transects.

Whitebark pine surviving the current mountain pine beetle outbreak will continue to be stressed by white pine blister rust. Blister rust affects all aspects of the forest regeneration process. Unlike mountain pine beetle that attack larger trees, white pine blister rust infects all size classes and causes mortality in both young and old trees. High levels of blister rust can affect the sustainability of the population (Schoettle and Sniezko 2007) and influence ecosystem recovery long after the current beetle epidemic is over. Long term monitoring conducted by the Interagency Whitebark Pine Monitoring Working Group will detect how rates of blister rust infection change and track the survival and generation of whitebark pine in the Greater Yellowstone Ecosystem over time.

Whitebark Pine Recruitment

We use ground based methods to monitor recruitment of young trees into the reproductive population by tracking and recording the presence of cones or cone scars on individual trees. Twenty-four percent of the live trees >1.4 m tall are mature enough to have produced cones at least once. Counts of unique small trees <1.4 m tall within transects document densities of live trees in the understory ranging from 0 to 12,500 per hectare ($\bar{x}$ = 865, SE = 114, n = 176). Since 2007, 145 trees have grown up to or above the 1.4 m tall threshold and were subsequently tagged and added to the live tree database in 2008 or 2009.

Future Directions

In 2010 we plan to conduct a full resurvey for each transect in panel 3 and a partial resurvey focused on mountain pine beetle indicators in panel 1. As before, both surveys will record tree status as live, dead, or recently dead. If adequate funding is available, we will resurvey another 2 panels in 2011. Once we have a complete resurvey for white pine blister rust at the end of 2011, we can determine changes in the proportion of trees with white pine blister rust in the GYE.

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 staff and statisticians from Department of Mathematics Sciences at Montana State University are collaborating with the study team on this project.

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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

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[a] This project represented a collaboration in the truest since 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 (2010):

Greater Yellowstone Whitebark Pine Monitoring Working Group. 2010. Monitoring whitebark pine in the Greater Yellowstone Ecosystem: 2009 Annual Report. Pages 63–71 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2009. 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
July 2010

Recent Actions

In September 2009, a U.S. District Court order restored federal protective status to the Yellowstone grizzly bear (*Ursus arctos horribilis*) population (75 FR 14496, March 26, 2010). This order effectively nullified the 2007 delisting of the Yellowstone grizzly and reinstated threatened designation to the population under the Endangered Species Act. Yellowstone grizzly bears will continue to be managed and monitored in compliance with the monitoring and reporting protocol of the *Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area* (hereinafter referred to as Conservation Strategy; U.S. Fish and Wildlife Service [USFWS] 2007*a*). The Conservation Strategy became a legal document in 2007 with the delisting of the Yellowstone grizzly bears, and is no longer a required standard now that grizzly bears have been relisted in the lower 48 states. However, the Conservation Strategy incorporates the most comprehensive protocols available for monitoring secure habitat. It is for this reason that state and federal managers throughout the ecosystem are committed to continue working together under this framework to ensure that healthy and viable habitat endures for the long-term growth and sustainability of the Yellowstone grizzly population.

Background

The most critical factors negatively impacting grizzly bear survival are consequences of human activity across the landscape. Key human-related factors impacting grizzly bear survival, identified in the Conservation Strategy and more recently in scientific research (Schwartz et al. 2010), include motorized access, amount of secure habitat, and sites of human development. Additionally, livestock grazing on public lands continues to be a leading source of conflicts between bears and humans (Gunther et al. 2009) and consequently impose mortality risks for grizzly bears (Knight et al. 1988, Gunther et al. 2004, Bridger-Teton National Forest 2010). To mitigate the negative influence of these human-induced factors, a series of 3 grizzly bear habitat standards were established to ensure that habitat conditions inside the Grizzly Bear Recovery Zone (GBRZ) remain at, or improve upon those that existed in 1998. These 3 standards, as specified in the Conservation Strategy, require that the following baseline attributes are maintained at or improve upon 1998 levels for each bear management subunit within the GBRZ: (1) percent secure habitat, (2) number and capacity of developed sites, and (3) number of active commercial livestock grazing allotments and permitted sheep animal months. The 1998 "baseline" is predicated on the landscape conditions that enabled the Yellowstone grizzly bear population to sustain an adequate growth rate of 4–7% throughout the 1990s (Eberhardt et al. 1994, Boyce et al. 2001, USFWS 2007*b*). Because 1998 signifies a benchmark in grizzly bear recovery, it was chosen as the standard against which all future habitat comparisons are to be made.

Habitat standards in the Conservation Strategy were formalized for the 6 national forests in the Greater Yellowstone Ecosystem (GYE) when they were amended, and thereby incorporated into their respective National Forest Plans (USDA Forest Service 2006). Likewise, comparable requirements and standards from the Conservation Strategy were formalized for the 2 national parks in the GYE when integrated into the respective park's *Superintendent's Compendium* (Grand Teton National Park 2007 and Yellowstone National Park 2007). Grizzly bear habitat monitoring requirements, specified in the Conservation Strategy and Forest Plan Amendment, are listed in Attachments A and B of this document. Although no longer legally bound by these standards, the agencies responsible for grizzly bear habitat protection continue to monitor and report as per the Conservation Strategy.

Introduction

This report is the collective response to the Conservation Strategy and Forest Plan Amendment commitments from the national forests and national parks in the GYE. Information cited in this report was compiled to evaluate current status of grizzly bear habitat as measured against the 1998 baseline standards. In compliance to the monitoring protocol of the Conservation Strategy, this report documents all permanent and temporary changes that occurred in 2009 inside the GBRZ pertaining to the following factors affecting grizzly bear habitat: (1) seasonal and total road densities, (2) percent secure habitat, (3) number of active commercial livestock grazing allotments and permitted sheep animal months (AMs), (4) the number and capacity of human developed sites, and (5) grizzly bear/livestock conflicts occurring on allotments both inside and outside of the GBRZ during the past fiscal year (FY2009). These 5 monitoring topics are reported by bear management subunit (Figure 1). All topics, except livestock conflict information, are measured against the 1998 baseline.

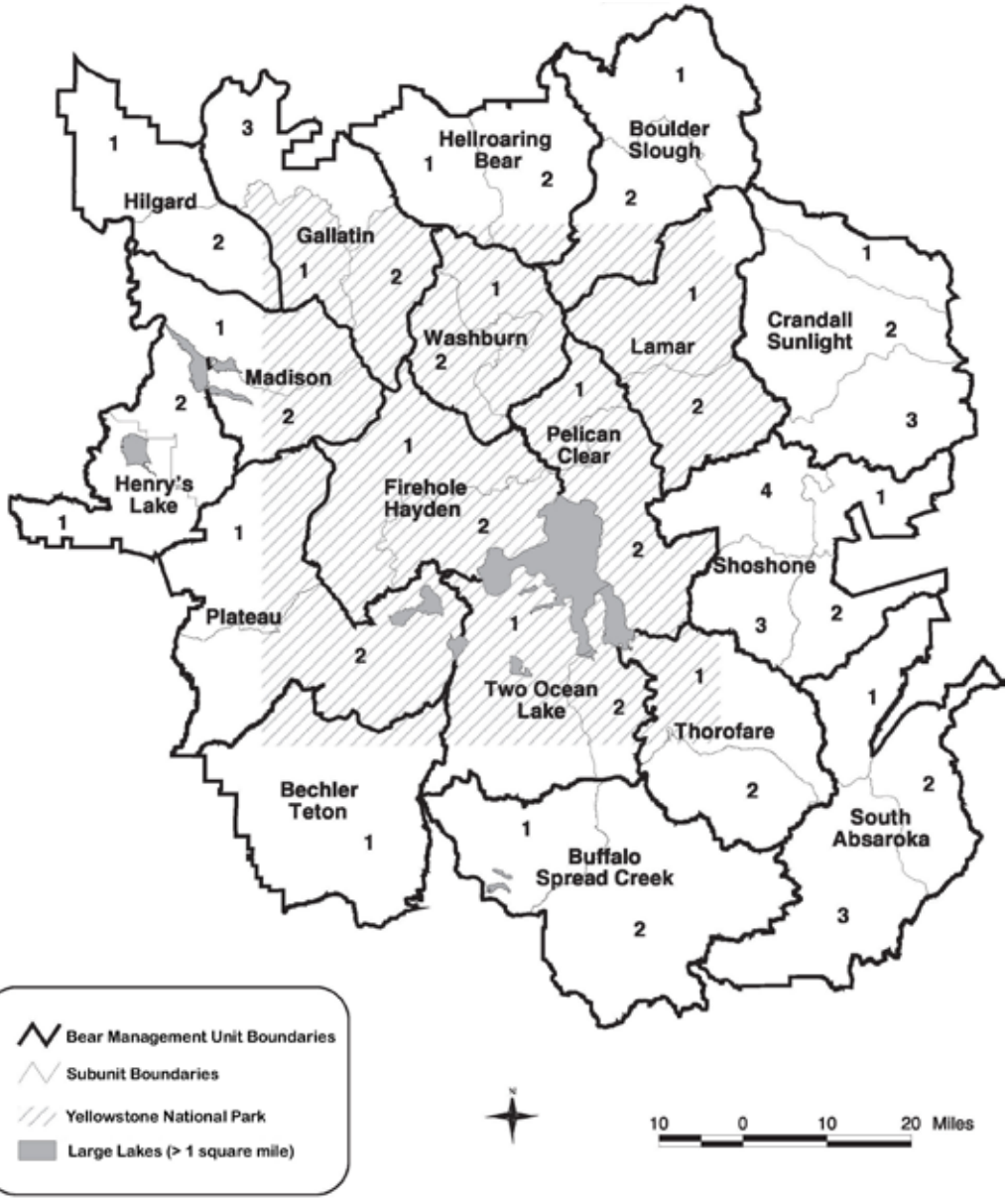

Figure 1. Bear Management Units and subunits inside the Grizzly Bear Recovery Zone.

2009 Corrections to the 1998 Baseline:

In theory, the 1998 baseline should be a static measurement bound to a single point in time. In reality, this baseline continues to evolve as more reliable information is acquired, errors in the baseline are identified and corrected, and as new geoprocessing tools are developed to better estimate road densities and to model secure habitat. Comparing the 1998 baseline numbers provided in this 2009 report with those originally cited in the Conservation Strategy or previous annual reports, a change in road density numbers is apparent. These differences derive from a much improved method for estimating road density that was incorporated into the 2009 spatial modeling algorithms for evaluating the status of current grizzly bear habitat. This new method takes advantage of more powerful geoprocessing tools available in today's geographic information systems (GIS) software, and greatly enhances the accuracy of road density estimations. Consequently, the 1998 road density values were recalculated using the newer tools so that they could be more accurately compared to the 2009 values. This recalculation of the 1998 road density values account for the differences between values presented in this report and those reported in previous documents.

It is important to note that the source data for the 1998 baseline roads has not been changed at this point. In other words, the original database containing records of roads that existed in 1998 has not changed. Instead, it is only the method from which road density is calculated that has been greatly improved. Although the new method for calculating road density has resulted in different estimates of 1998 road density, the actual *change* in road density between 1998 and 2009 is almost identical regardless of whether the new or old method for analysis is used. Since the monitoring protocol for grizzly bear habitat is predicated on preserving ground conditions representative of 1998, it is the *change* in ground conditions since 1998 that becomes the crucial quantity to track over time. The application of this new geoprocessing tool enhances the accuracy of both the 1998 and 2009 road density measurements equally, and is therefore justified. The method for calculating secure habitat per Bear Management Unit (BMU) is in no way affected by the new method for calculating road density.

Future Corrections to the 1998 Baseline:

The 1998 source data used in this 2009 report represents the most accurate data currently available for estimating 1998 ground conditions on the landscape. However, there are known errors in the 1998 roads database which will most likely be corrected as future improvements are made in the source data itself. There are 2 factors affecting the 1998 baseline inventory of roads. First and foremost is the reliability and spatial accuracy of the 1998 source data itself. Secondly, is the geospatial analysis of this source data used to quantify road density and percent secure habitat. The latter factor has been addressed in 2009 with the new analytic techniques employed that not only improve the accuracy of road density calculations, but also automates the modeling of road density and secure habitat. The former factor (*quality* of source data) is a much more challenging problem since the technology for mapping ground conditions in 1998 is based on older, less reliable methods than those commonly used today. In 1998, mobile and affordable global positioning system (GPS) devices were not as readily available as they are today. Over time, as GPS became more accessible and affordable, it has become possible to capture road features more efficiently and with far greater spatial accuracy. To date, many of the forests in the GYE are in the process of improving the completeness and accuracy of their roads database. Once these corrections are completed across the ecosystem, it will be possible to incorporate these corrections into the current roads database as well as the 1998 base data from which comparisons are made. Using vintage satellite imagery for example, it is possible to verify which roads existing today were present in 1998. The spatial accuracy of 1998 ground features could then be updated with current measurements. Resource managers from the 6 National Forest units in the GYE plan to improve the quality of their 1998 base layers over the next 2 years. Once all of the individual administrative units have completed corrections to their 1998 base layers, these corrections will be collectively incorporated into the 1998 ecosystem-wide baseline analysis.

Monitoring for Livestock Grazing

Status of Allotments and Sheep Animal Months inside the GBRZ

The livestock allotment standard, as specified in the Conservation Strategy, states that there will be no new commercial livestock grazing allotments nor any increase in permitted sheep AMs established inside the GBRZ from that identified in the 1998 baseline. Sheep AMs are calculated by multiplying the permitted number of sheep times the months of permitted use on a given allotment. Existing allotments are to be phased out as the opportunity arises with willing permittees. The changes in number of active and vacant livestock allotments cited in this report account for all grazing on commercial allotments occurring on national forest and park lands within the GBRZ. They do not include horses associated with outfitters in backcountry situations or private in-holdings.

Changes in Cattle Allotments since 1998:
Since 1998 the total number of active cattle/horse allotments (hereinafter referred to as cattle allotments) inside the GBRZ has decreased from 71 to 59 (Table 1). Three of these deactivated cattle allotments have been officially closed and 10 were vacated. Of the 12 vacant cattle allotments in 1998, 4 have been permanently closed, and 1 allotment that was vacant on the Caribou-Targhee National Forest was reactivated in 2007.

Table 1. Number of commercial livestock grazing allotments and sheep animal months (AMs) inside the Grizzly Bear Recovery Zone in 1998 and in 2009.

Administrative units	Cattle/horse allotments				Sheep allotments					
	Active		Vacant[2]		Active		Vacant		Sheep AMs[1]	
	1998 Base	Current 2009	1998 Base	Current 2009	1998 Base	Current 2009	1998 Base	Current 2009	1998 Base	Current 2009
Beaverhead-Deerlodge NF[3]	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[3]	11	9	1	3	7	1	4	0	14,163	0
Custer NF	0	0	0	0	0	0	0	0	0	0
Gallatin NF[4]	23	17	9	11	2	0	3	2	3,540	0
Shoshone NF[3]	24	24	0	0	2	0	0	0	5,387	0
Grand Teton NP[3]	1	0	0	1	0	0	0	0	0	0
Total in GBRZ	71	59	12	17	11	1	7	2	23,090	0

[1] Sheep AMs are calculated by multiplying the permitted number of sheep times the months of permitted use.
[2] 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.
[3] In 2009, no changes in the number or status of commercial allotments occurred inside the GBRZ.
[4] One cattle allotment active in 1998 (Wapiti) went to vacant, and 2 others (Horse Butte and Sage Creek) were closed in 2009. One sheep allotment active in 1998 (Haystack) went vacant in 2008 and was officially closed in 2009. Also, a sheep allotment vacant in 1998 (Meatrack/Carbonate) was closed in 2009.

Changes in Sheep Allotments since 1998:
A total of 16 sheep allotments inside the GBRZ have changed status since 1998. Nine allotments that were active and 6 that were vacant in 1998 have since been permanently closed. Ten of these closed allotments occur on the Caribou-Targhee, 3 on the Gallatin, and 2 on the Shoshone National Forest. An additional sheep allotment that was active in 1998 is now vacant. The only sheep allotment remaining active inside the GBRZ today is the Meyers Creek allotment on the Caribou-Targhee National Forest.

Allotment Changes from 2008 to 2009:
A total of 5 changes in livestock allotment status took place inside the GBRZ in 2009, all on the Gallatin National Forest. Two cattle and 2 sheep allotments that were vacant in 2008 were permanently closed in 2009 (Horse Butte and Sage Creek cattle allotments, Haystack and Meatrack-Carbonate sheep allotments). Also, one active cattle allotment (Wapiti) was changed to vacant status in 2009. Finally, the only active sheep allotment currently left inside the GBRZ (Meyers Creek) took a no-use permit, accounting for the zero sheep AMs cited for 2009.

Livestock Conflicts Inside and Outside the GBRZ

Livestock conflicts are reported on an annual basis for all commercial grazing allotments and forage reserves on federal lands located within the GYE. Conflicts regarding livestock typically consist of grizzly bear depredation on grazing allotments. During the last 5 years, 239 separate grizzly bear/livestock conflicts have occurred on 34 different grazing allotments throughout the GYE. Only 11% of these conflicts occurred inside the GBRZ. The Bridger-Teton and Shoshone National Forests account for 94% of the conflicts (61% and 33%, respectively). Seven grizzly bears have been removed from the population in the past 5 years as a result of livestock depredation. Four of these bear removals occurred on federal grazing allotments with recurring conflicts.

Livestock Conflicts in 2009:
In 2009 there were 56 conflicts reported on 12 grazing allotments within the GYE (Table 2). Five of these allotments are either completely or partially inside the GBRZ. Two sheep allotments, both outside the GBRZ, reported conflicts in 2009. Several cattle and sheep allotments that have experienced conflicts during the past 5 years have been closed or are now vacant and are not listed in Table 2.

Recurring Conflicts:
Grizzly bear/livestock conflicts are considered recurring if 3 or more years of recorded conflict occur on a given allotment in the most recent 5-year period. In 2009, 4 commercial grazing allotments within the GYE have experienced recurring conflicts involving livestock depredation by grizzly bear (Table 2). Below is a summary of the recurring conflicts.

- The *Upper Green River* cattle allotment located outside the GBRZ on the Pinedale District of the Bridger-Teton National Forest has been a recurring hotspot for grizzly bear/livestock conflicts. In the past 5 years there have been 109 livestock depredation incidents occurring on multiple pastures within the Upper Green River allotment, resulting in removal of 4 male grizzly bears from the population. In 2009 a series of 15 separate incidents resulted in 8 calves killed as well as 6 calves and a cow euthanized due to injuries. Traps were set and grizzly bears #617 and #625 were captured and relocated.

- *Squirrel Meadows*, a cattle allotment located inside the GBRZ on the Caribou-Targhee NF, had 11 separate incidents reported in the past 5 years. Over the past 5 years these recurring conflicts have resulted in the injury of 2 calves, and the death of 6 calves and 3 steers due to grizzly bear depredation. Four of these mortalities (1 calf, 1 cow, and 2 steers) occurred in 2009. Male grizzly bear #611 was captured and relocated to Thirsty Creek in July 2009, but the bear returned later in the month and killed a second steer. Subsequent snares were unsuccessful at capture. No further action was taken.

- The *Bench* (*Clarks Fork*) cattle allotment straddling the GBRZ on the Shoshone National Forest cited 8 separate conflicts in the last 3 consecutive years. These recurring conflicts resulted in the death of 7 yearlings and the euthanization of 2 additional calves due to injuries. Two of these depredations occurred in 2009. No management actions were taken on grizzly bears.

- *The Wiggins Fork* cattle allotment outside the GBRZ on the Shoshone National Forest has reported 8 conflicts spanning over 4 of the past 5 years. These recurring conflicts have resulted in the death of 6 calves and 1 adult cow as well as the injury of another calf. Two conflicts were reported in 2009 and accounts for 2 of these calf mortalities. No management actions were taken on grizzly bears.

Table 2. Recurring grizzly bear/livestock conflicts.

Allotment name	Total acres	Acres inside GBRZ	Conflicts					Recurring conflicts Y or N (comments)
			2005 (Y/N)	2006 (Y/N)	2007 (Y/N)	2008 (Y/N)	2009 (number of conflicts)	
Beaverhead-Deerlodge National Forest								
West Fork Madison	53,093	0	Y	N	Y	N	0	N
Bridger-Teton National Forest								
Bacon Creek[1]	66,328	0	N	Y	N	N	0	N
Badger Creek	7,254	0	N	Y	N	N	2	N
Beaver-Horse	25,358	0	N	N	Y	N	0	N
Elk Ridge Complex (**Sheep**)	30,577	0	Y	N	N	N	20	N[2]
Jack Creek C&H	32,389	0	N	Y	N	N	0	N
Kinky Creek	22,833	0	Y	N	N	N	0	N
Union Pass Forage Reserve	23,801	0	N	N	N	N	0	N
Upper Green River	131,944	0	Y	Y	Y	Y	15	**Y**
Caribou-Targhee National Forest								
Gerritt Meadows	1,101	0	N	N	N	Y	0	N
Palisades (**Sheep**)	16,812	0	N	N	N	N	1	N
Squirrel Meadows	28,467	28,467	Y	N	Y	Y	4	**Y**
Shoshone National Forest								
Bald Ridge	24,853	5,839	N	Y	N	N	0	N
Basin	73,115	72,067	N	N	Y	Y	0	N
Bear Creek	33,672	0	N	N	N	Y	0	N
Beartooth	30,316	24,169	Y	Y	N	N	0	N
Belknap	13,049	13,049	N	Y	N	N	1	N
Bench (Clarks Fork)	28,751	4,736	N	N	Y	Y	3	**Y**
Crandall	30,089	30,089	N	N	N	Y	0	N
Deep Lake	6,486	228	N	Y	N	N	0	N
Dunoir	15,692	2,124	Y	N	N	Y	0	N
Face of the Mtn.	8,553	0	Y	N	N	Y	0	N
Fish Lake	12,742	0	N	N	Y	Y	0	N

Table 2. Recurring grizzly bear/livestock conflicts.

Allotment name	Total acres	Acres inside GBRZ	Conflicts					Recurring conflicts Y or N (comments)
			2005 (Y/N)	2006 (Y/N)	2007 (Y/N)	2008 (Y/N)	2009 (number of conflicts)	
Hardpan Table Mtn.	13,474	8,430	Y	N	N	Y	0	N
Horse Creek	29,980	18,513	N	N	N	Y	0	N
Little Rock	4,901	0	N	Y	N	N	0	N
Parque Creek	13,528	4,601	N	N	Y	N	2	N
Piney	14,287	0	Y	N	N	N	1	N
Salt Creek	8,263	0	N	Y	N	Y	0	N
Table Mtn.	13,895	13,895	N	N	Y	N	0	N
Union Pass	39,497	0	N	N	N	Y	2	N
Warm Springs	16,875	0	N	N	Y	N	0	N
Wiggins Fork	37,653	0	Y	Y	N	Y	2	**Y**
Wind River	44,158	14,899	N	N	Y	N	3	N

[1] A large portion of the Bacon Creek allotment was closed and the rest has been placed in a forage reserve which has not been grazed since 2007.
[2] A series of 20 separate incidents on the Elk Ridge sheep complex resulted in 25 lambs and 25 ewes killed, and 2 lambs injured. Multiple traps and snares were set and guard dogs were caught on 3 occasions. Grizzly bears #613 and G146 were captured and relocated (bear G146 was relocated twice). The Elk Ridge sheep complex generally refers to the following 4 adjacent allotments on the Pinedale district outside the GBRZ: Lime Creek, Rock Creek, Elk Ridge, and Tosi Creek.

Monitoring for Developed Sites

Changes in Developed Sites since 1998:
The standard for developed sites within the GBRZ requires that the number and capacity of developed sites be maintained at or below 1998 levels. Inside the GBRZ the number of developed sites has in fact shown a net decrease from 592 in 1998 to 586 in 2009 (Table 3). Although there has been a small decline in the total number of developed sites within the GBRZ, 2 bear management subunits (Henry's Lake #2 and Hilgard #2) have had an increase of 1 developed site each since 1998. Four other subunits have had developed sites decrease by 1, and another subunit a decrease by 3. For a complete summary of all documented changes in developed sites and associated mitigation since 1998 action please refer to Attachment C.

Changes in Number of Developed sites in 2009:
There was only 1 change in the number of developed sites inside the GBRZ during 2009. The Willow Creek Mine site on the Henry's Lake Subunit #2 in the Caribou-Targhee National Forest was permanently closed.

Table 3. The 1998 and 2009 numbers of developed sites on public lands in each subunit of the Bear Management Units within the Grizzly Bear Recovery Zone.

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	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	
Bechler/Teton #1	534	CTNF YNP GTNP	60	0 0 0	0 0 0	1 0 8	1 0 8	5 2 3	5 2 3	2 0 1	2 0 1	4 2 4	4 2 4	16 2 10	16 2 10	0 0 0	0 0 0	0
Boulder/Slough #1	282	CNF GNF	20	0 0	0 0	0 1	0 1	1 6	1 6	0 0	0 0	0 1	0 1	0 3	0 3	6 2	6 2	0
Boulder/Slough #2	232	GNF YNP	9	0 0	0 0	0 1	0 1	0 3	0 3	0 0	0 0	2 2	2 2	0 1	0 1	0 0	0 0	0
Buffalo/Spread Creek #1	222 (220)	BTNF GTNP	18	0 0	0 0	1 0	1 0	1 7	1 7	0 2	0 2	0 2	0 2	2 3	2 3	0 0	0 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 GNF	23	0 0	0 0	2 2	2 2	5 2	5 2	1 0	1 0	1 0	1 0	5 5	5 5	0 0	0 0	0
Crandall/Sunlight #2	316	SNF GNF	18	0 0	0 0	5 0	5 0	4 0	4 0	1 0	1 0	2 0	2 0	5 0	5 0	1 0	1 0	0
Crandall/Sunlight #3	222	SNF WG&F	11	0 0	0 0	2 2	2 2	3 0	3 0	0 0	0 0	1 1	1 1	2 0	2 0	0 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 YNP	17	0 0	0 0	2 0	2 0	9 0	9 0	0 0	0 0	0 0	0 0	6 0	6 0	0 0	0 0	0
Hellroaring/Bear #1	185	GNF YNP	35	0 0	0 0	5 0	5 0	11 1	11 1	0 0	0 0	3 0	3 0	6 1	6 1	8[9] 0	8[9] 0	0
Hellroaring/Bear #2	229	GNF YNP	4	0 0	0 0	0 0	0 0	1 0	1 0	0 0	0 0	1 2	1 2	0 0	0 0	0 0	0 0	0
Henry's Lake #1	201 (191)	CTNF	20	2	2	3	3	1	1	0	0	3	3	10	10	1[10]	0	-1
Henry's Lake #2	153 (140)	CTNF GNF	18	0 5	0 5	0 3	0 3	1 4	1 4	0 0	0 0	1 0	1 0	1 2	1 3[11]	1 0	1 0	+1

Table 3. The 1998 and 2009 numbers of developed sites on public lands in each subunit of the Bear Management Units within the Grizzly Bear Recovery Zone.

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	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	
Hilgard #1	202	BDNF	14	0	0	0	0	0	0	0	0	3	1[13]	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[14]	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	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[15]	1	1	0	0	0	0	0	0	-1
Shoshone #4	189	SNF	23	3	3	3	2[16]	3	3	6	6	0	0	8	9[16]	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[17]	0	0	-1

Table 3. The 1998 and 2009 numbers of developed sites on public lands in each subunit of the Bear Management Units within the Grizzly Bear Recovery Zone.

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	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	1998 Base	2009	
Thorofare #1	273	BTNF YNP	4	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 4	0 4	0 0	0 0	0 0	0 0	0
Thorofare #2	180	BTNF YNP	2	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	2 0	2 0	0 0	0 0	0 0	0 0	0
Two Ocean/Lake #1	485 (372)	YNP BTNF GTNP	14	0 0 0	0 0 0	2 1 0	2 1 0	3 0 1	3 0 1	1 0 0	1 0 0	3 0 0	3 0 0	2 0 1	2 0 1	0 0 0	0 0 0	0
Two Ocean/Lake #2	143 (125)	YNP BTNF	4	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	2 1	2 1	0 1	0 1	0 0	0 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
GBRZ	**9,210** **(9,036)**	**ALL**	**592**	**24**	**24**	**67**	**66**	**161**	**160**	**28**	**28**	**117**	**115**	**167**	**166**	**28**	**27**	**-6**

[1] Area in parenthesis is the area of the subunit excluding lakes with surface area greater than 1 square mile.
[2] Abbreviations for administrative units: 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.
[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] Willow Creek mine site was closed in 2009.
[11] New Rees Pass day use site added in 2006.
[12] Taylor Falls/Lightning Trailhead moved across the road from Hilgard #1 to Hilgard #2 in 2005.
[13] Indian Creek and Shedhorn cow camps no longer in use.
[14] Tepee Creek snowmobile parking area eliminated.
[15] Kitty Creek Trailhead was closed in 1999.
[16] Sleeping Giant Campground was converted to a picnic area in 2003.
[17] Outfitter transfer corrals closed in 2002 and use transferred to existing facilities at Brooks Lake Lodge.

Monitoring for Secure Habitat and Motorized Route Density Inside the GBRZ

Maintaining or improving secure habitat at or above the 1998 levels in each of the bear management subunits inside the GBRZ was required under the Conservation Strategy and Forest Plan Amendment and remains a desired objective. Secure habitat is defined as any contiguous area ≥10 acres occurring more than 500 meters away from an open or gated motorized route. Lakes larger than 1 square mile in spatial extent are excluded from the secure analysis. Annual reporting of changes in secure habitat is required annually for areas inside the GBRZ and in alternating years for areas outside the GBRZ. Secure analysis was reported for areas both inside and outside the GBRZ in 2008.

There are no mandatory standards for maintenance of motorized route density inside the GBRZ, but changes in this parameter must be monitored and reported annually. According to protocol, 2 route density values are reported on an annual basis: 1) seasonal open motorized access route density >1 mile per square mile (OMARD), and 2) total motorized access route density >2 miles per square mile (TMARD). OMARD is reported 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. Refer to Attachments A and B for a comprehensive outline of the monitoring rules.

Motorized access route density is calculated using ArcGIS software and a moving windows algorithm. Output route density values are stored in a 30-meter raster format. For each 30-meter cell in the output raster, the total length in miles of access routes falling within a square mile search radius (circular window) is calculated (Figure 2). All motorized access routes are included in the TMARD calculation including gated, permanently restricted, and open motorized routes. Only open motorized access routes that are open during Season 1 and/or Season 2 are included in the seasonal OMARD calculations.

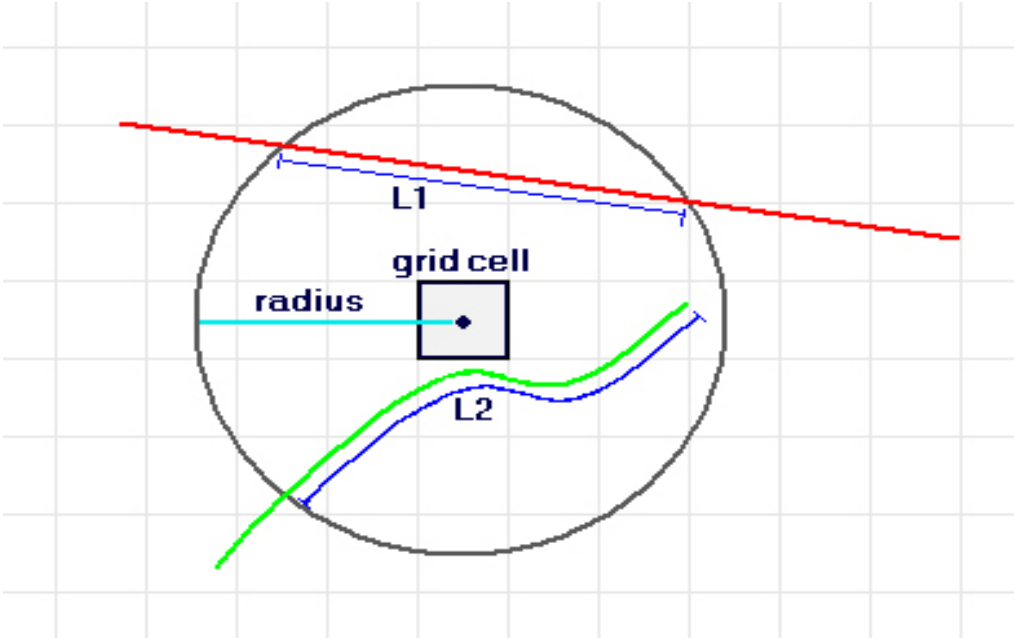

Figure 2. A raster cell is shown with its circular window. L1 and L2 represent the length of the portion of each linear access route that falls within the window. Density = (L1 + L2)/(area of circle).

Summary of Permanent Changes in OMARD, TMARD, and Secure Habitat since 1998
Since 1998 there has been no decline in secure habitat in any of the 40 bear management subunits within the GBRZ. Conversely, secure habitat has increased in 18 subunits from that identified in the 1998 baseline. Increases in percent secure habitat ranged from as little as 0.01% for Lamar subunit #1, up to 13.4% for Gallatin subunit #3 (Table 4). Most increases in secure habitat were a result of either decommissioning or permanently restricting motorized routes that had been open or gated in 1998. Other increases were due to the official change in status of open motorized routes to non-motorized trail. Since 1998, a total of 412 km (256 miles) of open motorized routes inside the GBRZ have been permanently closed to motorized use. These closures translate to a gain of 54.6 square miles (34,944 acres) in secure habitat. Most of the increase in secure habitat (approximately 86%) occurred on the Gallatin National Forest as a result of their recent Travel Management Planning effort.

Since 1998, both Seasons 1 and 2 open OMARD decreased for 17 subunits inside the GBRZ. TMARD decreased for 18 subunits (Table 4). All decreases in OMARD and TMARD correspond to the decommissioning and/or permanent restriction of access routes, but do not necessarily result in the increase of secure habitat. Corresponding increases in secure habitat depend on the proximity of neighboring open motorized access routes. Buffalo/Spread Creek #2 is the only subunit inside the GBRZ which has experienced a net increase in open motorized route density since 1998. This increase in Season 1 OMARD on the Buffalo/Spread Creek subunit did not diminish secure habitat because the gain in route density occurred in an area already designated as non-secure.

For a more detailed account of changes since 1998 in secure habitat and route density summarized by bear management subunit, please refer to Attachment D.

Summary of Permanent Changes in OMARD, TMARD, and Secure Habitat between 2008 and 2009
A total of 24.5 kilometers (15.2 miles) of open or gated roads inside the GBRZ were closed to motorized use in 2009. These incremental decreases in road density occurred on 5 subunits spanning 3 National Forests and led to a small increase of 0.02% (1.5 square miles; 960 acres) in secure habitat inside the GBRZ (Table 5).

Gallatin National Forest: Almost half of the 2009 closures (11.7 km) occurred in 4 subunits within the Gallatin National Forest (Lamar #1, Crandall/Sunlight #1, and Madison #1 & #2) as part of continued efforts in implementing their Travel Plan. Closures on the Gallatin were exclusively due to permanent decommissioning of open or gated motorized access routes with the exception of the Ovis Lake road (Crandall/Sunlight subunit) which went from open motorized status to non-motorized access. In addition to closures of motorized access routes, 62.1 km (38.6 miles) of nonmotorized trails were permanently decommissioned on the Hellroaring #2 and Boulder #2 subunits inside the Gallatin National Forest.

Bridger-Teton National Forest: A series of road closures occurred on the Buffalo #2 subunit in the Bridger-Teton National Forest when 9 kilometers of open motorized and 1.4 kilometers (0.9 miles) of gated motorized access routes were changed to permanently restricted. These closures yielded minor decreases in Season 1 and Season 2 OMARD (0.47% and 0.50%, respectively). However, due to the close proximity of remaining open motorized routes, these closures did not yield a discernable increase in secure habitat.

Caribou-Targhee National Forest: A minor decrease in TMARD was reported on the Henrys Lake #1 subunit due to the permanent restriction enforced on a 2 km (1.2 miles) segment of the Willow Creek road and the decommission of 0.3 km (0.2 miles) of Forest Service Road Number 047. A small decrease in OMARD (0.01%) and TMARD (0.02%) on Henrys Lake subunit #2 was an indirect result of road closures on adjacent Madison subunit #2 reported above.

Temporary Changes to Secure Habitat, 2009
Projects that temporarily affect secure habitat are allowed under the Conservation Strategy but must adhere to the application rules for temporary changes to secure habitat (Attachments A and B). A project under the secure habitat standard is one that results in a temporary reduction in secure habitat inside the grizzly bear recovery zone (GBRZ) due to changes in motorized access. Projects typically involve the building of new roads, modifying existing roads, and or opening permanently restricted roads. Application standards stipulate that only 1 temporary project may be active at any given time in a particular subunit. Also, the total acreage of secure habitat affected by the project within a given BMU must not exceed 1% of total acreage in the largest subunit within that BMU. To qualify as a temporary project, implementation will last no longer than 3 years and secure habitat must be restored within 1 year upon termination of the project.

There was only 1 active project (Deadman timber sale, Shoshone National Forest) occurring inside the GBRZ during 2009 (Table 6). Three other temporary projects have either been approved or cancelled.

Bridger-Teton National Forest: The **North Fork Fish Creek** timber sale approved for the Buffalo-Spread Creek subunit #2 on the Bridger-Teton National Forest was dead-on-arrival and closed before implementation occurred due to fire. This project is unlikely to occur in the future and is considered closed.

Shoshone National Forest: The **Deadman** timber sale approved for the Crandall-Sunlight subunit #2 was designed to reduce potential wildfire and diminish effects of potential beetle infestation. This project was completed in 2009, and all temporary access roads associated with this project have been decommissioned and permanently closed to motorized access.

Two other projects on the Shoshone National Forest, prepared in compliance with National Environmental Policy Act (NEPA), have been approved but not yet initiated. The **Upper Clarks Fork** timber sale has been approved for implementation on the Crandall-Sunlight #2 subunit and the **Upper Wind River** timber sale has been approved for the South Absaroka subunit #3. Both proposed timber sales will temporarily affect less than 0.1% of the maximum allowed secure habitat.

Table 4. 1998 Baseline and 2009 values for Season 1 Open (OMARD), Season 2 Open and Total (TMARD) motorized access route density, and secure habitat per bear management subunit inside the Grizzly Bear Recovery Zone (GBRZ).

Bear Management Unit subunit name	OMARD % >1 mile/mile²						TMARD % >2 miles/mile²			% Secure habitat			Square miles (excluding lakes)		
	Season 1 (3/1–7/15)			Season 2 (7/16–11/30)											
	1998	2009	% chg	1998	2009	% chg	1998	2009	% chg	1998	2009	% chg	Subunit	1998 Secure habitat	2009 Secure habitat
Bechler/Teton	17.03	16.92	-0.11	17.03	16.92	-0.11	5.78	5.78	0.00	78.05	78.05	0.00	534.3	417.02	417.03
Boulder/Slough 1	3.23	3.23	0.00	3.23	3.23	0.00	0.28	0.28	0.00	96.56	96.56	0.00	281.9	272.21	272.21
Boulder/Slough 2	2.06	2.06	0.00	2.06	2.06	0.00	0.04	0.04	0.00	97.71	97.71	0.00	232.4	227.08	227.08
Buffalo/Spread Creek 1	11.41	11.41	0.00	11.52	11.52	0.00	5.25	5.25	0.00	88.28	88.28	0.00	219.9	194.09	194.09
Buffalo/Spread Creek 2	14.46	15.30	0.84	15.57	14.80	-0.77	12.71	12.46	-0.25	74.31	74.33	0.02	507.6	377.22	377.32
Crandall/Sunlight 1	13.34	12.98	-0.36	19.34	18.98	-0.36	7.17	7.00	-0.18	81.08	81.30	0.22	129.8	105.24	105.53
Crandall/Sunlight 2	15.62	15.22	-0.39	16.57	16.37	-0.20	11.67	11.57	-0.10	82.32	82.33	0.02	316.2	260.26	260.32
Crandall/Sunlight 3	14.43	14.35	-0.08	19.17	19.09	-0.08	10.64	10.64	0.00	80.39	80.65	0.27	221.8	178.33	178.93
Firehole/Hayden 1	10.38	10.38	0.00	10.38	10.38	0.00	1.72	1.72	0.00	88.34	88.34	0.00	339.2	299.65	299.65
Firehole/Hayden 2	8.94	8.94	0.00	9.02	9.02	0.00	1.53	1.53	0.00	88.43	88.43	0.00	172.2	152.28	152.27
Gallatin 1	3.56	3.00	-0.55	3.56	3.00	-0.55	0.53	0.48	-0.05	96.27	96.87	0.60	127.7	122.95	123.72
Gallatin 2	9.54	9.54	0.00	9.54	9.54	0.00	4.50	4.50	0.00	90.19	90.19	0.00	155.2	139.95	139.95
Gallatin 3	45.95	31.22	-14.73	45.96	31.22	-14.74	22.94	13.41	-9.53	55.25	68.68	13.43	217.6	120.25	149.48
Hellroaring/Bear 1	22.40	21.34	-1.06	23.14	22.08	-1.06	15.80	14.74	-1.05	76.98	77.62	0.64	184.7	142.17	143.36
Hellroaring/Bear 2	0.09	0.09	0.00	0.09	0.09	0.00	0.03	0.03	0.00	99.54	99.54	0.00	228.9	227.81	227.81
Henry's Lake 1	49.04	49.04	0.00	49.04	49.04	0.00	31.21	31.18	-0.03	45.38	46.09	0.71	191.2	86.76	88.12
Henry's Lake 2	49.91	49.40	-0.51	49.91	49.40	-0.51	35.21	33.54	-1.68	45.69	45.98	0.28	140.2	64.08	64.48
Hilgard 1	29.04	23.59	-5.45	29.04	23.59	-5.45	15.31	8.84	-6.47	69.75	74.12	4.37	201.2	140.35	149.14
Hilgard 2	21.04	20.57	-0.47	21.04	20.57	-0.47	13.56	12.09	-1.47	71.43	73.14	1.71	140.5	100.36	102.77

Table 4. 1998 Baseline and 2009 values for Season 1 Open (OMARD), Season 2 Open and Total (TMARD) motorized access route density, and secure habitat per bear management subunit inside the Grizzly Bear Recovery Zone (GBRZ).

Bear Management Unit subunit name	OMARD % >1 mile/mile²						TMARD % >2 miles/mile²			% Secure habitat			Square miles (excluding lakes)		
	Season 1 (3/1–7/15)			Season 2 (7/16–11/30)											
	1998	2009	% chg	1998	2009	% chg	1998	2009	% chg	1998	2009	% chg	Subunit	1998 Secure habitat	2009 Secure habitat
Lamar 1	9.85	9.83	-0.02	9.85	9.83	-0.02	3.80	3.72	-0.08	89.40	89.41	0.01	299.9	268.08	268.12
Lamar 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00	180.8	180.75	180.75
Madison 1	29.15	28.90	-0.25	29.47	29.16	-0.30	12.52	11.45	-1.07	71.50	71.82	0.31	227.9	162.94	163.66
Madison 2	33.74	32.87	-0.88	33.74	32.87	-0.88	24.01	21.27	-2.74	66.51	67.29	0.78	149.4	99.38	100.55
Pelican/Clear 1	2.03	2.03	0.00	2.03	2.03	0.00	0.53	0.53	0.00	97.79	97.79	0.00	108.4	105.98	105.98
Pelican/Clear 2	5.43	5.43	0.00	5.43	5.43	0.00	0.41	0.41	0.00	94.08	94.08	0.00	251.6	236.71	236.71
Plateau 1	22.03	20.56	-1.47	22.23	20.78	-1.45	12.94	10.16	-2.78	68.83	70.91	2.08	286.3	197.04	203.00
Plateau 2	8.46	8.46	0.00	8.46	8.46	0.00	3.47	3.23	-0.23	88.66	88.76	0.09	419.9	372.26	372.66
Shoshone 1	1.51	1.47	-0.03	1.51	1.47	-0.03	1.14	1.11	-0.02	98.47	98.52	0.06	122.2	120.35	120.42
Shoshone 2	1.28	1.28	0.00	1.28	1.28	0.00	0.73	0.71	-0.02	98.84	98.84	0.00	132.4	130.87	130.87
Shoshone 3	3.87	2.92	-0.95	3.83	2.88	-0.95	2.13	1.62	-0.51	96.96	97.74	0.78	140.7	136.46	137.56
Shoshone 4	4.48	4.48	0.00	5.28	5.28	0.00	2.94	2.94	0.00	94.88	94.88	0.00	188.8	179.13	179.13
South Absaroka 1	0.60	0.60	0.00	0.60	0.60	0.00	0.12	0.12	0.00	99.21	99.21	0.00	163.2	161.89	161.89
South Absaroka 2	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	99.87	99.87	0.00	190.6	190.31	190.31
South Absaroka 3	2.39	2.38	0.00	2.39	2.38	0.00	2.75	2.75	0.00	96.80	96.80	0.00	348.3	337.13	337.13
Thorofare 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00	273.4	273.37	273.37
Thorofare 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00	180.1	180.05	180.05
Two Ocean/Lake 1	3.46	3.46	0.00	3.46	3.46	0.00	0.33	0.33	0.00	96.34	96.34	0.00	371.9	358.28	358.28
Two Ocean/Lake 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00	124.9	124.90	124.90

Table 4. 1998 Baseline and 2009 values for Season 1 Open (OMARD), Season 2 Open and Total (TMARD) motorized access route density, and secure habitat per bear management subunit inside the Grizzly Bear Recovery Zone (GBRZ).

Bear Management Unit subunit name	OMARD % >1 mile/mile²						TMARD % >2 miles/mile²			% Secure habitat			Square miles (excluding lakes)		
	Season 1 (3/1–7/15)			Season 2 (7/16–11/30)											
	1998	2009	% chg	1998	2009	% chg	1998	2009	% chg	1998	2009	% chg	Subunit	1998 Secure habitat	2009 Secure habitat
Washburn 1	16.09	16.09	0.00	16.09	16.09	0.00	4.21	4.21	0.00	82.96	82.96	0.00	178.3	147.95	147.95
Washburn 2	7.38	7.38	0.00	7.38	7.38	0.00	1.06	1.06	0.00	91.96	91.96	0.00	144.1	132.55	132.55
GBRZ mean/total area	**12.33**	**11.67**	NA	**12.71**	**12.01**	NA	**6.72**	**6.02**	NA	**85.98**	**86.64**	NA	**9025.4**	**7724.5**	**7779.10**

Table 5. 2008 and 2009 values for Season 1 Open (OMARD), Season 2 Open and Total (TMARD) motorized access route density, and secure habitat per bear management subunit inside the Grizzly Bear Recovery Zone (GBRZ).

Bear Management Unit subunit name	OMARD % >1 mile/mile²						TMARD % >2 miles/mile²			% Secure habitat			Square miles (excluding lakes)		
	Season 1 (3/1–7/15)			Season 2 (7/16–11/30)											
	2008	2009	% chg	2008	2009	% chg	2008	2009	% chg	2008	2009	% chg	Subunit	2008 Secure habitat	2009 Secure habitat
Bechler/Teton	16.92	16.92	0.00	16.92	16.92	0.00	5.78	5.78	0.00	78.05	78.05	0.00	534.3	417.03	417.03
Boulder/Slough 1	3.23	3.23	0.00	3.23	3.23	0.00	0.28	0.28	0.00	96.56	96.56	0.00	281.9	272.21	272.21
Boulder/Slough 2	2.06	2.06	0.00	2.06	2.06	0.00	0.04	0.04	0.00	97.71	97.71	0.00	232.4	227.08	227.08
Buffalo/Spread Creek 1	11.41	11.41	0.00	11.52	11.52	0.00	5.25	5.25	0.00	88.28	88.28	0.00	219.9	194.09	194.09
Buffalo/Spread Creek 2	15.77	15.30	-0.47	15.31	14.80	-0.50	12.46	12.46	0.00	74.33	74.33	0.00	507.6	377.32	377.32
Crandall/Sunlight 1	13.20	12.98	-0.22	19.20	18.98	-0.22	7.05	7.00	-0.05	81.08	81.30	0.22	129.8	105.24	105.53
Crandall/Sunlight 2	15.22	15.22	0.00	16.37	16.37	0.00	11.57	11.57	0.00	82.33	82.33	0.00	316.2	260.32	260.32
Crandall/Sunlight 3	14.35	14.35	0.00	19.09	19.09	0.00	10.64	10.64	0.00	80.65	80.65	0.00	221.8	178.93	178.93
Firehole/Hayden 1	10.38	10.38	0.00	10.38	10.38	0.00	1.72	1.72	0.00	88.34	88.34	0.00	339.2	299.65	299.65
Firehole/Hayden 2	8.94	8.94	0.00	9.02	9.02	0.00	1.53	1.53	0.00	88.43	88.43	0.00	172.2	152.27	152.27
Gallatin 1	3.00	3.00	0.00	3.00	3.00	0.00	0.48	0.48	0.00	96.87	96.87	0.00	127.7	123.72	123.72
Gallatin 2	9.54	9.54	0.00	9.54	9.54	0.00	4.50	4.50	0.00	90.19	90.19	0.00	155.2	139.95	139.95
Gallatin 3	31.22	31.22	0.00	31.22	31.22	0.00	13.41	13.41	0.00	68.68	68.68	0.00	217.6	149.48	149.48
Hellroaring/Bear 1	21.34	21.34	0.00	22.08	22.08	0.00	14.74	14.74	0.00	77.62	77.62	0.00	184.7	143.36	143.36
Hellroaring/Bear 2	0.09	0.09	0.00	0.09	0.09	0.00	0.03	0.03	0.00	99.54	99.54	0.00	228.9	227.81	227.81
Henry's Lake 1	49.04	49.04	0.00	49.04	49.04	0.00	31.19	31.18	-0.02	45.66	46.09	0.43	191.2	87.30	88.12
Henry's Lake 2	49.41	49.40	-0.01	49.41	49.40	-0.01	33.56	33.54	-0.02	45.98	45.98	0.00	140.2	64.48	64.48

Table 5. 2008 and 2009 values for Season 1 Open (OMARD), Season 2 Open and Total (TMARD) motorized access route density, and secure habitat per bear management subunit inside the Grizzly Bear Recovery Zone (GBRZ).

Bear Management Unit subunit name	OMARD % >1 mile/mile²						TMARD % >2 miles/mile²			% Secure habitat			Square miles (excluding lakes)		
	Season 1 (3/1–7/15)			Season 2 (7/16–11/30)											
	2008	2009	% chg	2008	2009	% chg	2008	2009	% chg	2008	2009	% chg	Subunit	2008 Secure habitat	2009 Secure habitat
Hilgard 1	23.59	23.59	0.00	23.59	23.59	0.00	8.84	8.84	0.00	74.12	74.12	0.00	201.2	149.14	149.14
Hilgard 2	20.57	20.57	0.00	20.57	20.57	0.00	12.09	12.09	0.00	73.14	73.14	0.00	140.5	102.77	102.77
Lamar 1	9.85	9.83	-0.02	9.85	9.83	-0.02	3.77	3.72	-0.05	89.40	89.41	0.01	299.9	268.08	268.12
Lamar 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00	180.8	180.75	180.75
Madison 1	29.07	28.90	-0.18	29.34	29.16	-0.18	11.52	11.45	-0.07	71.68	71.82	0.14	227.9	163.35	163.66
Madison 2	32.89	32.87	-0.02	32.89	32.87	-0.02	21.47	21.27	-0.20	67.28	67.29	0.02	149.4	100.53	100.55
Pelican/Clear 1	2.03	2.03	0.00	2.03	2.03	0.00	0.53	0.53	0.00	97.79	97.79	0.00	108.4	105.98	105.98
Pelican/Clear 2	5.43	5.43	0.00	5.43	5.43	0.00	0.41	0.41	0.00	94.08	94.08	0.00	251.6	236.71	236.71
Plateau 1	20.56	20.56	0.00	20.78	20.78	0.00	10.16	10.16	0.00	70.91	70.91	0.00	286.3	203.00	203.00
Plateau 2	8.46	8.46	0.00	8.46	8.46	0.00	3.23	3.23	0.00	88.76	88.76	0.00	419.9	372.66	372.66
Shoshone 1	1.47	1.47	0.00	1.47	1.47	0.00	1.11	1.11	0.00	98.52	98.52	0.00	122.2	120.42	120.42
Shoshone 2	1.28	1.28	0.00	1.28	1.28	0.00	0.71	0.71	0.00	98.84	98.84	0.00	132.4	130.87	130.87
Shoshone 3	2.92	2.92	0.00	2.88	2.88	0.00	1.62	1.62	0.00	97.74	97.74	0.00	140.7	137.56	137.56
Shoshone 4	4.48	4.48	0.00	5.28	5.28	0.00	2.94	2.94	0.00	94.88	94.88	0.00	188.8	179.13	179.13
South Absaroka 1	0.60	0.60	0.00	0.60	0.60	0.00	0.12	0.12	0.00	99.21	99.21	0.00	163.2	161.89	161.89
South Absaroka 2	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	99.87	99.87	0.00	190.6	190.31	190.31
South Absaroka 3	2.38	2.38	0.00	2.38	2.38	0.00	2.75	2.75	0.00	96.80	96.80	0.00	348.3	337.13	337.13

Table 5. 2008 and 2009 values for Season 1 Open (OMARD), Season 2 Open and Total (TMARD) motorized access route density, and secure habitat per bear management subunit inside the Grizzly Bear Recovery Zone (GBRZ).

Bear Management Unit subunit name	OMARD % >1 mile/mile²						TMARD % >2 miles/mile²			% Secure habitat			Square miles (excluding lakes)		
	Season 1 (3/1–7/15)			Season 2 (7/16–11/30)											
	2008	2009	% chg	2008	2009	% chg	2008	2009	% chg	2008	2009	% chg	Subunit	2008 Secure habitat	2009 Secure habitat
Thorofare 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00	273.4	273.37	273.37
Thorofare 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00	180.1	180.05	180.05
Two Ocean/Lake 1	3.46	3.46	0.00	3.46	3.46	0.00	0.33	0.33	0.00	96.34	96.34	0.00	371.9	358.28	358.28
Two Ocean/Lake 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00	124.9	124.90	124.90
Washburn 1	16.09	16.09	0.00	16.09	16.09	0.00	4.21	4.21	0.00	82.96	82.96	0.00	178.3	147.95	147.95
Washburn 2	7.38	7.38	0.00	7.38	7.38	0.00	1.06	1.06	0.00	91.96	91.96	0.00	144.1	132.55	132.55
GBRZ mean/total area	**11.69**	**11.67**	NA	**12.03**	**12.01**	NA	**6.03**	**6.02**	NA	**86.61**	**86.64**	NA	**9025.4**	**7777.61**	**7779.10**

Table 6. Approved or ongoing projects in 2009 that temporarily affect secure habitat inside the Grizzly Bear Recovery Zone.

Bear Management Unit (BMU) subunit	**1998 Secure habitat of BMU subunit** (sq miles)	**2009 secure habitat of BMU subunit** (sq miles)	**Maximum change allowed[1]** (sqmiles)	**Project Name and Administrative Unit[2]**	**Secure habitat of BMU subunit with project** (sq miles)	**Temporary change in Secure habitat** (sq miles)	**Total percent temporary change in secure habitat[1]**	**Project status**
Buffalo/Spread Creek 1	194.1	194.1	**5.1**	**North Fork Fish Creek** (Bridger-Teton NF)	194.1	0.0	**0.3%**	Project CLOSED (never implemented)
Buffalo/Spread Creek 2	377.2	377.3			376.0	**1.3**		
Crandall/Sunlight 1	105.2	105.5	**3.2**	**Deadman** (Shoshone NF)	105.2	0.0	**<0.1%**	Project CLOSED 2009
Crandall/Sunlight 2	260.3	260.3			260.3	**<1**		
Crandall/Sunlight 3	178.3	178.9			178.9	0.0		
Crandall/Sunlight 1	105.2	105.5	**3.2**	**Upper Clarks Fork** (Shoshone NF)	105.5	0.0	**<0.1%**	Project approved but not yet implemented
Crandall/Sunlight 2	260.3	260.3			260.2	**<1**		
Crandall/Sunlight 3	178.3	178.9			178.9	0.0		
South Absaroka 1	161.9	161.9	**3.5**	**Upper Wind River** (Shoshone NF)	161.9	0.0	**<0.1%**	Project approved but not yet implemented
South Absaroka 2	190.3	190.3			190.3	0.0		
South Absaroka 3	337.1	337.1			337.0	**<1**		

[1] The maximum allowable temporary change in secure habitat for projects within a BMU is equal to 1% of the area of the largest subunit. Only 1 project can be active in a given subunit at any time.

[2] Projects correspond to those subunits listed in bold text. Where 2 projects in a given BMU subunit are approved, the first project listed will be completed before starting the subsequent project. Projects in a given BMU may affect secure habitat in adjacent subunits or in subunits of adjacent BMUs. None of the projects listed above affect secure habitat in adjacent BMU subunits.

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Attachment A

Conservation Strategy Habitat Standards and Monitoring Requirements

Habitat Standards

References to appendices and baseline tables in the Conservation 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. Table A-1 provides a summary of the secure area management rules. The rule set in Table 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 1 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 1 year after completion of the project.

Table 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.

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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.

Refer to Table B-1 for a summary of criteria and definitions used in the Amendment Record of Decision (ROD).

Table 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.

Attachment C

Developed Sites Constituting the 1998 Baseline and Subsequent Changes by Bear Management Subunit Inside the Primary Conservation Area[1]

(Changes in developed sites since 1998 are shaded and italicized).

Bear Management subunit	Admin Unit[2]	Name and type of developed sites tallied in Table 3
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.

Bear Management subunit	Admin Unit[2]	Name and type of each site tallied in Table 3
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.

Bear Management subunit	Admin Unit[2]	Name and type of each site tallied in Table 3
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.

Bear Management subunit	Admin Unit[2]	Name and type of each site tallied in Table3
Henrys 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 Site closed in 2009.
Henrys 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**

Bear Management subunit	Admin Unit[2]	Name and type of each site tallied in Table 3
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 Avalanche Peak. **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.

Bear Management subunit	Admin Unit[2]	Name and type of each site tallied in Table 3
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.

Bear Management subunit	Admin Unit[2]	Name and type of each site tallied in Table 3
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] The terms Primary Conservation Area (PCA) and Grizzly Bear Recovery Zone (GBRZ) refer to the same administrative boundary but represent 2 distinct vocabularies that accompany the legal status of the grizzly bear. With the recent relisting, the term PCA reverts to the GBRZ to represent the recovering status of the bear.

[2] **Admin Unit - 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 Department, **YNP** = Yellowstone National Park.

Attachment D

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) were removed in 2009 with the highway reconstruction project as mitigation for the composting operation. The composting site was inactive in 2009 and will be officially closed in 2010.	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.

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 were closed as integral part of the Togwotee Highway reconstruction.	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.
Caribou-Targhee National Forest				
Henrys Lake #1	Willow Creek Mining Site	Closed in 2009	None required	Site and capacity banked
Gallatin National Forest				
Henrys 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 Grizzly Bear Recovery Zone boundary.

Subunit	Developed Site	Change from 1998 Baseline	Mitigation as per the application 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.

Subunit	Developed Site	Change from 1998 Baseline	Mitigation as per the application 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.