Declaration

East Paradise Range Allotment Management Plan

State of Montana Federal District Court
Case CV 22-149-M-DLC-KLD

David J. Mattson, Ph.D.

2023

The Grizzly Bear Recovery Project

P.O. Box 2406,
Livingston,
Montana

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MONTANA
MISSOULA DIVISION

WESTERN WATERSHEDS PROJECT, a non-profit organization, *et al.*, Plaintiffs, vs. RANDY MOORE, in his official capacity as Chief of the U.S. Forest Service, *et al.*, Federal-Defendants.	CV 22-149-M-DLC-KLD DECLARATION OF DAVID J. MATTSON

I, DAVID J. MATTSON, hereby declare:

1. I am a scientist and retired wildlife management professional with extensive experience in grizzly bear research and conservation spanning four plus decades. My educational attainments include a B.S. in Forest Resource Management, an M.S. in Plant Ecology, and a Ph.D. in Wildlife Resource Management. My professional positions prior to retirement from the U.S. Geological Survey (USGS) in 2013 included Research Wildlife Biologist, Leader of the Colorado Plateau Research Station, and Acting Center Director for the Southwest Biological Science Center, all with the USGS; Western Field Director of the Massachusetts Institute of Technology-USGS Science Impact Collaborative; Visiting Scholar at the Massachusetts Institute of Technology; and Lecturer and Visiting Senior Scientist at the Yale School of Forestry & Environmental Studies.

2. I have been consulted by brown/grizzly bear managers and researchers worldwide, including from Russia, Japan, France, Spain, Greece, Italy, and, most notably, Canada. I have

also given numerous public presentations on grizzly bear ecology and conservation, including talks at the Smithsonian (Washington, D.C.) and American Museum of Natural History (New York, New York).

3. My credentials of direct relevance to this declaration include having been a lead investigator of grizzly bear research in the Yellowstone Ecosystem during 1983-1993 preceded by involvement as a research technician during 1979-1982; publications during 1985-2011 resulting from this research; close involvement with development of the Yellowstone Grizzly Bear Cumulative Effects Model (CEM) during 1984-2004; being a resident of occupied grizzly bear habitat since 2010; and being a close follower of published grizzly bear research during the last 41 years. Perhaps most relevant, my dissertation focused on the ecology of grizzly bears in the Greater Yellowstone Ecosystem (GYE) during 1977-1996 (Mattson 2000).

4. This declaration addresses numerous shortcomings in government analyses of how implementation of the East Paradise Range Allotment Management Plan (hereafter "East Paradise decision" or "decision") will affect grizzly bears. I address key decision documents that include the U.S. Fish & Wildlife Service Biological Opinion (hereafter "BiOP"), U.S. Forest Service Environmental Assessment (hereafter "EA"), and related Wildlife Addendum (hereafter "WA"). Shortcomings in the government's analysis include assertions without any scientific or evidentiary basis; misrepresentation or incomplete consideration of relevant science and relevant factors; a failure to consider important aspects of the decision; logical fallacies; and inadequate temporal and spatial scope (see Points 83-89 below). References cited in what follows are listed in Attachment 1 in alphabetical order and by year of publication.

ECOLOGICAL AND NUTRITIONAL CONTEXT

5. Citing Gunther et al. (2014), the BiOP and EA assert that grizzly bears are opportunistic omnivores that will utilize a wide variety of plants and subsist on a wide variety of foods, with the strongly implied notion that grizzly bear behavior, survival, and reproduction are unaffected by dietary differences. There are, moreover, claims that the Greater Yellowstone Ecosystem (GYE) grizzly bear population is somehow being limited by density of conspecifics (i.e., density-dependent mechanisms) independent of food quantity and quality, or mechanisms arising from differences in diet and habitat use that govern levels of human-bear contact and conflict.

6. Parenthetically, authors of the BiOP and EA then contradict themselves in several places by asserting that GYE grizzly bears rely primarily on only four foods for most energy and nutrients, and that there is little or no dietary overlap between cattle and grizzly bears because bears don't utilize herbaceous foods. This claim is apparently fielded with the intent of dismissing concerns about competition between cattle and bears.

7. Regarding the claim summarized in Point 6, there is ample evidence that GYE grizzly bears do eat copious amounts of the same grasses, sedges, and forbs consumed by cattle, although the energetic benefits of this grazing are unclear (e.g., Mealey 1975, Mattson et al. 1991a, Mattson 2000, Mattson et al. 2004). Moreover, grizzly bear exploitation of herbaceous foods is highly sensitive to the density and structure of plants (Rode et al. 2001) and thus likely to be affected by even modest levels of utilization by cattle. Mealey et al. (1977), Irwin & Hammond (1985), and Stivers (1988) lend weight to this concern by noting that cattle grazing can have negative effects on bear foods, with these effects aggravated by cattle grazing during June – as is being proposed in the EA.

8. The following points 9-12 together with Section 1 of Attachment 4 address untenable claims made in the EA and summarized in Point 5.

9. Not all bear foods are, in fact, equal. Animals, including vertebrates and insects, are not only 2-4 times more digestible by bears compared to vegetal foods, but also richer in fat and protein. Among the vegetal foods, roots and fruits are more digestible than foliage and offer higher concentrations of starch and sugar (Mattson et al. 2004:19-21).

10. These differences in food quality together with landscape-level differences in food quantity and distribution unambiguously affect the fitness, physical condition, and survival of bears (e.g., Hilderbrand et al. 1999a, Pease et al. 1999, Rode & Robbins 2000, Felicetti e al. 2003, Haroldson et al. 2006, Robbins et al. 2007, Erlenbach et al. 2014, López-Alfaro et al. 2015, McLellan 2015, Hertel et al. 2018, Hilderbrand et al. 2018). Cumulatively, these demographic and physiological processes manifest in orders-of-magnitude differences in grizzly bear densities that reflect diets and overall habitat productivity (Mowat et al. 2013).

11. More to the point, although bears are omnivores, much like humans they are not indifferent to the quality and quantity of available foods. Bears efficiently select diets that optimize energetic gain and intake of seasonally important nutrients while minimizing exposure to perceived risk (e.g., Reinhart & Mattson 1990; Mattson 1997a, 2000, 2001, 2002, 2004; Welch et al. 1997; Rode et al. 2001; Mattson et al. 2002; Ben-David et al. 2004; Gende & Quinn 2004; Quinn et al. 2017; Lincoln & Quinn 2019). A handful of high-quality foods consequently dominate the seasonal diets of bears, with exact dietary composition depending on seasonal and regional availability of foods. Among many such examples, huckleberries dominate bear diets in southeast British Columbia and northwest Montana (Proctor et al. 2023); buffaloberries and

hedysarum roots dominate diets of bears in Alberta (Munro et al. 2006); and spawning salmonids dominate diets of bears in coastal Alaska (Mowat & Heard 2006).

12. Of parenthetical relevance here, bears are not Latin taxonomists. In other words, bears are not keying out plants from *Flora of the Pacific Northwest*—say, differentiating one bluegrass from another, or bluegrass from wheatgrass. In other words, taxonomic distinctions of relevance to people such as Gunther et al. (2014) have little or no relevance for grizzly bears. Differences among foods arise from characteristic densities and architectures at foraging sites, the energetic expenses of extraction, and per gram densities of energy and nutrients—and how all of this varies seasonally and annually (e.g., Mattson et al. 2004). In other words, the fact that Yellowstone's grizzly bears eat "260 species of foods…representing 4 of the 5 kingdoms of life" (Gunther et al. 2014) is largely irrelevant to judging the effects of diets and dietary changes on grizzly bears.

13. Related to this topic, population density, as such, is not a mechanism that directly limits population growth (Krebs 1995, 2002). Instead, nearly all effects of conspecific density are mediated through competition for shared foods, natural mortality caused by starvation or conspecific predation, increases in vulnerability to predators (e.g., humans) caused by conspecific displacement, and interactions of all with carrying capacity, which axiomatically varies in time and space. Any invocation of density-dependent effects without regard for these intervening factors, most of which relate to food quality and quantity, is uninformative at best and inane at worst – as with claims in both the EA and BiOP.

IMPORTANCE OF DIETARY MEAT FOR GRIZZLY BEARS

14. The BiOP, EA, and WA fail to address an important relevant factor: the potentially substantial importance of meat from vertebrates in grizzly bear diets, the magnitude and

contingencies of predation by grizzlies on ungulates of all species, and the relevance of these phenomena to potential depredation of cow-calves on East Paradise allotments. The following Points 14-20 clarify the nature of this deficiency.

15. Tissue from large hooved herbivores (i.e., ungulates) is a primary source of energy and nutrients for bears in many ecosystems, especially in colder, less productive, or more open regions where meat accounts for between 50-80% of assimilated nutrients (Hilderbrand et al. 1999b, Jacoby et al. 1999, Mowat & Heard 2006, Vulla et al. 2009, Bojarska & Selva 2012, Milakovic & Parker 2013, Niedziałkowska et al. 2019). In most regions, brown and grizzly bears obtain almost all this meat from native ungulates, whereas in some areas, such as along Montana's Rocky Mountain East Front, livestock are the primary source (Aune & Kasworm 1989). Consumption of fat- and protein-rich animal tissue by bears is primarily constrained only by availability and the need to balance nutrients (Rode & Robbins 2000, Robbins et al. 2007, Erlenbach et al. 2014, Nielsen et al. 2017).

16. Much of the meat obtained from ungulates during late spring and early summer comes from preying on calves, with bear predation often taking a heavy toll on survival and recruitment of moose, elk, caribou, and muskox calves (Ballard et al. 1981, 1991; Larsen et al. 1989; Adams et al. 1995; Bertram & Vivion 2002; Arthur & Del Vecchio 2017; Brockman et al. 2017). Even so, grizzly bears will prey on vulnerable animals of any size during any season, including adult moose and elk (Coel 1972, Ballard et al. 1981, Schleyer 1983, Craighead et al. 1995, Mattson 1997b, Reynolds et al. 2002, Kermish-Wells 2018). Predatory bears clearly optimize to maximize reward while minimizing risk, with vulnerability arising from several factors, including small size, docile or inattentive conspecifics, lack of vigor, or lack of agility.

17. Male brown and grizzly bears consistently eat more meat than conspecifics or sympatric black bears (Mattson 1997b, 2000; Hilderbrand et al. 1999b; McLellan 2011; Milakovic & Parker 2013; Schwartz et al. 2014). Even so, diets of male and female grizzlies converge on consuming substantial amounts of meat if alternate high-quality foods are not available (Mattson 1997b, Schwartz et al. 2014). Aside from differences attributable to sex and age, some bears clearly become more proficient than others at preying on larger ungulates such as adult elk and moose weakened by winter weather or the fall rut (Gunn & Miller 1982, Schleyer 1983, Reynolds et al. 2002, Rauset et al. 2012).

18. Bears are primarily ambush predators that exploit opportunities provided by vegetation and topography to closely approach prey – including livestock – or natural impediments such as snow and water that provide them with comparatively greater mobility (Cole 1972, Gunn & Miller 1982, Bjorge 1983, Schleyer 1983, Mattson 1990, Craighead et al. 1995, Cristescu et al. 2014, Doan-Crider et al. 2017). Consequently, bears tend to preferentially prey on animals such forest-dwelling moose that are more vulnerable to ambush (Mattson 1997b, Niedziałkowska et al. 2019). Alternatively, bears will use smell and area-intensive searches to seek out very young calves using immobility for their defense (French & French 1990, Gunther & Renkin 1990, Hamer & Herrero 1991, Blanco et al. 2011). Even so, calves are typically vulnerable to bear predation for only about 10-45 days of age largely because neonates of native ungulate species rapidly develop speed and agility (Ballard et al. 1991, Larsen et al. 1989, Adams et al. 1995, Swenson et al. 2007, Griffin et al. 2011, Brockman et al. 2017).

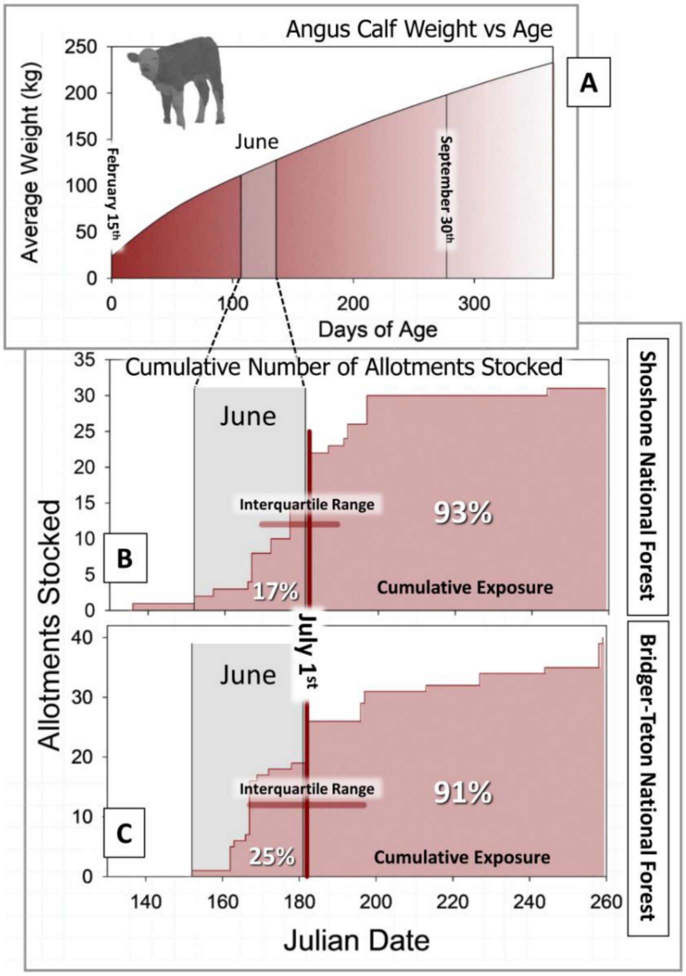


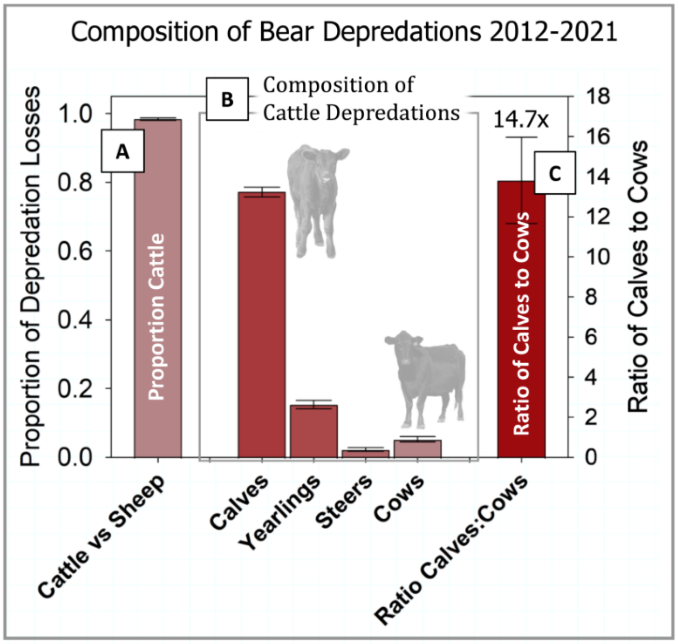
Figure 1.

The figures at left show calendar trends relevant to assessing the cumulative vulnerability and exposure of cow-calves to grizzly bear depredation on public land grazing allotments in the GYE. The approximate weight of angus calves relative to age in days in shown in (A), with the month of June highlighted, assuming a birth date of mid-February characteristic of husbandry practices in the GYE. Panels (B) and (C) show the cumulative number of allotments stocked with cow-calves during the grazing season on the Shoshone and Bridger-Teton NFs, respectively, with cumulative stocking shown shaded red. Most depredation in the GYE has historically occurred on these two forests. This red-shaded area is proportional to the date-specific number of allotments on which cow-calves are exposed to potential grizzly bear depredation. June is differentiated from the rest of the year. A median stocking date of July 1st on both National Forests is shown by the vertical burgundy line. Percentages shown for June and July-September represent the proportion all allotments stocked during each time period, adjusted for dates during each when stocking begins and ends. This percentage is equivalent to total exposure of cow-calves historically to potential depredation: roughly 4-5 times greater during July-September compared to June.

19. In many respects, cow-calves are ideal prey for brown and grizzly bears, especially prior to mid-July. Optimal-sized prey for grizzly bears of average weight (140-180 kg) is in the range of 95-120 kg (Vézina 1985) – the approximate weight of June cow-calves born during February (Bourdon & Brinks 1982, Jakubec 1983; Figure 1a). Cow-calves are also likely to be much more vulnerable than even 1-month-old native ungulates simply because they are less agile and, in the case of Angus cows, bred to be docile (Haskell et al. 2014) – a trait accompanied by lessened vigilance (Linnell et al. 1999, Kleuver et al. 2008, Flörcke & Grandin 2013) and diminished encephalization (i.e., intelligence; Balcarcel et al. 2021) compared to wild ungulates. These

characteristics hold not only for cow-calves but also for attendant adults, which renders cow-calves vulnerable to bear predation even among other cattle.

Figure 2.



The bar graphs above show the proportional composition of livestock depredations by GYE grizzly bear during 2012-2021. The bar in (A) shows the proportion of all depredations that involved cattle versus sheep: nearly all during this time period were cattle. The bars in (B) show the sex and age composition of cattle depredated by bears; error bars denote standard deviations. Calves accounted for 77% of all depredated cattle. The bar in (C) is proportional to the ratio of cow-calves killed by grizzlies relative to fully adult cows. Cow-calves were roughly 15-times more likely to have been killed by grizzly bears relative to comparable numbers of accompanying adult cows, suggesting that cow-calves were at 15-times more vulnerable to depredation, presumably because of smaller size and greater helplessness.

20. The absolute as well as comparative vulnerability of cow-calves explains the pervasive tendency of bears to kill many more calves than adults on public as well as private rangelands worldwide (Murie 1948, Dorance 1982, Horstman & Gunson 1982, Bjorge 1983, Mattson 1990, Doan-Crider et al. 2017). In the Greater Yellowstone Ecosystem (GYE), calves comprised over 70% of total cattle losses to grizzly bear predation during 2012-2021 – nearly 15-fold more than

losses of adult cows present in comparable numbers (Figure 2b; Van Manen et al. 2013-2022: Section – Monitoring of Livestock Grazing).

21. The potential severity of human-perpetrated impacts arising from conflicts over grizzly bear predation on vulnerable cattle is highlighted by both history and current patterns of grizzly bear density and survival. Storer & Tevis (1963), Brown (1985), and Mattson (2022) all describe dynamics entrained by a flood of cattle into California and the Southwest during the 1800s, resulting heightened levels of grizzly bear predation on livestock, and consequent persecution by local people leading to the extirpation of grizzly bears in these regions. Current distributions and densities of grizzly bears in North America continue to be negatively correlated with cattle densities (Mowat et al. 2013), consistent with higher mortality rates of GYE grizzly bears on public land grazing allotments (Merrill & Mattson 2003).

22. The EA and BiOP do not address any of the considerations identified in Points 14-21, and instead claim that cow-calves are no more vulnerable in June, when still relatively small, than during the remainder of the year, when much larger. The authors of these documents furthermore fail to address the well-documented importance of meat to grizzly bears, the extent to which bears can be formidable predators on younger ungulates of all species, including cattle, and the fact that few allotments in the GYE have been stocked in June compared to the rest of the grazing season.

ECOLOGICAL AND HISTORICAL CONTEXT FOR THE GYE

23. The BiOP, EA, and WR fail altogether to address the nature and magnitude of changes in environmental conditions in the GYE since 1998 and, because of that, fail to provide context for understanding emerging changes grizzly bear diets, foods habits, and relations with livestock and people, not only the in GYE, but also Paradise Valley, with implications for stocking of the East

Paradise allotments. The following Points 22-30 along with Section 4 of Attachment 4 clarify the nature of this deficiency along with fatal flaws in research cited in the EA and BiOP as reason to disregard changes in grizzly bear foods, notably Schwartz et al. (2013).

24. Cutthroat trout, whitebark pine seeds, and tissue from elk, bison, and moose were historically dominant sources of energy and nutrients for grizzly bears in the GYE – trout in southern Yellowstone National Park (YNP), pine seeds wherever available, and meat primarily in central and northern parts of the ecosystem (Mattson & Reinhart 1995; Mattson 1997b, 2000; Felicetti et al. 2004; Mattson et al. 2004; Gunther et al. 2014). Army cutworm moths emerged as a dominant bear food in the Absaroka Mountains of Wyoming beginning in the mid-1980s (Mattson et al. 1991b, French et al. 1995).

25. Grizzly bears in Yellowstone have long been known to eat more meat than any other grizzly bear population at mid-latitudes, accounting for >50% of assimilated nitrogen averaged over all bears and >70% of assimilated nitrogen for adult males (Mattson et al. 1991a, Green et al. 1997, Mattson 1997b, Hilderbrand et al. 1999b, Schwartz et al. 2014). Despite preying heavily on elk calves during mid-May to mid-July, most meat obtained by bears from predation historically came from adult ungulates, including bull elk and moose during the fall, and winter-weakened animals during the spring (Mattson 1997b).

26. This surprisingly heavy predation on vulnerable larger ungulates comports with the tendency of bears to maximize food reward within an acceptable range of risk of injury from prey, and further suggests that cow-calves would be and are optimal prey for adult grizzly bears in the GYE.

27. Whitebark pine seeds were historically used nearly twice as heavily by female versus male grizzly bears in the GYE (Mattson 2000, Felicetti et al. 2003), with consequences for

female reproductive success (Mattson 2000). Females that consumed more pine seeds reproduced earlier and more often had 3-cub litters. Annual variation in sizes of seed crops also had additional substantial effects on grizzly bear demography. Relative to adult males, subadult and female grizzly bears spent comparatively more time near people and human infrastructure seeking natural and anthropogenic foods during years when seed crops were poor (Mattson et al. 1992, Haroldson & Gunther 2013). As a result, bears died at a much higher rate during years with poor seed crops, largely due to elevated levels of conflict with people (Mattson et al. 1992, Mattson 1998, Pease & Mattson 1999, Haroldson et al. 2006).

28. Grizzly bears in the GYE historically compensated by eating more meat from native ungulates during years when whitebark pine seeds were scarce, including meat obtained from the remains of elk killed by big game hunters outside of YNP (Mattson 1997b, Ruth et al. 2003, Haroldson et al. 2004).

29. This compensatory consumption of meat when pine seeds were scarce logically suggests that grizzly bears would turn in a more sustained way to eating meat from ungulates – including cattle – if whitebark pine suffered widespread mortality. This point, historical patterns of compensatory meat consumption, and emerging evidence (see Points 31-34) contradict an assertion in the EA and BiOP that grizzly bear depredation on livestock varies independently of natural food availability.

30. Spawning cutthroat trout exploited by grizzly bears in streams tributary to Yellowstone Lake catastrophically declined in numbers beginning around 1990, with terminal losses occurring after 2000. Levels of exploitation by bears closely tracked these declines and have not since recovered (Reinhart & Mattson 1990, Felicetti et al. 2004 Haroldson et al. 2005, Fortin et al. 2013, Tiesberg et al. 2014). The Yellowstone Lake cutthroat trout population collapsed not

only because of predation from non-native lake trout, but also because of climate-driven deteriorating hydrologic conditions in smaller spawning streams preferentially used by bears (Keading 2013, 2020).

31. Mature cone-producing whitebark pine trees suffered similar catastrophic mortality from an outbreak of mountain pine beetles during 2000-2010 driven largely by warmer temperatures in the typically frigid haunts of whitebark pine. By the end of this period, roughly 70% of mature trees had been killed by bark beetles, with relatively healthy stands persisting only at highest elevations of the Wind River Range in Wyoming and Beartooth Mountains in Montana (Attachment 2, Macfarlane et al. 2013).

32. Losses of both whitebark pine and cutthroat trout in the GYE since 2000 were driven directly or indirectly by climate warming that precipitated greater vulnerability to a native predator in the case of whitebark pine, and hydrologic conditions deleterious to spawning habitats in the case of cutthroat trout.

COMPENSATORY INCREASES IN DEPREDATION AND CONSUMPTION OF MEAT

33. In contradiction to claims in the EA and BiOP citing Gunther et al. (2004) that depredation of livestock in the GYE has no relationship to availability of natural foods, multiple lines of evidence show that grizzly bears throughout the GYE did, in fact, compensate for losses of whitebark pine and cutthroat trout by eating more meat from ungulates such as elk, bison, and cattle (Figure 3). This increased consumption included elk calves (Barber-Meyer et al. 2008, Middleton et al. 2013), remains of hunter-killed elk (Podruzny 2012, Orozco & Miles 2013), undifferentiated ungulates (Fortin et al. 2013, Schwartz et al. 2014, Ebinger et al. 2016, Van Manen et a. 2023: Monitoring of Grizzly Bear Foods), and livestock (Gunther et al. 2004, Schwartz et al. 1998-2011: Human-Grizzly Bear Conflicts, Van Manen et al. 2012-2023:

Monitoring of Livestock Grazing). The marked increase in exploitation of ungulates by bears that began in the early to mid-2000s and accelerated after the terminal demise of whitebark pine around 2010 is irrefutable.

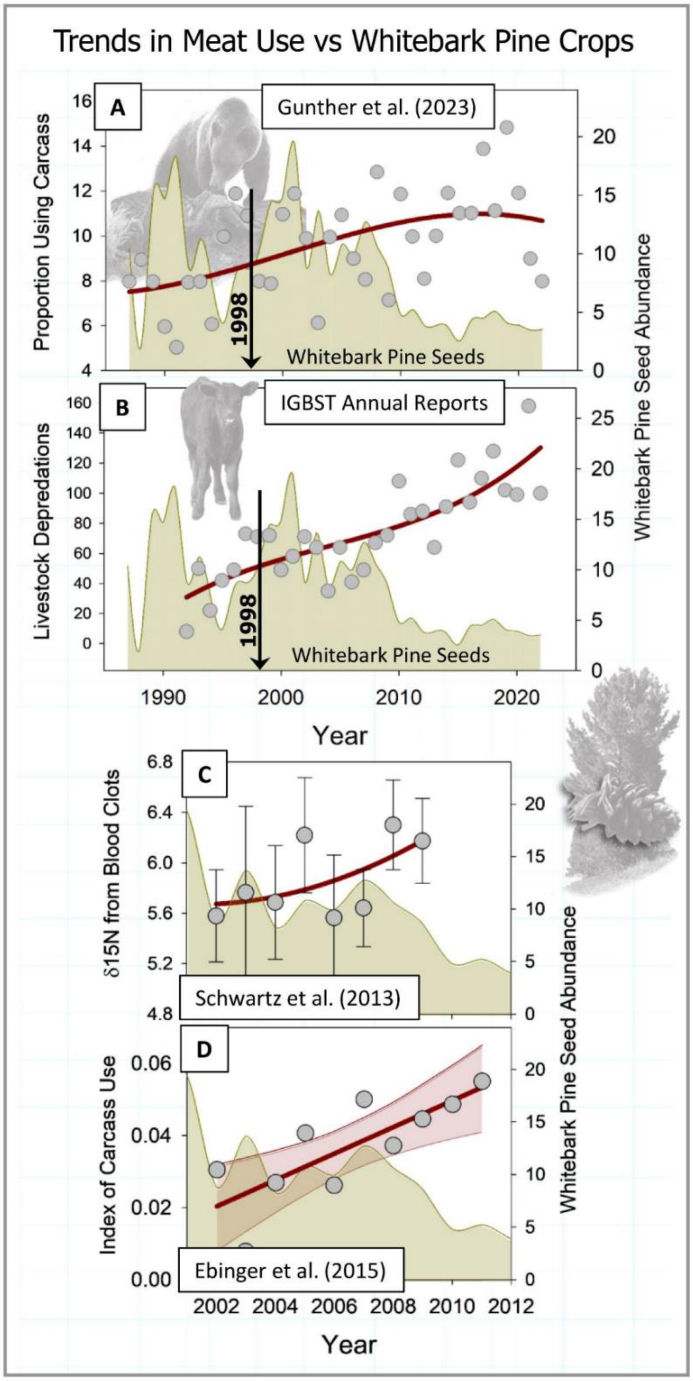


Figure 3.

The figures at left show trends in consumption of meat from ungulates by grizzly bears in the GYE derived from different sources of data. Annual values are shown as gray dots; generalized trends as burgundy lines. The baseline year of 1998 is shown for each series of data that encompasses both earlier and later years. Ecosystem-wide trend in availability of whitebark pine seeds is shown in light green. Each panel shows trend from a different identified source using different methods. The proportion of all incidental sightings of bears in Yellowstone Park that involved a bear consuming meat from an ungulate carcass is shown in (A); Numbers of livestock depredations by grizzly bears in the GYE are shown in (B); The relative abundance of animal-origin nitrogen assimilated into body tissues of grizzly bears in the GYE is shown in (C); and relative numbers of grizzly bear telemetry location clusters where consumption of an ungulate was consumed are shown in (D). These four diverse metrics all show the same trend. Consumption of meat from ungulates by GYE grizzly bears has increased over time, but with this trend tending to accelerate after terminal declines in availability of whitebark pine seeds.

34. Much of this increase in meat consumption by bears after 2010 has involved exploitation of cattle using public-land grazing allotments located on the periphery of grizzly bear distribution, including allotments on the Bridger-Teton and Shoshone National Forests where grizzly bears and cattle had been sympatric since well before 2000 (Attachment 3; Wells et al. 2019, Van Manen et al. 2023). Levels of depredation-related conflicts have been orders-of-magnitude greater in the GYE during the last two compared to previous three decades despite a long history of sympatry between cattle and grizzly bears, notably on allotments in the upper Green River and Wind River drainages of Wyoming (Attachment 3). This trend is true as well for livestock-related conflicts on rangelands in Tom Miner Basin at mid-elevations of Paradise Valley in Montana – a phenomenon that the BiOP or EA failed to address, despite nearness of Tom Miner Basin to the East Paradise allotments (Figure 4a).

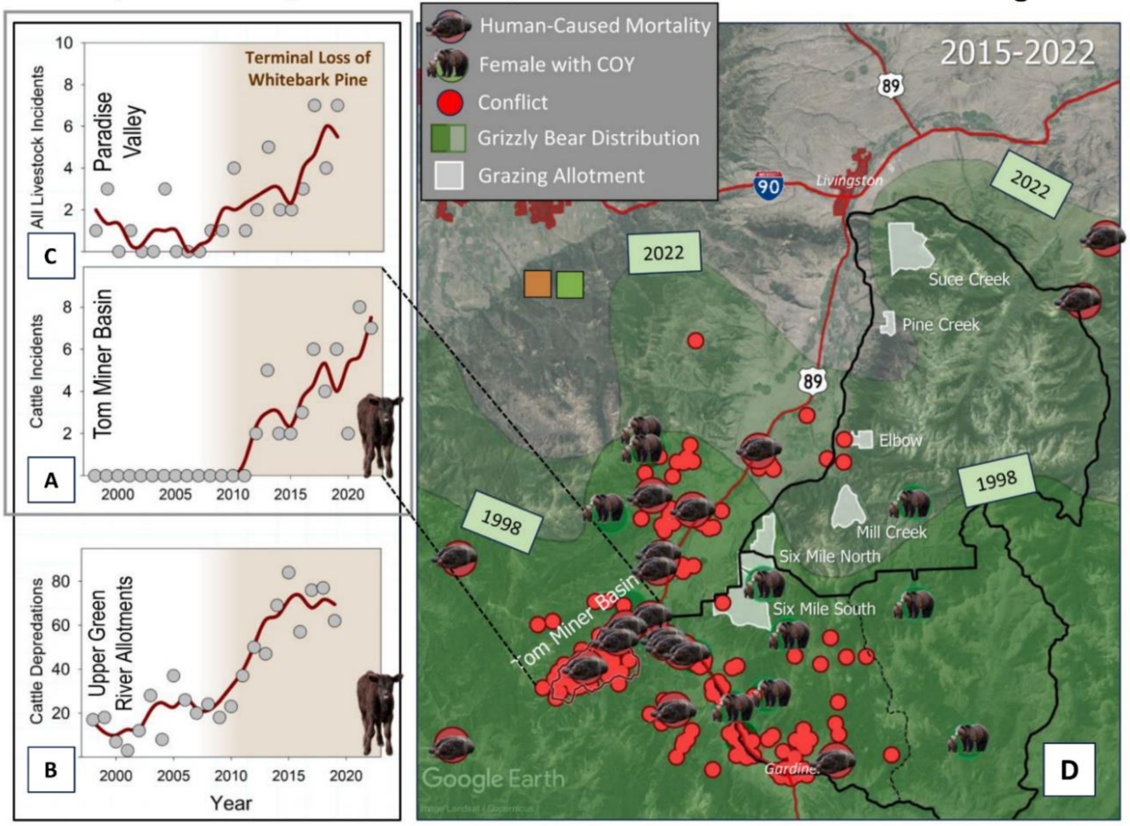
35. These increases in livestock depredation by grizzly bears in the GYE have led, in turn, to a dramatic escalation in numbers of bear killed because of livestock-related conflicts since around 2008 (data from Schwartz et al. 1998-2011, Van Manen et al. 2012-2023). This increase, together with an antecedent increase in numbers of bears killed during conflicts with big game hunters has resulted in mortalities resulting from meat-related conflicts with humans proportionately more than doubling since 2000 (Figure 5a).

36. These increases in bear mortalities arising from meat-related conflicts have fueled a near four-fold increase in numbers of grizzly bears annually known to die in the GYE (Figure 5b), leading, in turn, to a 2.5-fold increase in numbers of known bear deaths as a proportion of total estimated population size (Figure 5c; total population size from Van Manen et al. [2023]). This increase in the ratio of dead to live bears has occurred while proportions of known deaths attributable to natural causes have declined, casting into doubt the role of natural mortality in

curbing growth of the GYE grizzly bear population since 2008. Meat-related deaths are more plausibly implicated in slowed growth of the population (see also Points 76-82 below).

Conflicts, Bear Deaths, Females wt COY, & Distribution

Figure 4.



The graphics feature patterns of grizzly bear depredation and other human-bear conflicts in and near Paradise Valley, Montana. Figures (C) and (A) show trends in livestock depredation by grizzly bears for all of Paradise Valley and only for Tom Miner Basin, which is labeled in the map in (D). Depredations for the totality of Paradise Valley include all livestock, with most earlier depredations involving poultry and animals such as goats. Depredations shown for Tom Miner Basin represent only cattle, predominantly cow-calves. Similar data for the Upper Green River allotments in Wyoming are shown in (B) as a point of comparison. Annual data are shown as gray dots and generalized trends as burgundy lines. The period during which whitebark pine seeds were lost as a primary food source in highlands around Paradise Valley is shown shaded orange. Cow-calf depredations clearly escalated dramatically in both Tom Miner Basin and the Upper Green River after terminal losses of whitebark pine. The map in (D) places all of this in a spatial context. East Paradise grazing allotments are labeled and shaded white. Human-grizzly bear conflicts of all types documented during 2015-2022 are shown as red dots. Grizzly bear deaths are shown by dead bear symbols and the general vicinity of unduplicated females with cubs-of-the-year (COY) are shown by the symbol of a sow with a cub. The approximate boundaries of grizzly bears distribution during 1998 and 2022 are shown in shades of green. Numerous human-bear conflicts and human-caused deaths have occurred up-valley a short distance from the East Paradise Valley allotments during the last 7 years. Several females with COY have been documented during this same period near the allotments. Remarkably, cow-calf depredations were nearly non-existent prior to 2010 in areas where grizzly bears and cattle had been sympatric for >10 years but rapidly proliferated shortly after terminal losses of whitebark pine.

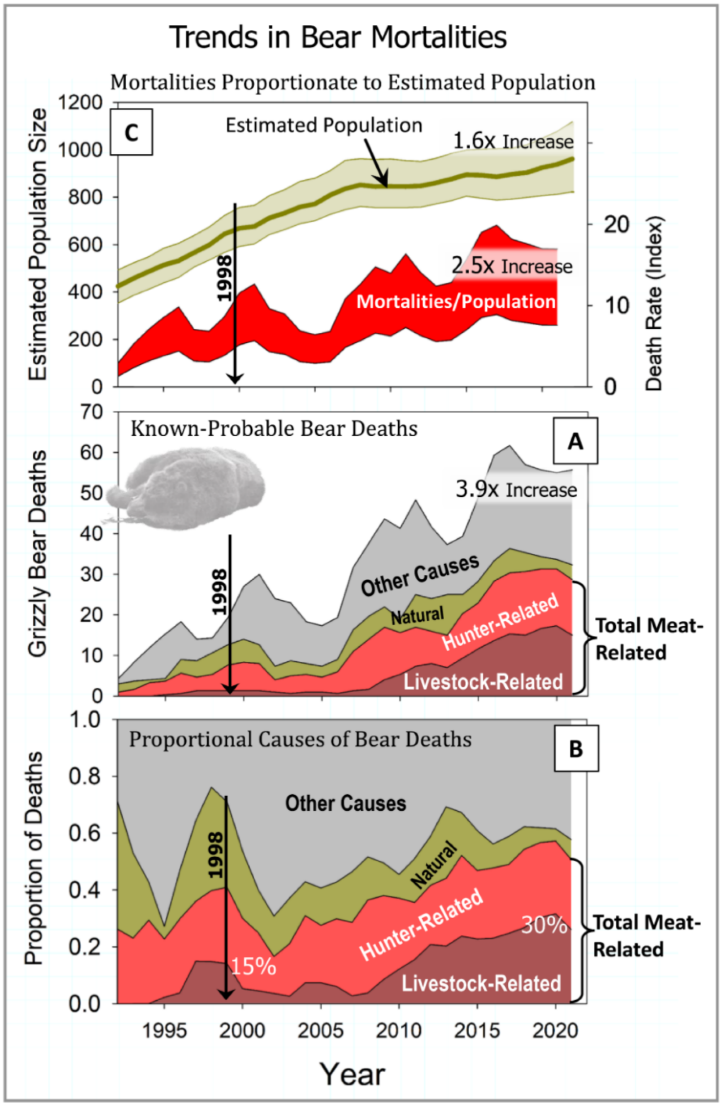


Figure 5.

The figures at left show trends in annual numbers of known or probable grizzly bear deaths in the GYE along with probable causes as a 3-year running average. The benchmark year of 1998 is also shown. Panel (A) shows absolute number of deaths differentiating those resulting from retaliation for livestock depredation (in burgundy) from those arising from encounters with big game hunters (in red) and natural (green) and residual (gray) causes. Panel (B) shows these causes proportionally. Grizzly bear deaths arising from conflicts with people over meat (i.e., livestock and remains of hunter-killed animals) increased 5-fold after 1998 and proportionately doubled. Most of these increases occurred during and after terminal losses of whitebark pine between 2005 and 2010. Panel (C) shows total 3-year-averaged grizzly bear mortalities as a proportion of estimated total population size. Known and probable mortalities were adjusted to estimate total grizzly bear mortality using two different multipliers, a lower value from Interagency Grizzly Bear Study Team Annual Reports 2013-2021 and a higher value from Lamb et al. (2023). Mortalities as a proportion of live bears have increased 2.5-fold since 1998, with most of this increase again occurring after terminal losses of whitebark pine.

37. Public land grazing allotments spared noteworthy increases in depredation after 2010 have primarily been restricted to areas near army cutworm moth aggregation sites in alpine areas of Wyoming's Absaroka Range (Attachment 3). These sites saw a dramatic increase in levels of grizzly bear activity after 2010 (Van Manen et al. 2021: Grizzly Bear Use of Insect Aggregation Sites), suggesting that, as in the case of increased meat consumption, increases in exploitation of fat-rich moths by grizzly bears have likely been in compensation for loss of whitebark pine

seeds. Parenthetically, these substantial increases in levels of bear activity on moth sites have been synchronous with comparative stasis in size of the GYE bear population (Van Manen et al. 2023), which debars a significant effect attributable to increasing numbers of bears.

38. The rapid emergence of heavy predation by grizzly bears on cow-calves in locales with comparatively long histories of sympatric cattle and bears highlights the extent to which recent histories of depredation are a poor basis for predicting a rapidly changing future, as was done by authors of the EA and BiOP. That having been said, broader trends in the GYE suggest that high levels of depredation can rapidly emerge in areas where whitebark pine has suffered heavy mortality, as in the mountains surrounding Paradise Valley and the East Paradise allotments (Figure 4a) – with a predictable toll on involved grizzly bears.

39. Points 28-36 throw into relief the fallacy of assuming that maintenance of a fixed historical human infrastructure, reckoned almost wholly in terms of grazing allotments, roads, and other human developments – as was done in the EA and BiOP – somehow accounts for all the factors driving grizzly bear demography in the GYE. The natural environment has changed dramatically in the GYE since 1998 (see Section 4 of Attachment 4), driving related changes in grizzly bear diets, habitat use, and interactions with humans. These changes during the last twenty years have clearly resulted in a dramatic change in the complexion and distribution of human-caused bear mortality, with a major shift to causes related to conflicts over meat – all while the extent of roads, developments, and grazing allotments has remained essentially the same as in 1998.

CHARACTERISTICS OF CATTLE DEPREDATION IN THE GYE

40. Citing Gunther et al. (2004) and Wells et al. (2019), the BiOP and EA repeatedly field claims that likelihood of grizzly bear cattle depredations on East Paradise grazing allotments is

very low, if not nil, because most depredations in the GYE have historically occurred later in the grazing season. This claim is fallacious because it conflates absolute numbers with risk, which is intrinsically pro-rated against exposure. The BiOP and EA also ignore the changing nature of grizzly bear depredation on cattle during the last 20 years, with important implications for forecasting risk and impacts for grizzly bears. The following points clarify the nature of these deficiencies.

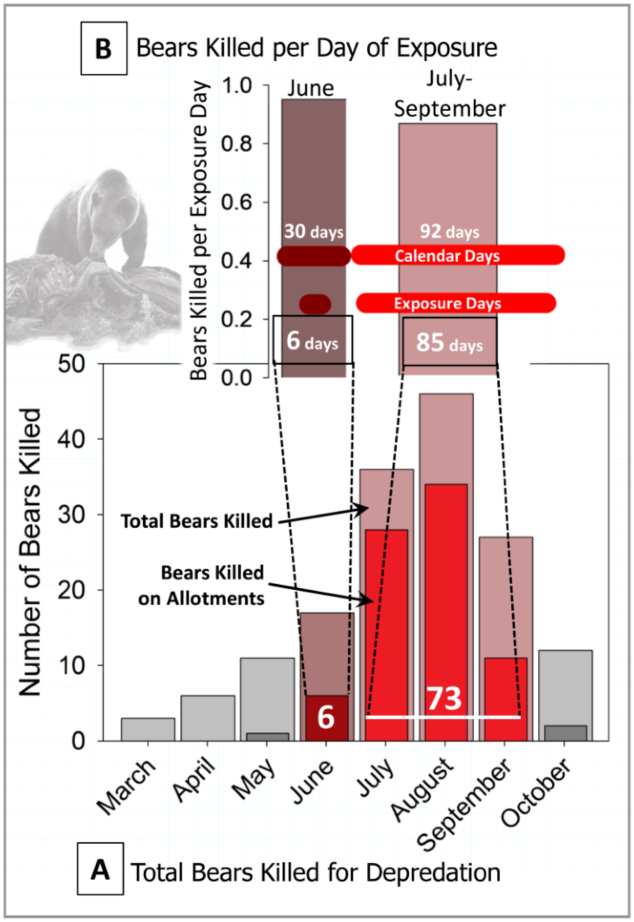


Figure 6.

The figures at left show the monthly distribution of grizzly bears killed because of depredation-related conflicts, both as a total number (A) and pro-rated to the numbers of cow-calves exposed to depredation (B). Bears killed on public land grazing allotments are differentiated from those killed on private lands by being shaded a darker hue, burgundy during June and red during July-September. Over 12-times as many bears were killed during the latter compared to the former period. However, this break-down is not pro-rated to numbers of cow-calves exposed to risk of depredation, as shown in (B). Based on calendar days alone, June accounts for 30 days and July-September for 92 days. After accounting for the total number of stocked allotments and the duration of stocking during each period (see Figure 1b and 1c), days during which calves are exposed is 6 and 85 for the two respective periods. With numbers of bears killed in the numerator and figurative numbers of calves exposed to risk of depredation in the denominator, daily per capita risk to calves and bears were comparable for June and July-September. This sort of calculation is analogous to how risk of crime is reported for various jurisdictions in the United States.

41. More than 90% of grizzly bear predation on cow-calves and related lethal removals of depredating bears during the last 30 years in the GYE have, indeed, occurred during July and August (Figure 6a; data from Craighead et al. 1988, Knight et al. 1988-1997, Schwartz et al. 1998-2011, Van Manen et al. 2012-2023). This statistic has been used in the EA and BiOP to

argue that cow-calves on grazing allotments are much less vulnerable to bear predation during June compared to the rest of the year. As a point of reference, most of these invoked depredations and related retaliatory killings of bears have occurred on the Bridger-Teton and Shoshone National Forests (NFs; Wells et al. [2019]).

42. Absolute numbers do not provide a basis for judging time-specific risks for livestock and grizzly bears on grazing allotments because absolute numbers do not account for total predation opportunities, i.e., the number of cow-calves and number of allotments that were stocked during a given month and available for bears to depredate. Analogously, risk of crime for jurisdictions in the United States is judged in terms of per capita rates rather than absolute numbers. As a result, cities with high absolute numbers of crimes such as New York City turn out to be three to four-times safer than places such as Brimingham, Alabama, that have much lower absolute numbers of crime.

43. When absolute numbers of depredations and lethal removals of bears are pro-rated to the number of allotments stocked during a given month, as well as number of days each is stocked during a given month (see Figures 1b and 1c; Intermountain Region, Bridger-Teton National Forest 2023; U.S. Forest Service 1996), time-specific rates are comparable for June and July-September (Figure 6b). More to the point here, the best available information suggests that risks to both bears and livestock on grazing allotments in East Paradise Valley will be roughly the same during June as during July-September, a critical aspect of judging consequences arising from an earlier stocking date that was not considered in the EA or BiOP.

44. Authors of the EA and BiOP invoked Gunther et al. (2004) and Wells et al. (2019) to dismiss out of hand risks associated with stocking the East Paradise allotments in June. In doing so, these authors failed to recognize that essentially all the data used in these papers came from

allotments that were stocked after June, as shown in Figure 1, and that Gunther et al. (2014) only considered depredations prior 2001, well before when environmental changes precipitated major dietary changes among Yellowstone grizzly bears. Gunther et al. (2004) and Wells et al. (2019) consequently had little or no basis for judging risks to cow-calves and grizzly bears arising from earlier stocking dates, especially post 2010.

45. Authors of the EA and BiOP furthermore apparently conflated stocking dates with stocking duration, which was the variable considered in Wells et al. (2019). Wells et al. (2019) did find that duration of stocking on allotments had little effect on number of depredations. However, Wells et al. (2019) *did not* address any effect attributable to *when* stocking began, largely because so few allotments were stocked prior to July (Figure 1).

46. Turning to patters of grizzly bear mortality associated with depredation-related conflicts, longer-term, removals of grizzly bears in the GYE because of predation on livestock shifted after 1998 from incidents predominantly involving depredation on sheep to incidents almost exclusively (>90%) related to cow-calf depredations (Figure 7a; data from Schwartz et al. 1998-2011, Van Manen et al. 2012-2023).

47. More important than this shift from conflicts involving sheep to conflicts involving cattle, the sex and age composition of bears killed because of livestock-related conflicts changed from predominantly (>60%) adult male grizzly bears prior to 2018 to predominantly other sex-age classes thereafter (Figure 7b). Even more problematic from a demographic perspective, the proportion of female deaths doubled from around 20% prior to 2016 to nearer 40% after 2020. Of these, roughly half were reproductive-aged females. The EA and BiOP failed to consider or address this demographically important trend.

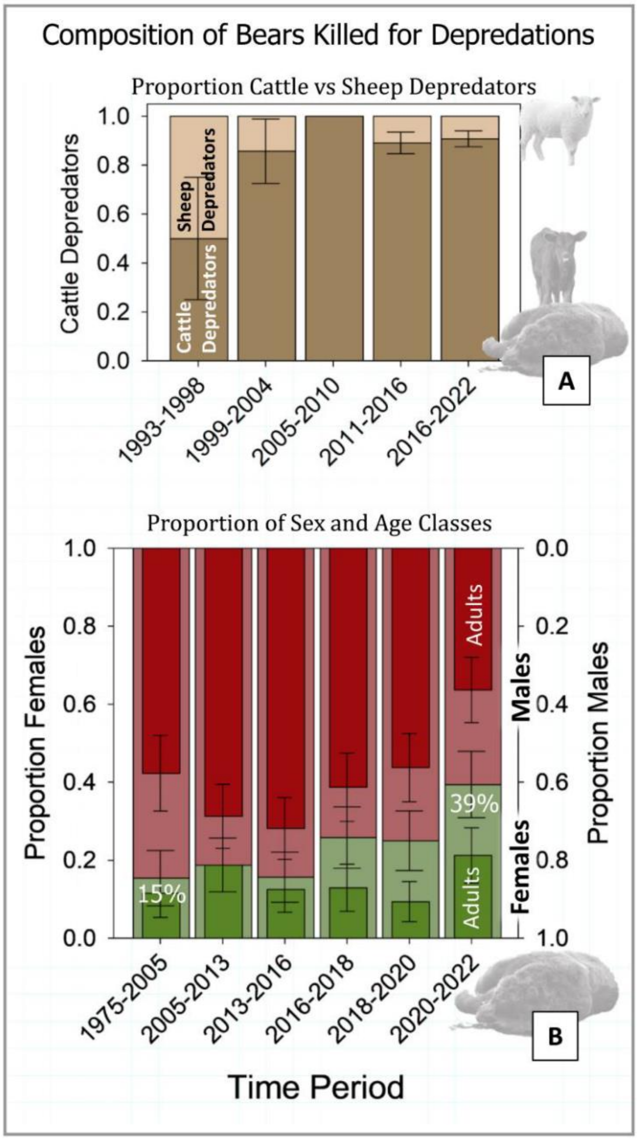


Figure 7.

The two bar charts at left show in (A) the proportional break-down of grizzly bears killed in retaliation for depredation on sheep versus cattle and in (B) the sex and age class of killed depredators. The proportion of depredators that killed cattle is shown in brown in (A) for five different 6-year periods. Bears involved in cattle depredation have accounted for virtually all those killed since 1999, in contrast to a preponderance involved in sheep depredation during earlier years. The sex-age composition of bears killed because of depredations are shown in (B) for time periods defined to provide comparable sample sizes. Males are shown in shades of burgundy, females in shades of green, and adults of each in darker hues. The representation of females increased substantially after 2016, and more than doubled during 2020-2022 compared to 1975-2016. By contrast, adult males declined from representing the preponderance (>60%) of depredators during 2005-2018 to accounting for proportionately nearly half as many during 2020-2022. These trends suggest that females are more often being killed because of depredation-related conflicts, of which almost all involve cow-calves.

48. This substantial increase in female mortality resulting from retaliations against predation on cow-calves compromises prospects for the GYE grizzly bear population for two key reasons. For one, growth of brown and grizzly bear populations has repeatedly been shown to depend on high survival rates among females – especially reproductive-aged females (Knight & Eberhardt 1985, Wiegand et al. 1998, Schwartz et al. 2006, Mace et al. 2012, Gosselin et al. 2015) – and, for another, growth rate of the GYE population substantially declined towards stasis around

2008, concurrent with terminal declines of whitebark pine and marked increases in consumption of meat from anthropocentric sources (Figure 4a, Van Manen et al. 2023).

49. The increasing representation of females among bears killed to prevent or retaliate for livestock depredation is indicative of a convergence of male and female bear diets on meat obtained under risky conditions (see Point 16), all of which reflects major environmental change in the GYE since roughly 2005 (see Section 4 of Attachment 4 and Points 28-30). More important, there is good reason to think that female grizzly bears will continue to comprise a large portion of bears killed because of future livestock-related conflicts, with implications for anticipating the composition of grizzly bear deaths in areas such as Paradise Valley and the East Paradise allotments.

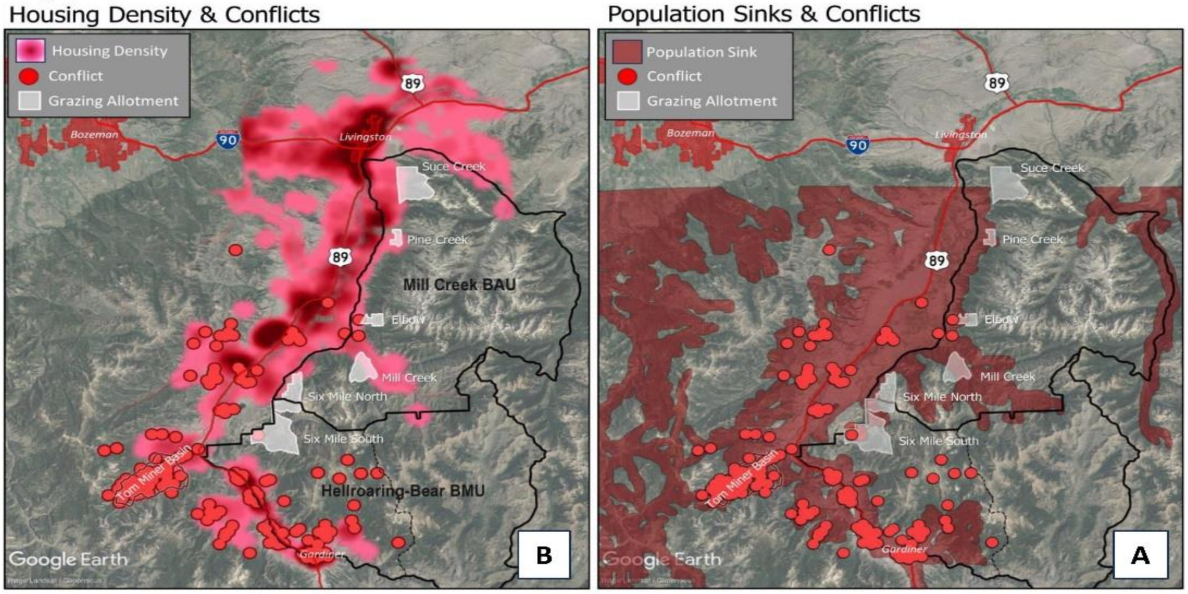
50. Overall, Points 31-46 highlight the extent to which any given extent and number of grazing allotments in the GYE is uncoupled from the toll taken by these allotments and associated cattle on the grizzly bear population. Even with somewhat fewer stocked allotments in the GYE compared to the baseline of 1998, two to three-times as many grizzly bears are being killed because of cattle-related conflicts, including proportionately more females, synchronous with plateauing of the GYE grizzly bear population (Figure 5c). Mindless tallies of numbers and acreages of public land grazing allotments, as in the BiOP and EA, provide little basis for assessing risks posed by cattle on Forest Service lands.

THE GEOGRAPHY OF EAST PARADISE GRAZING ALLOTMENTS

51. Paradise Valley is a singular wedge of human impacts dividing otherwise secure grizzly bear habitat in the Absaroka Mountains to the east from secure habitat in the Gallatin Range to the west. This wedge of bottomland was judged by Schwartz et al. (2010) to be a population sink for GYE grizzly bears – an area where modeled adult female survival was less than needed for

local population persistence (Figure 8a). A heavy human footprint is reflected in residential densities that, when averaged within a 1-square mile moving window, compromise grizzly bear survival under existing conditions in lower elevations of the Six Mile North, Mill Creek, Elbow, and Suce Creek allotments, as well as in all the Pine Creek allotment (Figure 8b; Park County Montana 2013). With a few exceptions north of Jardine, human-grizzly bear conflicts in the Paradise Valley area between 2010 and 2021 map almost exactly onto the population sink for grizzly bears associated with roads and residential areas (Figure 8a; data from Schwartz et al. 2011: Grizzly Bear-Human Conflicts in the Greater Yellowstone Ecosystem, Van Manen et al. 2012-2022: Human-Grizzly Bear Conflicts in Montana).

Figure 8.



The maps above show the nature and lethality of the human footprint in and near Paradise Valley. Map (A) shows areas in shades of burgundy that Schwartz et al. (2010) modeled as being population sinks for GYE grizzly bears. Sinks are areas where female mortality rates are too high to locally sustain bears. The truncation of sink areas to the north corresponds with the limits of mapped coverage by Schwartz et al. (2010). The map in (B) shows density of residential structures in Park County, Montana, averaged with a 1-square-mile moving window. Depiction of housing density is truncated to the west and east by County boundaries. The East Paradise grazing allotments are labeled and shown in white. Locations of human-grizzly bear conflicts documented during 2015-2022 are shown as red dots. Conflicts correspond almost exactly with both modeled population sinks and areas impacted by human residences, with both representations of human impacts overlapping substantially grazing allotment boundaries.

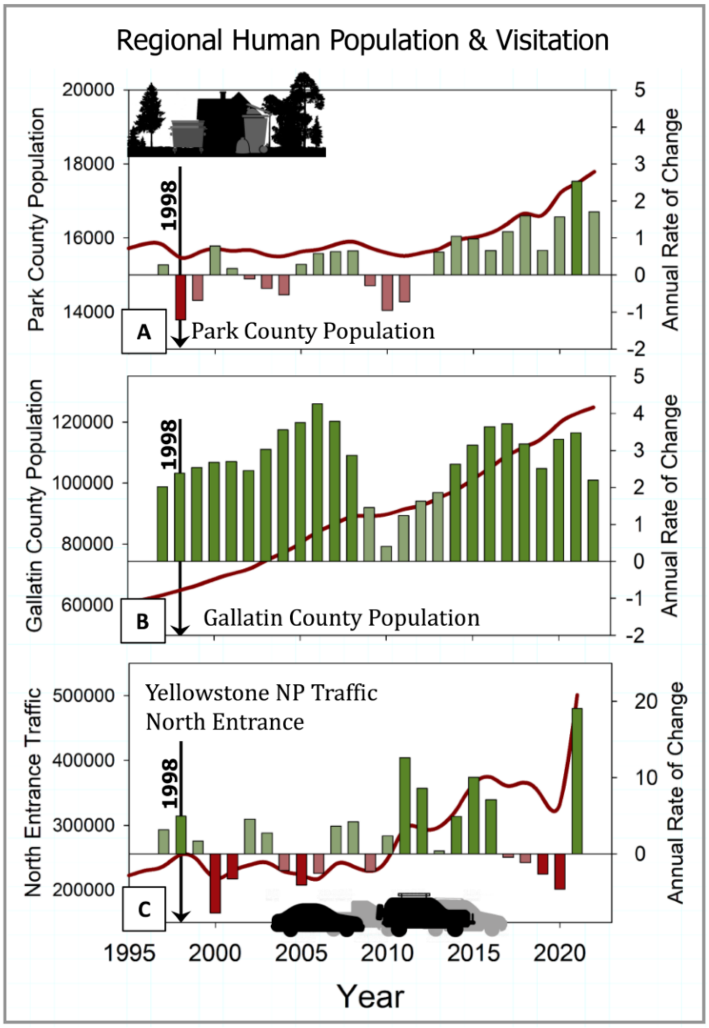


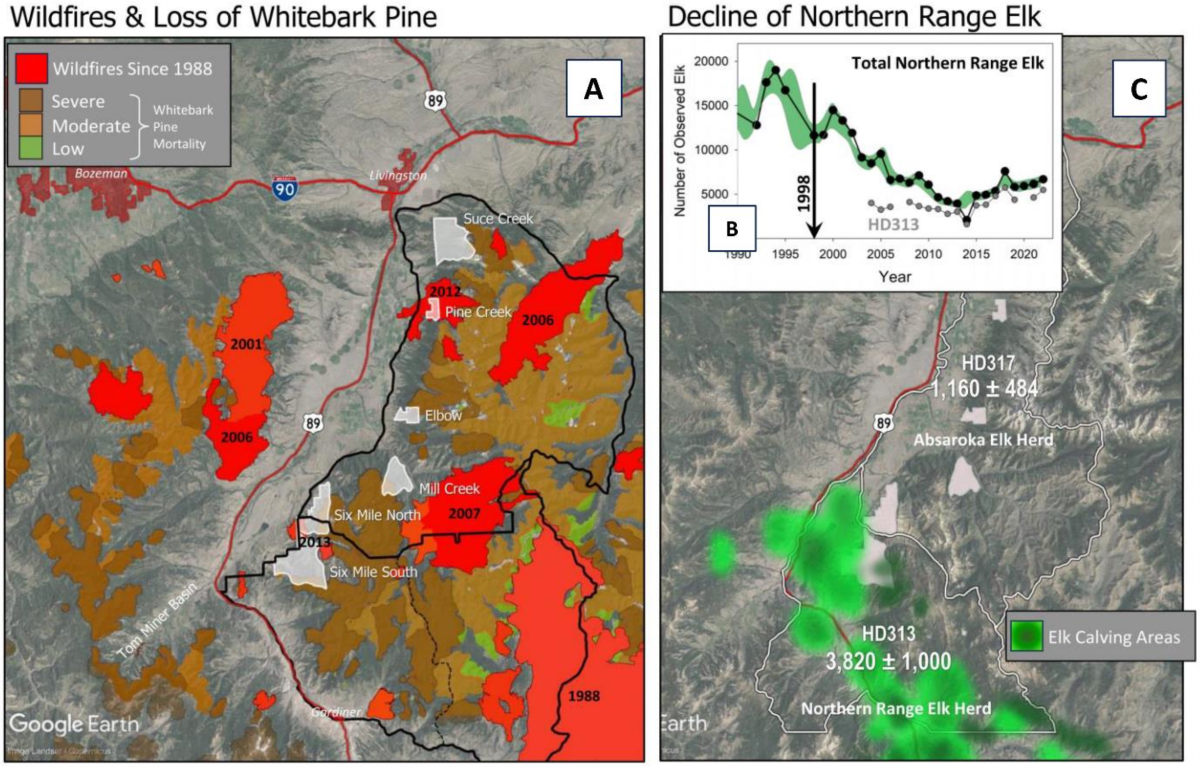
Figure 9.

The trend graphs to the left show trajectories and rates of growth for regional human populations and National Park visitation. Graph (A) shows population trend for Park County, Montana, which contains all of the East Paradise Valley allotments. Graph (B) shows trend for adjacent Gallatin County, which generates a substantial amount of recreational traffic on public lands in Park County, including Paradise Valley. Graph (C) shows annual numbers of vehicles entering Yellowstone National Park from the north through Paradise Valley, which likewise betokens a spillover of recreationists onto public lands in the Valley proper. Burgundy lines in each graph show a 3-year running average of populations or visitation; bars show annual rates of change, with green denoting a positive rate and red a negative rate. Rate of population growth in Gallatin County has consistently been high, whereas rate of growth in Park County has been more varied, except during the last 7 years when human numbers have mounted. Rates of change in visitation to Yellowstone have likewise varied but nonetheless resulted in an overall net positive increase since 2010. Overall, there are many more people living and recreating in the Paradise Valley area compared to before 1998.

52. Human impacts in and around Paradise Valley have mounted over time, especially since 2010, largely because of an increasing human population in Park County, mounting numbers of recreational visitors to the region, and spill-over of recreationists from nearby Gallatin County where the human population has doubled since 1998 (Figure 9; U.S. Census Bureau County Population Totals, U.S. National Park Service Stats Report Viewer). These trends compound the impacts of human infrastructure such as residences, roads, and trails on grizzly bears simply because there are far more people occupying or trafficking this infrastructure. Numerous studies have shown that loading more people on or near a fixed human infrastructure has substantial

deleterious effects on grizzly and brown bear demography, whether reckoned in terms of survival, density, or occurrence (e.g., Merrill et al. 1999, Suring & Del Frate 2002, Merrill & Mattson 2003, Johnson et al. 2004, Mattson & Merrill 2004, Schwartz et al. 2010, Apps et al. 2016, Mattson 2019, Lamb et al. 2020).

Figure 10.



Wildfires & Loss of Whitebark Pine

Decline of Northern Range Elk

These graphics show major changes in the abundance and distribution of key grizzly bear foods and habitats in and near Paradise Valley during the last 25 years. The East Paradise Valley grazing allotments are labeled and shown in white on each of the maps. Map (A) shows major changes in important vegetal foods attributable to wildfire and pathogens unleashed by warming temperatures. Areas in red show the extent of major wildfires, with dates of these fires shown for the largest. Areas shaded brown and green correspond with the distribution of whitebark pine. Dark brown shows areas where most whitebark pine were killed by a mountain pine beetle epidemic during 2000-2010. Areas shaded light brown denote areas of intermediate mortality and areas shaded green, areas where most mature whitebark pine survived. Figure (B) shows trend in size of the Northern Range elk herd, which comprises the elk on Hunting District 313 (HD313), encompassing the Six Mile South grazing allotment. The shaded green area in map (C) represents areas known to be used by elk for calving during June. Estimated sizes of the elk herds using HD313 and HD317 to the north are shown in white, with annual variation during the last 10 years shown as plus or minus one standard deviation. Important high-quality bear foods have substantially declined around Paradise Valley since 1998, leaving anthropogenic foods and native foods concentrated at lower elevations.

53. Remote higher-elevation habitats surrounding Paradise Valley have also been compromised for grizzly bears by deleterious environmental change since 1998 and in the Absaroka Range to the east by relatively unproductive conditions associated with cold and rocky subalpine or alpine habitats (e.g., Sells et al 2023a). Whitebark pine in areas near Paradise Valley was subject to pervasive moderate and severe mortality between 2000 and 2009, especially in areas surrounding the East Paradise grazing allotments (Figure 10a; Macfarlane et al. 2013). Large wildfires have additionally burned extensive areas since 2005 near the Six Mile South, Six Mile North, Mill Creek, and Pine Creek allotments (Figure 10a: Interagency Agency Fire Perimeter History).

54. Unlike in more productive regions of northwestern Montana where berry-producing shrubs are a key source of bear food, wildfires in the GYE do not yield short-term increases in high-quality bear foods at higher elevations, especially within the first 20 years (Blanchard 1983, Mattson & Knight 1989, Anderson 1994, Mattson 1997c). Notably, though, berry-producing shrubs such as chokecherry and serviceberry can be invigorated by wildfires at lower elevations typifying areas burned on the Pine Creek and Six Mile North and South allotments during the last 15 years (U.S. Forest Service 1997, 2000). A proliferation of berry-producing shrubs on these allotments would predictably attract both black and grizzly bears onto these allotments into areas used by cattle, especially in the absence of foods such as whitebark pine seeds that would otherwise keep bears at higher elevations.

55. Although GYE grizzly bears have clearly been more reliant since 2010 on meat obtained from ungulates (see Points 31-32), access to native elk has been compromised for grizzly bears in and near Paradise Valley by a near halving of the Northern Range elk population occupying Hunting District 313 (HD313) since 1998 (Figure 10b; MacNulty et al. 2016; Montana Fish,

Wildlife & Parks, HD 313 elk count: 2017-2022). This reduction in elk numbers predictably had and continues to have direct effects on grizzly bears ranging near the Six Mile South allotment. Farther north, elk in Hunting District 317 (HD317) have always been less abundant and are currently at roughly one-half the density of elk in HD313 (Figure 10c; Montana Fish, Wildlife & Parks, HD 317 elk count: 2015-2022).

56. This comparative dearth of native elk at a time when grizzly bears are more reliant on meat predictably increases the odds that bears will prey on cow-calves in and near Paradise Valley, a point that the EA and BiOP failed to consider.

57. Although GYE grizzly bears heavily exploit elk calves during June (see Point 15), cow-calves are predictably preferred prey for grizzlies during this same month (see Point 18). If anything, nearness to elk calving areas, as are the Six Mile South and North allotments (Figure 10c; Cunningham et al. 2009), would lure bears into areas occupied by preferred prey such as cow-calves with resulting heightened likelihood of depredation.

58. Vulnerabilities of cow-calves, spatial configurations of environmental change, and concentrations of productive habitats and high-quality foods at lower elevations typifying the East Paradise grazing allotments increase the odds that grizzly bears will depredate cow-calves, especially during June. This predictable dynamic is consistent with my personal observations of two cow-calves killed by black bears during June on private rangelands at lower elevations of the Suce Creek drainage within the last 5 years.

59. Patterns of grizzly bear depredation and human-bear conflict that have emerged in upper reaches of Paradise Valley during the last decade support this prediction. The map in Figure 4c shows distributions of documented conflicts (red dots) and grizzly bears killed by people (dead bear symbols) in and near the East Paradise grazing allotments (Van Manen et al. 2013-2023:

Human-Grizzly Bear Conflicts in Montana; Van Manen et al. 2011-2023). Although these conflicts and bear deaths have been concentrated to the south and west of the East Paradise allotments during the last 10 years, there is good reason to think that conflicts will emerge northward along an expanding front that encompasses the allotments.

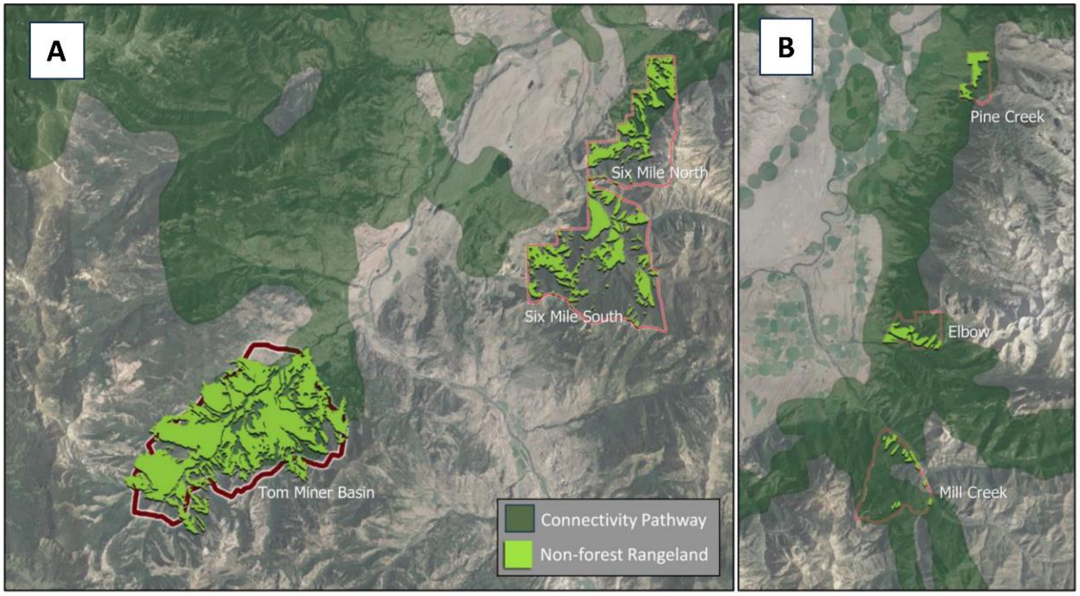
60. To date, most depredation-related conflicts in Paradise Valley have been concentrated in Tom Miner Basin, only five to seven miles distant from the Six Mile South and North grazing allotments (Figure 4c). Notably, cattle and grizzly bears were sympatric here for at least a decade without any documented depredation prior to a rapid escalation in bear predation on cow-calves following losses of whitebark pine in surrounding uplands (data from Montana Fish, Wildlife & Parks 2015, Van Manen et al. 2017-2023: Human-Grizzly Bear Conflicts in Montana). This trend, as in the upper Green River allotments of the Bridger-Teton NF (see Attachment 3), is an object lesson regarding how rapidly depredation-related conflicts could emerge in the East Paradise allotments and how the past is not a guide to the future – in contradiction to premises of the EA and BiOP.

61. Female grizzly bears with cubs-of-the-year (COY) have been increasingly documented near the Six Mile South, Six Mile North, Mill Creek, and Elbow allotments, which recommends additional caution when judging risks to the grizzly bear population arising from continued stocking of these allotments (Figure 4c; data from Van Manen et al. 2011-2023: Estimating Number of Females with Cubs). As I documented in Point 43 (Figure 7b), females are comprising an increasing portion of bears involved in depredations in the GYE, along with an increasing percentage of resulting lethal removals. Given the paucity of high-elevation foods, concentration of native foods such as berries at lower elevations encompassing the East Paradise allotments, and an apparent increasing reliance of female bears on meat, female grizzly bears of

reproductive age are at risk of becoming involved in depredation-related conflicts on these allotments and being lethally removed, evident in removal of a female with a cub in 2022 near the Six Mile allotments because of livestock depredation (Gould et al. 2023).

Figure 11.

East Paradise Allotments, Connectivity Areas & Pastures Edges



These maps show in light green the configurations of open pastures relative to forest and tall shrub cover on East Paradise Valley grazing allotments. These same configurations are shown in map (A) for in Tom Miner Basin, where grizzly bear depredations on cow-calves have been regionally concentrated during the past 14 years. Pastures and allotments are also shown superimposed on connectivity pathways modeled by Sells et al. (2023a). These pathways were defined as areas where higher probabilities of use by grizzly bears were denoted by Sells et al in shades of blue. These modeled pathways were truncated to the south in map (A) at the border of the Greater Yellowstone Ecosystem Recovery Area, which results in somewhat arbitrary exclusion of the Six Mile South grazing allotment. Open pasturelands were delineated by interpretation of high-resolution imagery from GoogleEarth.

62. Configurations of pastures, forest, and shrub-dominated bottomlands on the East Paradise allotments further increase odds of depredation on cow-calves by grizzly bears. As I document in Point 17, grizzly bears favor ambushing cattle (Bjorge 1983, Mattson 1990, Doan-Crider et al. 2017, Gastineau et al. 2019, Pop et al. 2023), which is facilitated by the availability of forests, shrublands, and rugged topography near where cattle graze. As illustrated in Figure 11, all the East Paradise allotments are typified by close interspersion of pastures with forest or shrubland

cover and, where not, characterized by relatively rugged terrain (Google Earth, 2023) that together make cattle more rather than less vulnerable to predation by grizzly bears.

63. Tom Miner Basin again provides an object lesson. As on the East Paradise allotments, pastures in Tom Miner Basin are closely interspersed with forest, shrub, and topographic cover, which has undoubtedly contributed to high levels of grizzly bear depredation in this area.

64. Despite indisputable evidence that changes in the natural and human environments similar to those occurring in and near the East Paradise allotments negatively affect grizzly bears, the EA and BiOP essentially dismiss these prospective effects out of hand. Cumulative and increasing impacts attributable to humans were given only passing reference, with little regard for the considerable body of scientific evidence showing that increasing human activity, whether near or far, has predictable negative effects on grizzly bears (see Points 51-52).

65. The EA and BiOP authors also cited papers such as Costello et al. (2014) to justify disregarding the effects of environmental change, including loss of whitebark pine. Attachment 4 provides a litany of reasons why Costello et al. (2014) is fundamentally flawed. However, even taking this research at face value, authors of the EA and BiOP failed to grasp that Costello et al. (2014) merely looked at movements by bears *within* established home ranges rather than concurrent dietary changes or longer-term changes in grizzly bear habitat use and home range locations in the aftermath of numerous weighty environmental changes that were culminating near the end of the period (2011) considered by the Costello et al. (2014) analysis. In short, Costello et al. (2014) provides little or no basis for assessing the impacts of environmental change on grizzly bears in or near Paradise Valley and is, in fact, contradicted by the evidence summarized in Points 30-39.

EFFICACIES OF MITIGATION AND PREVENTION

66. There is some evidence that selective removal of a few depredating grizzly bears can resolve conflicts for a short period of time (e.g., one to three years), contingent on specific circumstances (Anderson et al. 2002, Miller et al. 2016, Morehouse et al. 2016, Swan et al. 2017, Lennox et al. 2018, Proulx 2018). However, Murie (1948) and Linnell et al. (1999) cast doubt on the efficacy of such removals, which is consistent with the history of livestock depredation in Paradise Valley, notably in or near Tom Miner Basin, where at least 5 bears have been removed since 2014 without any evident abatement of depredations (Figures 4a and 4c).

67. There is both correlative and causational evidence suggesting that non-lethal measures can reduce levels of depredation for sustained periods of time, including: guardian dogs; selective deployment of electric fence and other deterrents; change in species, sex, and age of grazed livestock; closer guarding; relocation of pastures during key periods of livestock vulnerability; and removal of livestock carcasses (e.g., Bjorge 1983; Wilson et al. 2005, 2006, 2014; Karlsson & Johansson 2010; Miller et al. 2016; Treves et al. 2016; Eklund et al. 2017; Moreira-Arce et al. 2018; Khorozyan & Waltert 2019a, 2019b; Wells et al. 2019; Wilson 2023).

68. Of these measures, only the last has been invoked in the BiOP and EA for management of the East Paradise grazing allotments – with a repeated emphasis that far overstates the efficacy of carcass removals in preventing depredation by bears. Anderson et al. (2002) equivocate about the effectiveness of this measure, whereas Claar et al. (1986) and Bradley & Pletscher (2005) cast doubt on any benefits.

69. But, perhaps more importantly, there is definitive evidence from the GYE showing that retirement of livestock grazing allotments is the best means of eliminating or reducing depredation-related conflicts with bears. This is amply shown by lack of depredations on retired

allotments throughout the GYE (Attachment 3; Wells 2017, Wells et al. 2019), including a cessation of depredations after retirement of the Blackrock-Spread Creek allotment on the Bridger-Teton NF, where conflicts had been chronic since before the 1930s (Murie 1948, Knight & Judd 1983, Anderson et al. 2002), and a similar ending of depredations on retired sheep grazing allotments with long histories of chronic conflict (Johnson & Griffel 1982, Knight & Judd 1983, Jorgensen 1983, Van Manen et al. 2021).

70. Of relevance to this last point, the BiOP and EA dismiss Alternative 1 out of hand. This alternative would have retired all grazing on East Paradise allotments and almost certainly eliminated all prospect of future conflicts involving grizzly bears and cattle on Forest Service lands.

PARADISE VALLEY AND CONNECTIVITY PATHWAYS

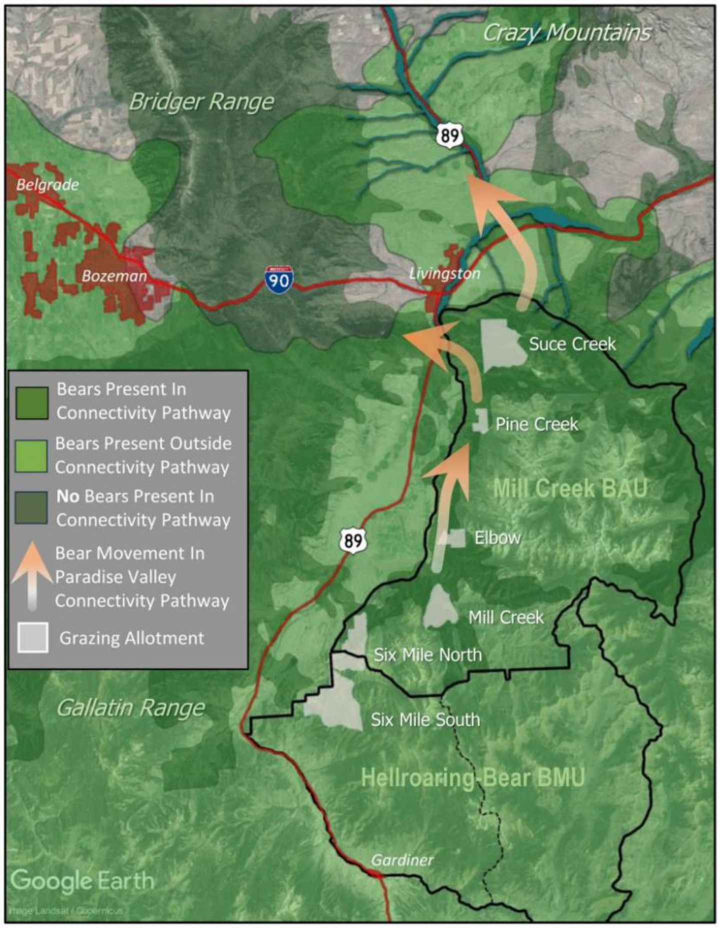
71. The US Forest Service and US Fish & Wildlife Service invoked Peck et al. (2017) in an email exchange during formulation of the EA and BiOP as a basis for claiming that the eastern side of Paradise Valley and the East Paradise grazing allotments are irrelevant to prospects for establishing connectivity between grizzly bear populations in the GYE and Northern Continental Divide Ecosystem (NCDE). This claim is in defiance of both Peck et al. (2017), more recent modeling results, and on-the-ground evidence.

72. Both Peck et al. (2017) and, more recently, Sells et al. (2023b) show a ‘feeder’ for grizzly bears dispersing into several connectivity pathways that originate on flanks of eastern Paradise Valley (Figure 12). This feeder connects with what is presumably a dominant pathway north from the Gallatin Range to the Bridger Range along highlands that cross the Yellowstone River immediately south of Livingston, Montana. Alone, these model-based results suggest that eastern

portions of Paradise Valley play a role in fueling dispersal and colonization that could result connecting the GYE and NCDE grizzly bear populations.

Connectivity Areas & "Bears May Be Present"

Figure 12.



The map at left shows connectivity pathways modeled by Sells et al. (2023a) for areas outside the current GYE Recovery Zone overlain on areas where the U.S. Fish & Wildlife Service has determined that grizzly bears 'may be present' (U.S. Fish & Wildlife Service) for the region encompassing Paradise Valley. Dark green identifies pathways where higher probabilities of use by grizzly bears were denoted by Sells et al in shades of blue on their pathway maps. Light green denotes areas where grizzly bears were known to be present as of 2022. East Paradise Valley grazing allotments are labeled and shaded white. Arrows show the main pathway skirting the east edge of Paradise Valley and western flanks of the Absaroka Mountains. This pathway is implicated in feeding dispersing and colonizing grizzly bears north into the Shields Valley and western slopes of the Crazy Mountains. Interestingly, grizzly bears have not yet been documented in most of the main pathway modeled by Sells et al. (2023) transecting the Bridger Range north of Interstate 90.

73. Perhaps even more compelling, maps produced by the US Fish & Wildlife Service documenting where 'bears might be present' show that grizzly bears have dispersed directly north from eastern portions of Paradise Valley and the Absaroka Mountains along a less likely route modeled to follow the Shields River Valley (Figure 12). In fact, dispersal along this route has advanced considerably farther than along the presumably dominant connectivity pathway between the Gallatin and Bridger Ranges. As is often the case, this more tangible evidence

suggests that models of bear dispersal can only approximate how bears will navigate real world landscapes.

74. Grizzly bears dispersing and colonizing north along the Shields Valley and through the Crazy and Castle Mountains have realistic prospects of connecting with grizzly bears that have been documented as far south from the NCDE as the Little Belt Mountains, roughly 50 miles away. This distance is within range of dispersal for male grizzly bears (McLellan & Hovey 2001, Proctor et al. 2004, Støen et al. 2006, Lamb et al. 2020) and along a route not interrupted by heavily trafficked Interstate Highways, as is the case with the connectivity pathway between the Gallatin and Bridger Ranges.

75. Of more immediate relevance to management of the East Paradise grazing allotments, the feeder that figuratively collects grizzly bears dispersing north into the Shields Valley as well as west along highlands south of Livingston, Montana, runs directly through all the focal East Paradise allotments, entailing all the risks for involved grizzly bears that I identified in Points 51-59.

76. As important, this lower elevation north-south oriented strip of productive-attractive habitat for grizzly bears is confined between bottomlands heavily impacted by humans and less productive-attractive higher-elevation. This configuration maximizes odds that grizzly bears will be concentrated in this strip and encounter cow-calves on East Paradise allotments, regardless of the density at which cow-calves may be stocked.

THE IMPORTANCE OF CONNECTIVITY

77. Neglect by the EA and BiOP of potential dispersal and colonization by grizzly bears along connectivity pathways originating from East Paradise Valley is all the more problematic

because of the extent to which connectivity is critical to achieving long-term viability of grizzly bears in the contiguous United States.

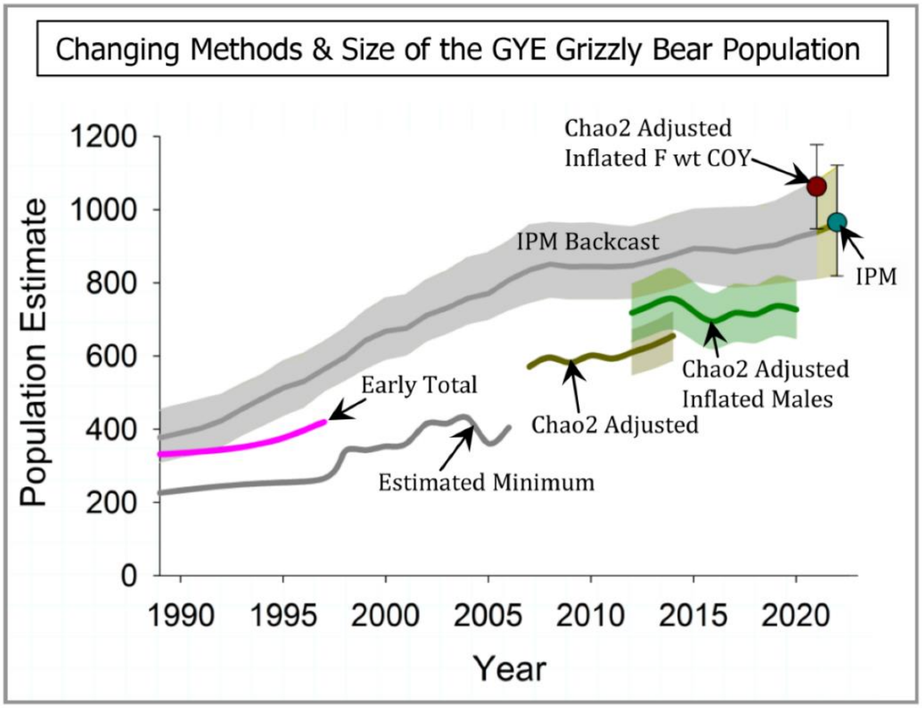
78. According to the current scientific consensus, long-term viability of populations is best defined in terms of conditions required to achieve roughly 99% probability of persistence for a period of approximately 40 generations (Reed et al. 2003, Frankham & Brook 2004, Reed & McCoy 2013). For grizzly bears, with average generation lengths of approximately 10 years, this time frame equates to around 400 years.

79. Given this definition, current research suggests that for a species such as the grizzly bear, with a low reproductive rate and a low ratio of effective to total population size, around 2,500-9,000 animals in a contiguous inter-breeding population are needed to attain long-term evolutionarily meaningful viability (Lande 1995; Reed et al. 2003; Cardillo et al. 2004, 2005; Frankham 2005; Brook et al. 2006; O'Grady et al. 2006; Traill et al. 2007; Frankham et al. 2014).

80. We are still far from reaching this benchmark for grizzly bears in the contiguous United States. Even the most optimistic estimates for total numbers of grizzly bears in the contiguous United States are in the range of 2,100 animals, but with these bears distributed among four isolated or partially isolated populations. Even the largest of these in the Northern Continental Divide and Greater Yellowstone Ecosystems number no more than about 1,000 bears (US Fish & Wildlife Service 2021, Van Manen et al. 2023).

81. Achieving meaningful viability for grizzly bears in the contiguous United States will require genetic and demographic connectivity among existing populations along with full colonization of the Bitterroot Recovery Area, entailing the vigorous functioning of connectivity pathways such as the one directing bear northward along the east side of Paradise Valley.

Figure 13.



This figure summarizes different estimates of population size for GYE grizzly bears based on seven different methods used between 1989 and 2022. Estimates derived from different methods are shown in different colors. Lavender shows trend in estimated *total* size of the population from Pease & Mattson (unpublished) and Eberhadt & Knight (1996). The dark gray line 1989-2006 shows the *minimum* number of bears estimated to be in the GYE population. The dusky and bright green lines (with associated confidence intervals) show estimated *total* population size using a method based on unduplicated counts of females with cubs-of-the-year (COY) multiplied by various factors to account for fractions of other sex, age, and reproductive classes. The increase in estimate size post-2011 resulted from inflating the estimated fraction of male bears in the population. The estimate for 2021 used the same basic method but inflated estimated number of females with COY by reducing the distance threshold for defining unique females. Finally, the estimate for 2022 was based on a method (Integrated Population Model or IPM) that integrated counts of females with COY and updated estimates of population vital rates. This method was then backcast to retrospectively estimate population size for previous years. Results of this exercise are shown in shades of gray. Managers and journalists frequently make claims about growth in size of the GYE population based on comparing estimates produced by these various incommensurate methods, analogous to comparing apples and oranges.

PROBLEMS WITH CURRENT ESTIMATES OF POPULATION SIZE AND TREND

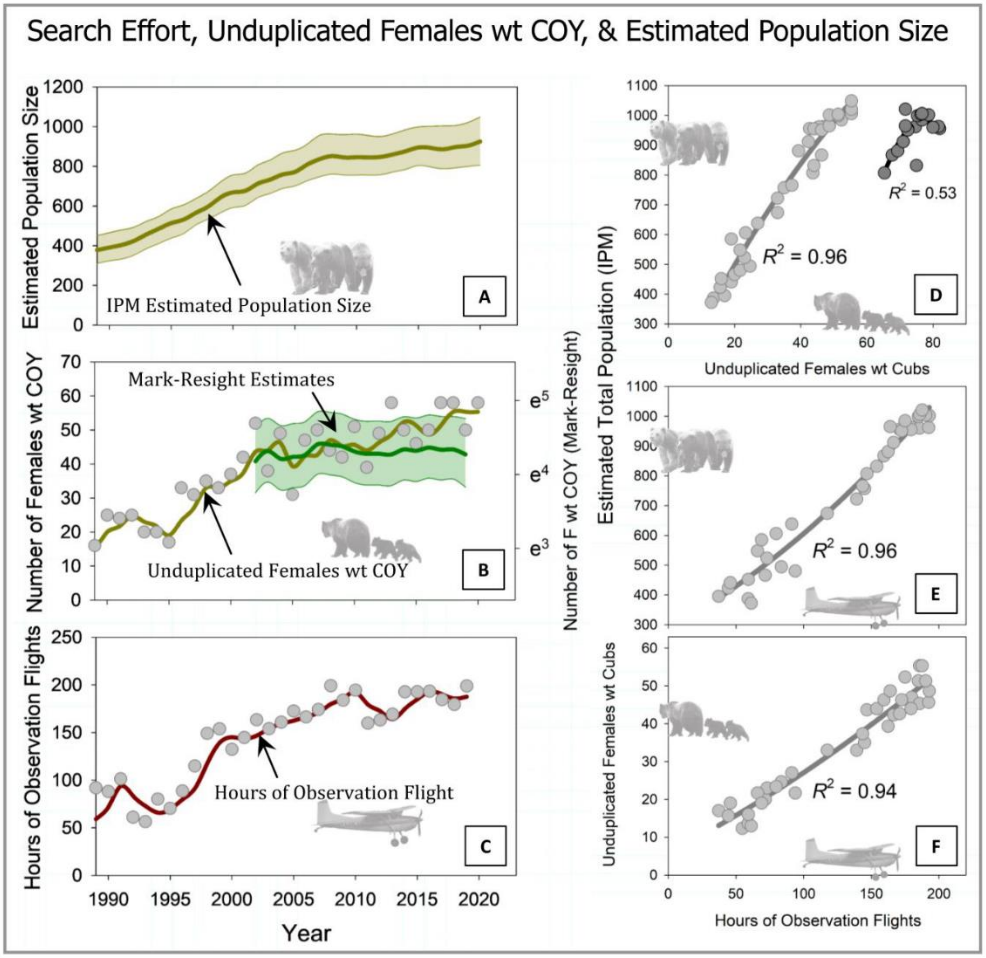
82. The importance of connectivity among grizzly bear populations in the contiguous United States for ensuring long-term viability is given greater weight by chronic and on-going problems with methods used to estimate population size and trend in the NCDE (Mattson 2019b) and

GYE. There is a long-standing critique of approaches used by agency scientists to estimate all aspects of grizzly bear demography in the GYE, as well as how this information is used in management decisions (Mattson & Reid 1991; Mattson & Craighead 1994; Craighead 1998; Mattson et al. 1996; Mattson 1996, 1997d, 1998; Doak & Cutler 2014a). Unresolved issues potentially introduce bias, uncertainty, and conceptual flaws (Doak & Cutler 2014b, Mattson 2016, Allendorf et al. 2019, Attachment 4).

83. Without presenting an exhaustive litany of potential flaws with current demographic analyses, Figures 13 and 14 along with Sections 2-9 in Attachment 4 illustrate a few key issues.

84. For one, representations of putative population increase during the last 30 years have largely been an artifact of changing methods rather than any real change in population size (Figure 13). Up until 2006, population size was reckoned in terms of a minimum number; between 2007 and 2015, as an estimate based on a statistical adjustment to counts of unduplicated females with cubs-of-the-year (COY), compounded by estimated fractions of different sex and age classes in the population; from 2013-2020, as an estimate using the same basic method, but with the fraction of male bears inflated by a substantial amount; in 2021, as an estimate based on methods employed during 2013-2020, but with a substantial increase in estimated numbers of females with COY based on a method that discounted distances between female sightings; and then, in 2022, by a more sophisticated method that incorporated estimated numbers of females with COY along with estimated population vital rates (i.e., an Integrated Population Model or "IPM"). IPM methods were then back-cast to estimate population size during previous years (for details and data see Pease & Mattson, unpublished; Knight et al. 1987-1993, 1997; Knight & Blanchard 1994-1996; Eberhardt & Knight 1996; Haroldson et al. 1998; Schwartz et al. 1999-2011; Van Manen et al. 2012-2023).

Figure 14.



The panels above illustrate problematic correlations between estimated size of the GYE grizzly bear population (as per the IPM, see Figure 13) and potentially confounding bias introduced by observer effort. As described in Figure 13, all recent annual estimates of population size have been largely informed by annual observations of unique (or unduplicated) females with cubs-of-the-year (COY). Many of these females with COY are observed during aerial overflights specifically designed to sight bears. Other observations are taken from at-large sources. The extent to which estimates of population size track estimated numbers of females with COY is evident in comparing (A) and (B). The extent to which both track observer effort (i.e., hours of observation flights) is evident by comparing panel (C) with panels (A) and (B). These relations are shown statistically in panels (D)-(F). Annual estimates of females with COY explain 96% of the variation in annual estimates of population size, and hours of observation flights likewise explains 96% of variation in estimated bear numbers as well as 94% of estimated unduplicated females with COY. All of this could be construed as meaning that observations of females with COY and derivative estimates of total population size are largely an artifact of observer effort rather than real population trends.

85. At face value, this last exercise highlights the extent to which the putative increases in size of the GYE grizzly bear population invoked in the BiOP, EA, and other government decision-making were – and continue to be – an artifact of methods and not real changes in population size, reinforcing the point I make above. Each change in methods instantaneously

added sometimes 100s of grizzly bears to total estimated population size without any change in real numbers of bears in the ecosystem. Even within the last year, revised methods yielded a reduction of 100 bears in the population estimate, independent of any real change in numbers of bears (Van Manen et al. 2023).

86. However, there is good reason for skepticism about estimates of size and trend produced by the IPM simply because of the extent to which these estimates continue to be informed by estimates of unduplicated females with COY, and the extent to which annual estimates of females with COY are correlated with search effort. Figure 14 highlights this issue by showing a juxtapose of trend in population size produced by the IPM (Figure 14a) with trend in 3-year-averaged estimates of unduplicated females with COY (Figure 14b) and 3-year-averaged hours spent by observers during aerial overflights systematically looking for bears (Figure 14c). Even a cursory visual examination suggests that all three are strongly correlated, which is borne out by the statistical relations shown in Figures 14d-14f. Annual estimates of unduplicated females with COY explain 96% of the variation in annual estimates of total population size (Figure 14d), and hours of observation flights explain 94% of variation in annual estimates of unduplicated females with COY (Figure 14e) as well as 96% of the variation in annual estimates of total population size (Figure 14f).

87. The likelihood that GYE grizzly bear population estimates are confounded by bias is compounded by the extent to which these estimates are also correlated with increasing numbers of bears using army cutworm moths in alpine areas of the Absaroka Mountains. Any grizzlies feeding at these sites are almost certain to be seen by aerial observers (Figure 15a; French et al. 1994, O’Brien & Lindzey 1998) in contrast to grizzly bears consuming pine seeds under typically dense forest canopies (Mattson 2000), which stand only a 7% chance of being seen. As

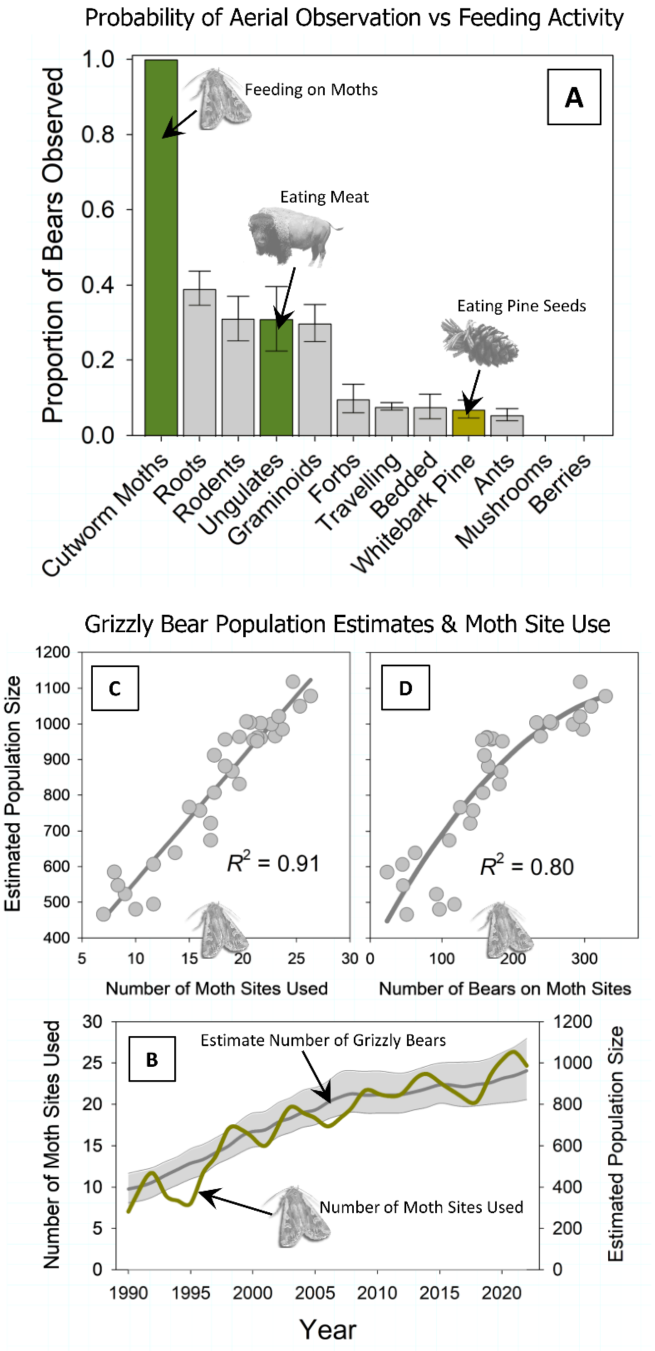


Figure 15.

The panels at left illustrate the extent to which changes in aerial observability of grizzly bears associated with changes in diet and habitat use could have biased estimates of population size and trend for the GYE grizzly bear population. The bars in (A) are proportional in height to the likelihood that a grizzly bear would have been visually observed from the air during radio-tracking flights as a function of the kind of activity that bear was engaged in (determined from later ground visits). Likelihood of observation varied by orders of magnitude. Notably, bears consuming army cutworm moths and meat from an ungulate were >10- and >3-times more likely to be seen, respectively, compared to bears eating whitebark pine seeds. Given that consumption of pine seeds has plummeted, and consumption of moths and meat has increased, these differences have major implications, in turn, for observations of females with COY and estimates of total population size (see Figure 14).

This potential bias is substantiated by how closely estimated numbers of GYE grizzly bears track number of moth sites annually used by grizzly bears (B). Statistically, number of exploited moth sites explains 91% of the variation in annual estimates of grizzly bear population size (C). Similarly, absolute numbers of bears observed on moth sites explains 80% of variation in population estimates. These relations could be construed as meaning that estimated numbers of GYE grizzly bears are largely an artifact of changes in sightability of bears associated with changes in food availability and diets.

relevant, bears feeding on ungulate carcasses have >30% chance of being observed. Given that consumption of pine seeds has plummeted while consumption of moths and meat has increased suggests that per capita sightability of bears has increased substantially during the last 20-30 years, increasing, in turn, the odds that any given bear will be seen whether during aerial overflights or by observers on the ground. Figure 15b shows how closely trends in estimated grizzly bear population tracks numbers of moth sites where grizzly bears were observed to consume moths. This visual approximation is corroborated by the fact that number of utilized moth sites explains 91% of variation in annual estimates of bear numbers (Figure 15c), and absolute numbers of bears observed on moth sites explains roughly 80% of variation in population size (Figure 15d).

88. One could conclude from these relations that annual estimates of total grizzly bear population size produced by the IPM are almost wholly an artifact of efforts by agency researchers to find females with COY each year and changes in diet and habitat use that have made grizzly bears easier to observe ground and aerial observers. Put another way, statistical relations this strong demand an irrefutable explanation of how they might exist without implying bias that severely compromises the validity of methods used to date to estimate size and trend of the GYE grizzly bear population – including the IPM (see also, Doak et al. 2014a, 2014b).

89. This last point should not be construed as suggesting that the GYE grizzly bear population has not grown during the last 30 years. Nonetheless, observations as simple as the ones presented in Points 78-81 cast doubt on the veracity of current estimates of population size and trend as well as any related assertions about size and trend made in the BiOP and EA (see also Points 12 and 34 above). As a bottom line, despite official representations to the contrary, there is, in fact, considerable uncertainty about status of the GYE grizzly bear population.

CONCLUSIONS

90. The East Paradise Grazing BiOP, EA, and WA are fundamentally flawed because they overlook and fail to account for a number of important and relevant factors about how the

decision may affect grizzly bears. Most claims in these documents invoke either a 1998 baseline of human infrastructure that is increasingly divorced from current, on-the-ground conditions; utilize recovery standards that have little or no support from the current scientific consensus regarding long-term population viability; and overlook, misconstrue, or misrepresent the best available science, choosing instead to rely on research that is suspect and of otherwise limited reliability (see Attachment 4). The EA and BiOP are further compromised by selective use of scientific and other evidentiary information, frequent misrepresentation or misunderstanding of referenced science, insufficient scope of analysis, and inadequate attention to the cumulative effects of changes in human activity and the natural environment on grizzly bears.

91. In my expert opinion, the analysis of how implementation of the East Paradise Range Allotment Management Plan in the BiOP, EA, and WA will likely affect GYE grizzly bears falls short and fails to provide a complete and accurate picture of the likely effects to grizzly bears and is not adequate for reaching a fully informed defensible decision.

92. Contrary to the limited analysis and statement included in the EA and BiOP, a sufficient analysis similar to what I've attempted to provide here would likely reveal that the East Paradise decision will harm individual grizzly bears and adversely affect prospects for meaningful recovery of not only the GYE grizzly bear population, but also grizzly bears in the contiguous United States, primarily by impairing prospects for colonization of additional habitat within the GYE and connectivity between the GYE and NCDE populations.

93. The BiOP and EA also fail to address the importance of meat in grizzly bear diets worldwide, the historical reliance of GYE grizzly bears on meat from ungulates, the extent to which grizzly bears can be formidable predators, the vulnerability of cow-calves to bear predation, and the extent to which configuration of East Paradise allotments favors ambush

predation by bears. Contrary to statements in the BiOP and EA, all these factors make grizzly depredation on cow-calves in the project area likely. This failure compounds problems introduced in the BiOP and EA by reliance of the authors on blind projection of site-specific history into a rapidly changing future with little resemblance to the past.

94. Grizzly bears in the East Paradise area are further hemmed in by relatively unproductive albeit remote highlands to the east and bottomlands heavily impacted by humans to the west, with the East Paradise grazing allotments sitting squarely astride a relatively narrow strip of attractive mid-elevation habitats likely to be used by grizzly bears, not only *in situ*, but also in transit north. This superimposition maximizes odds of livestock-related conflicts and resulting grizzly bear deaths – as if by design.

95. The BiOP, EA, and WA further fail to address implications of substantial increases in consumption of meat by GYE grizzly bears catalyzed especially by post-1998 losses of whitebark pine seeds – with much of this increase attributable to exploitation of cow-calves on public land grazing allotments. On-going trends in depredation and the sex-age composition of involved bears delegitimizes rote invocation of site-specific history, as is done in the BiOP and EA, and instead requires judicious extrapolation of evidence and trends from elsewhere. When done properly, emerging evidence and patterns support the conclusion that depredation-related conflicts will increase – potentially with surprising rapidity – in east Paradise Valley.

96. The BiOP and EA further invoke removal of cattle carcasses from allotments as a cure-all to prevent grizzly bear depredation in defiance of limited evidence for the efficacy of this tactic on public land allotments away from the residences of livestock owners. At the same time, the BiOP and EA dismiss out-of-hand the measure with greatest surety of preventing depredations: retirement of all grazing allotments in East Paradise Valley

I declare under penalty of perjury that the foregoing is true and correct.

Dated this 6th day of November, 2023.

David J. Mattson

David J. Mattson

DECLARATION OF DAVID J. MATTSON

Attachment 1.

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