

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

WILDEARTH GUARDIANS, a non-profit organization,

Plaintiff,

vs.

RYAN ZINKE, as Secretary of the Department of the Interior; the UNITED STATES DEPARTMENT OF THE INTERIOR, a federal department; GREG SHEEHAN, as acting director of the U.S. Fish and Wildlife Service; and the UNITED STATES FISH AND WILDIFE SERVICE, a federal agency,

Federal-Defendants.

No. 17-cv-00118-DLC

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 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.

My dissertation focused on the ecology of grizzly bears in the Greater Yellowstone Ecosystem (GYE) during 1977-1996 (Mattson 2000). I intensively studied grizzly bears in the GYE during 1979-1993 as part of the Interagency Grizzly Bear Study Team (IGBST) and was charged with designing and supervising field investigations during 1985-1993. My field research focused on human-grizzly bear relations; grizzly bear foraging, habitat selection, diet, and energetics; and availability and ecology of grizzly bear foods. I have continued to closely observe grizzly bears and their habitats in the GYE since the end of my intensive field investigations in 1993.

Although my field studies in the GYE ended in 1993, my involvement in grizzly bear-related research, management, and education, both regionally and internationally, has continued through the present. Throughout my career 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, nationally, at the Smithsonian (Washington, DC) and American Museum of Natural History (New York, NY), and, regionally, at the Denver Museum of Natural History (Denver, CO), the Museum of Wildlife Art (Jackson, WY), and the Museum of the Rockies (Bozeman, MT).

Attachment 2 is my Research Record as of 2011 prior to my retirement.

2. The grizzly bear sport hunt planned to begin in Wyoming and Idaho on September 1, 2018, will likely cause irreparable harm to Greater Yellowstone's grizzly bears. This irreparable harm will occur not only immediately upon implementation of the hunt, but also longer-term by entrained effects that will magnify long-standing and newly emergent threats. These threats include deleterious environmental changes and resulting dietary shifts manifest in burgeoning lethal conflicts with humans; a population that is isolated and too small to insure viability; uncertain and misleading monitoring methods that debar timely remediation by managers; and a punitive management regime that entails purposeful population reduction, inadequate conflict prevention, and vague dilatory aspirations to facilitate population connectivity.

Each point that follows more fully explicates this thesis, which each point building on the ones before to clarify how a sport hunt during fall of 2018 will be the figurative straw that broke the camel's back, in this case embodied by elements of a natural and manmade system that have synergistically brought Greater Yellowstone's grizzly bear population to crisis.

3. The grizzly bears killed by a sport hunt and lost to subsequent entrained effects will be of disproportionate importance to conservation and recovery, not only within the contiguous United States, but also continentally and globally. The reason is simple. Greater Yellowstone grizzly bears are ecologically, evolutionarily, and historically unique among bears worldwide.

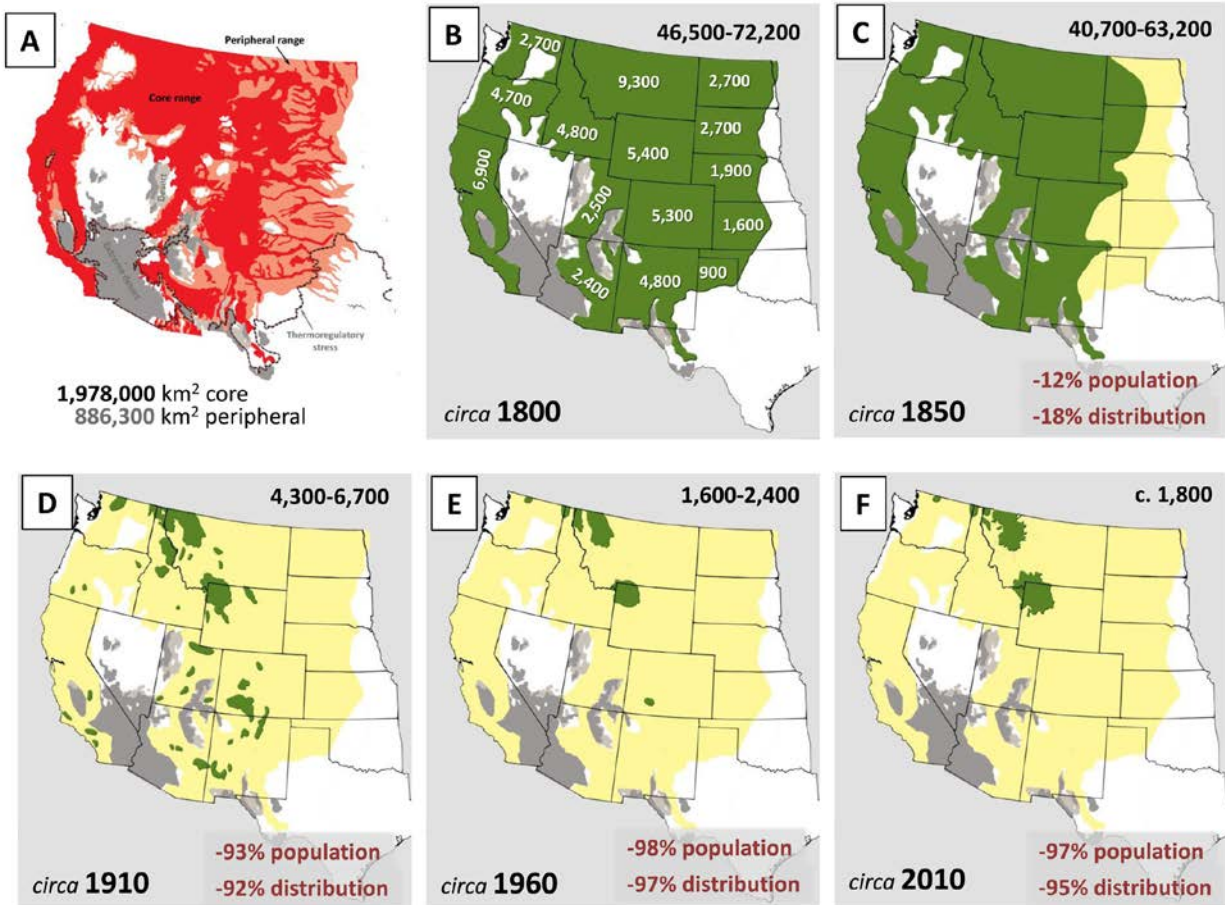


Figure 1. Losses of grizzly bear numbers and distributions in the western contiguous United States between 1800 and 1960 (Panels B, C, D, and E) along with the extent of gains since roughly 1970 (Panel F), largely under ESA protection. The extent of grizzly bear distributions at each time step are shown in green and the extent of losses in yellow. Estimated total populations are shown in the upper right corner of each figure and estimated cumulative losses of populations and distributions in red in the lower right-hand corner. Panel (A) shows estimated core and peripheral historical range relative to the extent of extreme desert and hot climates that would have imposed thermoregulatory limits on the distributions of grizzly bears.

Grizzly bears in the Greater Yellowstone region are the southernmost remnant of the 3% relic left after extirpations perpetrated by Europeans between 1800 and 1960 (see Fig. 1), and for that reason alone are of particular importance. As context, losses would almost certainly have been much greater without

Endangered Species Act (ESA) protections (Mattson and Merrill 2002), although gains since listing have been sufficient to recoup only 1% of the totality lost during the 1800s and early 1900s.

Greater Yellowstone's grizzly bear population is also important from an evolutionary standpoint as part of a currently rare genetic lineage (Clade 4¹) of brown bears that was one of three clades or subclades first emigrating from Eurasia to North America during the Pleistocene. These bears spread from Beringia south to middle latitudes of North America sometime before 30,000 years ago, prior to when continental ice sheets of the Last Glacial Maximum isolated grizzly bears to the south from conspecifics to the north. Since then, most bears of the Clade 4 lineage have been extirpated, and now consist only of a small relic in Hokkaido, Japan, and grizzly bears residing south of central Alberta and southeast British Columbia (Waits et al. 1998, Miller et al. 2006, Davison et al. 2011). These Clade 4 bears once occupied all of the western contiguous United States, south into Mexico, and bore the brunt of European-caused extirpations, resulting in the loss of roughly 95% of all bears belonging to this genetic lineage in North America, if not the world (Mattson, 2017, What's in a grizzly name,

<https://www.grizzlytimes.org/single-post/2016/11/11/Whats-in-a-Grizzly-Name>).

Conservation and recovery of Greater Yellowstone's grizzly bears are all the more important given that they are part of this rare and much diminished genetic lineage.

Finally, of ecological relevance, Greater Yellowstone's bears continue to exhibit behaviors and diets that were once widespread in mid-latitudes of North

¹ Clades and subclades are roughly equivalent to subspecies and the nomenclature currently preferred by taxonomists and phylogeneticists for referencing noteworthy genetic lineages within species.

America, but now largely vanished due to historical extirpations. The Greater Yellowstone ecosystem is thus a museum, and the grizzly bears within a truly rare relic of much that has been lost behaviorally. Overall, Greater Yellowstone's grizzly bears exhibit foraging behaviors, diets, and habitat relations that are unique in North America, and possibly the world.

More specifically, nowhere else in the world do grizzly bears depend, as they do in Greater Yellowstone, largely on energy and nutrients from army cutworm moths (*Euxoa auxiliaris*), whitebark pine seeds (*Pinus albicaulis*), elk (*Cervus elaphus*), bison (*Bison bison*), and, prior to 2000 (see ¶ 6), spawning cutthroat trout (*Oncorhynchus clarki*; Mattson et al. 2004). Although some have claimed that grizzly bears along the Rocky Mountain East Front in Montana have similar diets, bears here obtain most of their meat from livestock and deer rather than elk and bison (Aune and Kasworm 1989), very few seeds anymore from whitebark pine (Smith et al. 2008, Retzlaff et al. 2016), and unknown but probably only regionally minor amounts of army cutworm moths (White et al. 1998).

Of lesser energetic importance—but emblematic of behaviors lost to historical extirpations in the western U.S.,--grizzly bears in the GYE are also the only, worldwide, to currently eat substantial amounts of mushrooms, biscuitroots (*Lomatium cous*), yampah (*Perideridia gairdneri*), and pocket gopher (*Thomomys talpoides*) root caches, plus non-trivial amounts of wasps, bees, earthworms, and roots of sweet-cicely (*Osmorhiza* sp.) and pondweed (*Potamogeton* sp.) (Mattson 1997, 2000, 2002, 2004; Mattson et al. 2002a, 2002b, 2004, 2005).

Greater Yellowstone grizzly bears are truly ecologically special and unique.

4. Greater Yellowstone grizzly bears will be acutely vulnerable to any additional mortality caused by sport hunting simply because their birth rates are so low. In fact, grizzly bears are among the least fecund terrestrial mammals in the world, and certainly in North America. Figure 2 contextualizes this seminal point by locating grizzly bears relative to other terrestrial placental mammals in terms of three signifiers of fecundity: (1) annual reproductive rate; (2) age at which females reach sexual maturity; and (3) age at which a reproductive female replaces herself in the population. Grizzly bears, along with polar bears, have the lowest reproductive rate and longest generation length of any terrestrial mammal in North America. Globally, only elephants and some primates are less fecund. By contrast, black bears in North America produce ten to twenty- times as many cubs per unit area and exist at ten-times the densities of sympatric grizzly bears (Mattson et al. 2005).

As a consequence, grizzly bear populations are unable to accommodate appreciable human-caused mortality without declining, and even small rates of decline, if sustained, can result in catastrophic losses. Of relevance, even though annual rates of decline in grizzly bear populations in the western contiguous U.S. averaged only -3 to -4% between 1850 and 1910, cumulative losses totaled 90% (Mattson and Merrill 2002; Fig 2). This sensitivity of grizzly bear populations to even small, added increments of mortality leaves managers with little margin of error.

Consistent with this thesis, Weaver et al. (1996: 964, 972) succinctly note in their overview of carnivore conservation in the northern U.S. Rocky Mountains: “Grizzly bears...possess much less resiliency [than other carnivores] because of

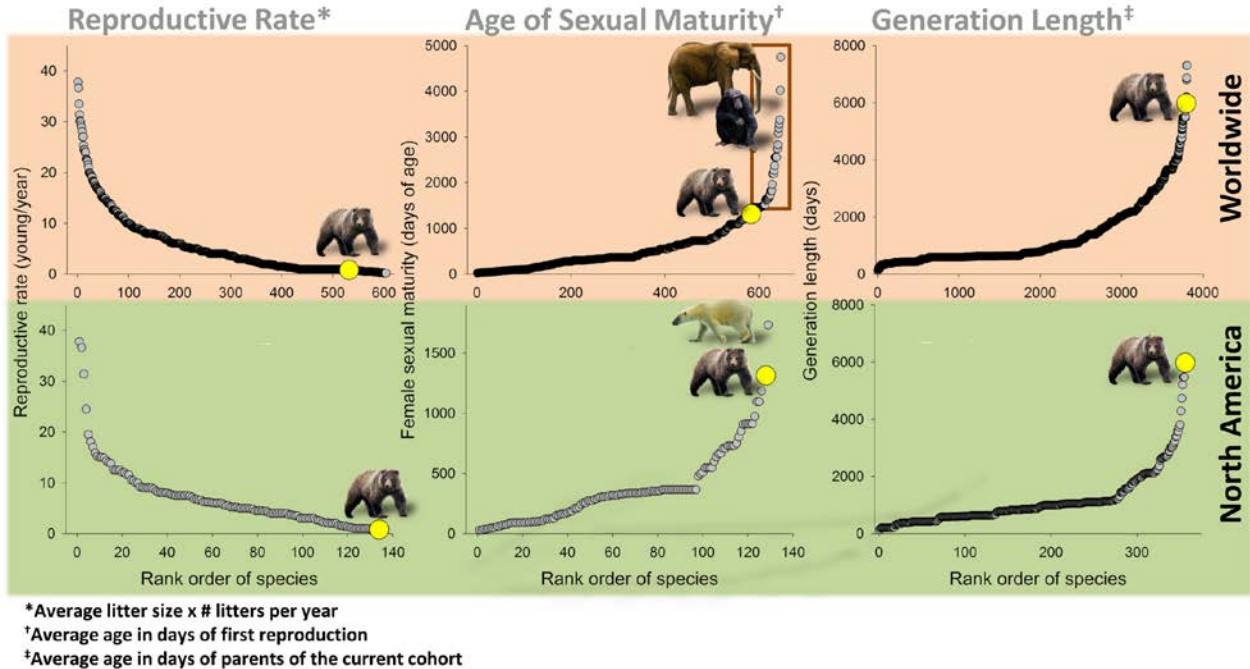


Figure 2. Signifiers of population productivity for grizzly bears (large yellow dots) relative to all other terrestrial mammals, worldwide (top) and in North America (bottom). Sources: Ernest, S. K. (2003). Life history characteristics of placental nonvolant mammals. *Ecology*, 84(12), 3402-3402.

<https://doi.org/10.6084/m9.figshare.c.3297992.v1>; Pacifici, M., Santini, L., Di Marco, M., Baisero, D., Francucci, L., Marasini, G. G., ... & Rondinini, C. (2013). Generation length for mammals. *Nature Conservation*, 5, 87-94. <http://datadryad.org/resource/doi:10.5061/dryad.gd0m3>; Tacutu, R., Craig, T., Budovsky, A., Wuttke, D., Lehmann, G., Taranukha, D., Costa, J., Fraifeld, V. E., de Magalhaes, J. P. (2013). Human Ageing Genomic Resources: Integrated databases and tools for the biology and genetics of ageing. *Nucleic Acids Research*, 41(D1), D1027-D1033. <http://genomics.senescence.info/species/query.php>

their need for quality forage in spring and fall, their low triennial productivity, and the strong philopatry² of female offspring to maternal home ranges.” I cover the implications of philopatry under ¶ 5.

The need for high-quality spring and fall forage leads to a conclusion seemingly at odds with the fact that grizzly bears are omnivores. Grizzlies do, in fact, require high-quality forage, optimally with high concentrations of fat

² Philopatry refers to the extent to which offspring share space and other resources with their mothers subsequent to attaining independence.

(Erlenbach et al. 2014), typically provided by only a few foods in environments that are otherwise paradoxically over-run with alternate but low-quality foods. Such is the case with Greater Yellowstone grizzly bears, as described above (§ 3), that have depended on just four main foods for most energy and nutrients. In contrast to the many other foods available to Greater Yellowstone bears, the euphemistic “Big Four” provide much higher concentrations of net digested energy

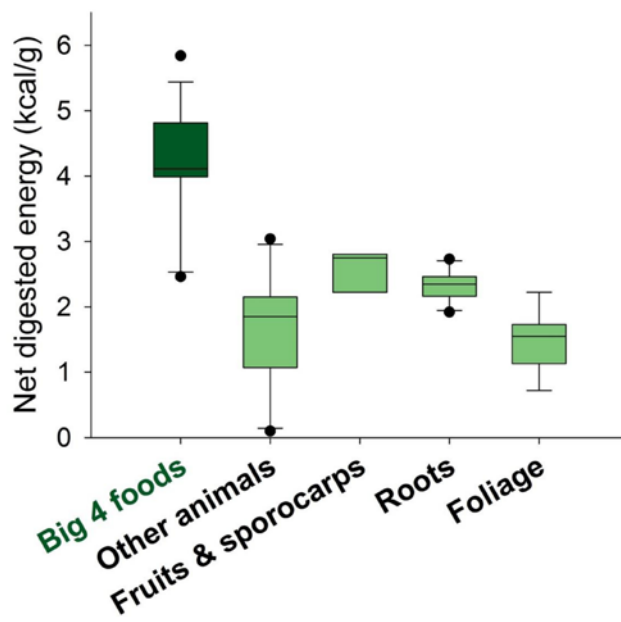


Figure 3. Median net digested energy available from the “Big 4” bears foods (whitebark pine seeds, army cutworm moths, meat from bison and elk, and cutthroat trout) versus all other known, alternate, foods in the GYE.

(Fig. 3; Mattson et al. 2004). As a consequence, grizzly bears such as those in Greater Yellowstone —as well as elsewhere in the world (Hilderbrand et al. 1999; McLellan 2011, 2015; Nielsen et al. 2017; Hertel et al. 2018) — can be affected in potentially major ways by losses of a high-quality mainstay food, despite compensatory subsistence for periods of time on low-quality alternate foods.

5. The effects of any mortality arising from a sport hunt will be aggravated, not only by low fecundity, but also by the isolation and small size of Greater Yellowstone’s grizzly bear population. The Greater Yellowstone population is, in fact, isolated and has probably been so for roughly a century (Miller and Waits 2003; Haroldson et al. 2010). This isolation is intrinsically problematic: first,

because the genetic diversity of Greater Yellowstone grizzly bears is lower than that of any other mainland North American grizzly bear population (Miller and Waits 2003); and second, because the current population of roughly 700 bears is far fewer than the thousands currently deemed necessary to ensure long-term viability (e.g., 99% probability of persistence for 40 generations; Lande 1995; Brook et al. 2006; Traill et al. 2007, 2010; Frankham et al. 2014). More to the point, Reed et al. (2003) estimated that, for species such as grizzly bears, minimum viable populations need to be near 9,000 when managed for little or no increase, as is the case for the GYE population (see also ¶ 8).

These viability considerations create a mandate for connectivity (e.g., Craighead and Vyse 1996; Servheen et al. 2001; Carroll et al. 2001, 2003, 2004; Proctor et al. 2005) that poses yet more problems, given the limited ability of grizzly bears to colonize even nominally nearby areas. Averaged across relevant studies (Blanchard and Knight 1991, McLellan and Hovey 2001, Proctor et al. 2004, Støen et al. 2006, Zedrosser et al. 2007, Norman and Spong 2015), female brown/grizzly bears disperse only around seven-miles from their natal ranges, in contrast to twenty-six miles for male bears. Assuming that annual survival rates in current protected areas apply to bears colonizing connective habitat, it would take female grizzlies roughly 80 years, and male grizzly bears roughly 50 years, to colonize areas 100 miles distant (note that the pace of colonization is slower than might be expected for males, given that their advance is pegged to the advance of reproductive females, barring the next to last generational step). Meaningful recovery and long-term viability is thus rendered nearly impossible if grizzly bears are subject to higher levels of mortality on the population periphery, as would

likely be introduced by sport hunting (see also ¶ 8).

6. All of these foundational considerations of relevance to the effects of sport hunting are being manifest in an environment typified by major losses of important grizzly bear foods. Since the mid-1990s climate warming and non-native invasive species have caused substantial deleterious and long lasting changes in the demography and diets of Greater Yellowstone grizzly bears. As described in ¶ 3, grizzly bears in the Greater Yellowstone Ecosystem once obtained most of their energy and nutrients from just four foods, or food-groups: (1) army cutworm moths; (2) elk and bison; (3) cutthroat trout; and (4) whitebark pine seeds. But predation by non-native lake trout, coupled with unfavorable climate-driven changes in the hydrology of spawning streams, had functionally extirpated cutthroat trout as a grizzly bear food by around 15 years ago (Kaeding 2010, Gunther et al. 2011; Fig. 4e). Soon after, between 2000 and 2010, 40 to 70% of all mature whitebark pine in the Greater Yellowstone Ecosystem were killed by an outbreak of mountain pine beetles (*Dendroctonus ponderosae*) driven by climate warming (Macfarlane et al. 2010, Van Manen et al. 2016). On top of these losses, almost all Greater Yellowstone Ecosystem elk populations declined between 1995 and 2010 (Fig. 4a) as a result of predation, deteriorating summer forage conditions, and sport hunting (Vucetich et al. 2005, Evans et al. 2006, Griffin et al. 2011, Brodie et al. 2013, Proffitt et al. 2014). As elaborated further below, the losses of cutthroat trout and whitebark pine likely catalyzed dietary changes that resulted in increasing grizzly bear mortality and stalling population growth.

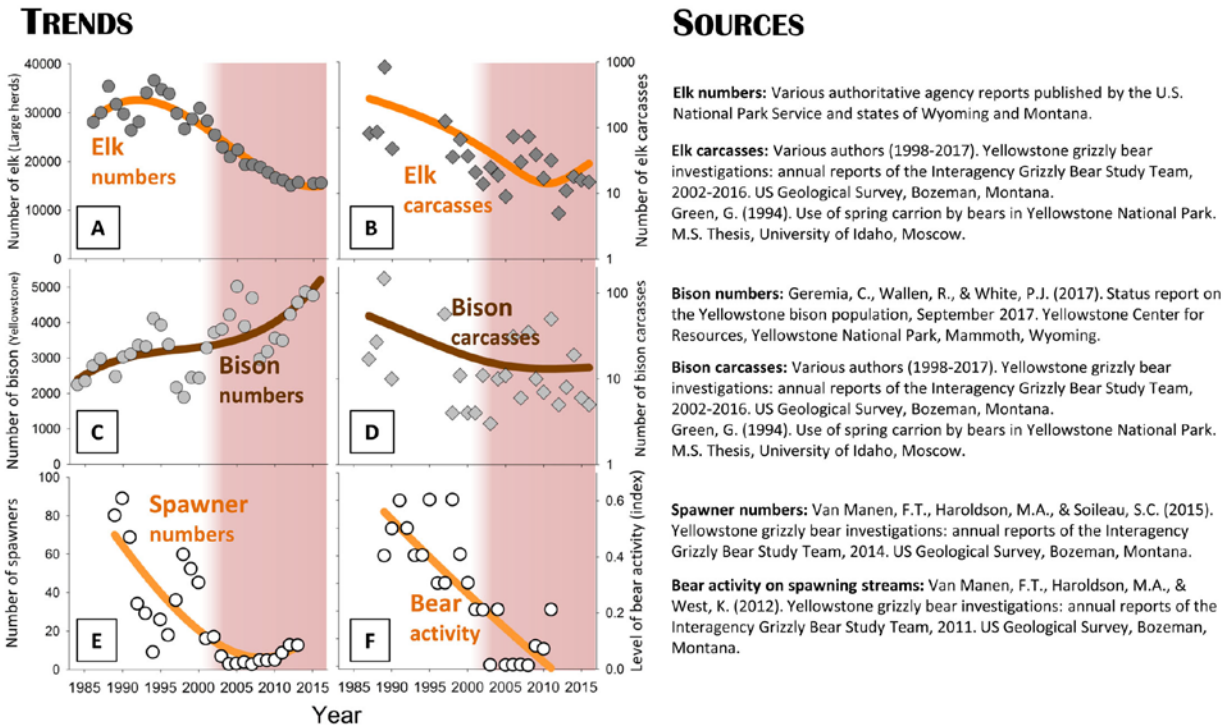


Figure 4. Summary of trends in availability of three important Greater Yellowstone Ecosystem grizzly bear foods, including: (A) size of the Northern Yellowstone and Jackson elk herds; (B) numbers of elk carcasses counted along fixed transects in Yellowstone National Park; (C) size of the Northern and Central bison herds; (D) numbers of bison carcasses counted along transects in Yellowstone Park; (E) numbers of spawning cutthroat trout counted in front-country streams around Yellowstone Lake; and (F) levels of indexed bear activity (scats and tracks) along these same streams. Sources for time series data are given to the right of each pair of graphs.

I have summarized key transitions in environments, diets, and demography of Yellowstone grizzly bears in Figures 4 and 5. Consumption of meat from large herbivores began to steadily climb around 2002 (Fig. 5d), soon after major declines in numbers of spawning cutthroat trout (Figs. 4e, 4f), and coincident with the onset of major losses of whitebark pine trees to bark beetles (Macfarlane et al. 2013). Meat consumption continued to increase after the mid-2000s when, of relevance to grizzly bears subsisting on pine seeds, losses of mature whitebark pine trees to beetles were no longer offset by what had been a fortuitous series of large cone

crops (Fig 5d).

Several researchers, including Middleton et al. (2013), Schwartz et al. (2013), and Ebinger et al. (2016), hypothesized that increased consumption of meat from large herbivores by Greater Yellowstone grizzlies was in compensation for losses of cutthroat trout and whitebark pine seeds. The weight of available evidence certainly makes this the most plausible of any candidate explanation. If so, this begs the question of where grizzly bears obtained additional meat given that elk populations had declined substantially (Fig. 4a), and that spring availability of ungulate carcasses on ungulate winter ranges either declined or remained static (Figs. 4b, 4d) despite increases in bison populations (Fig. 4c). Given these trends, grizzly bears plausibly obtained more meat from early-summer predation on elk calves, evident in a tripling of grizzly bear-specific calf mortality rates between the mid-1980s and mid-2000s (Middleton et al. 2013). Otherwise, grizzly bears likely obtained more meat during summer from livestock and, during fall, from remains of elk killed by big game hunters.

These latter two sources of meat are implicated in the exponential increases of grizzly bears dying because of conflicts over livestock depredation and encounters with big game hunters (Fig. 5c), coincident with the terminal decline in ecosystem-wide availability of whitebark pine seeds beginning in 2007 (Fig. 5d). These dramatic increases in hunter- and livestock-related grizzly bear deaths — signifying greater reliance by bears on meat — substantially contributed to sustained increases in total grizzly bear mortality in the Greater Yellowstone Ecosystem beginning, again, around 2007 (Fig. 5b). Death rates of cubs and yearlings also increased substantially during this same period (Van Manen et al.

2016), consistent with greater reliance on meat by reproductive females. Not surprisingly, the steady increase in grizzly bear deaths during the last eleven to twelve years correlates with a static number of reproductive females in the ecosystem (Fig. 5a). Van Manen et al. (2016) claim that this drop in population growth rate was caused by increasing grizzly bear densities and related increases in bears killing bears. These authors point to increasing rates of cub and yearling deaths as evidence of their thesis.

However, their thesis fails for several reasons. First, at the same time that numbers of reproductive females remained static, the distribution of the population increased by over 40% (Fig. 5a). Axiomatically, population-wide densities dropped rather than increased, given that essentially the same number of bears was spread over a much larger area. Second, the expansion of a static population over a larger area is consistent with a decline in carrying capacity, which is consistent, in turn, with losses of key foods that occurred during the last fifteen to twenty years. Third, the modeling reported by Van Manen et al. (2016) is at odds with straight forward data showing a 3.6% per annum increase in grizzly bear deaths in the Greater Yellowstone Ecosystem at the same time that population size remained more-or-less constant — hence, basic math dictates that death rates (numbers of bears dying divided by numbers of live bears) likely increased (Fig. 5b). Finally, increased rates of cub and yearling deaths are plausibly attributed to a shift by reproductive females towards eating more meat, which, even with constant bear densities, predictably exposes dependent young more often, not only to predatory grizzly bears (Mattson et al. 1992b, Mattson 2000), but also to predatory wolves (Gunther & Smith 2004).

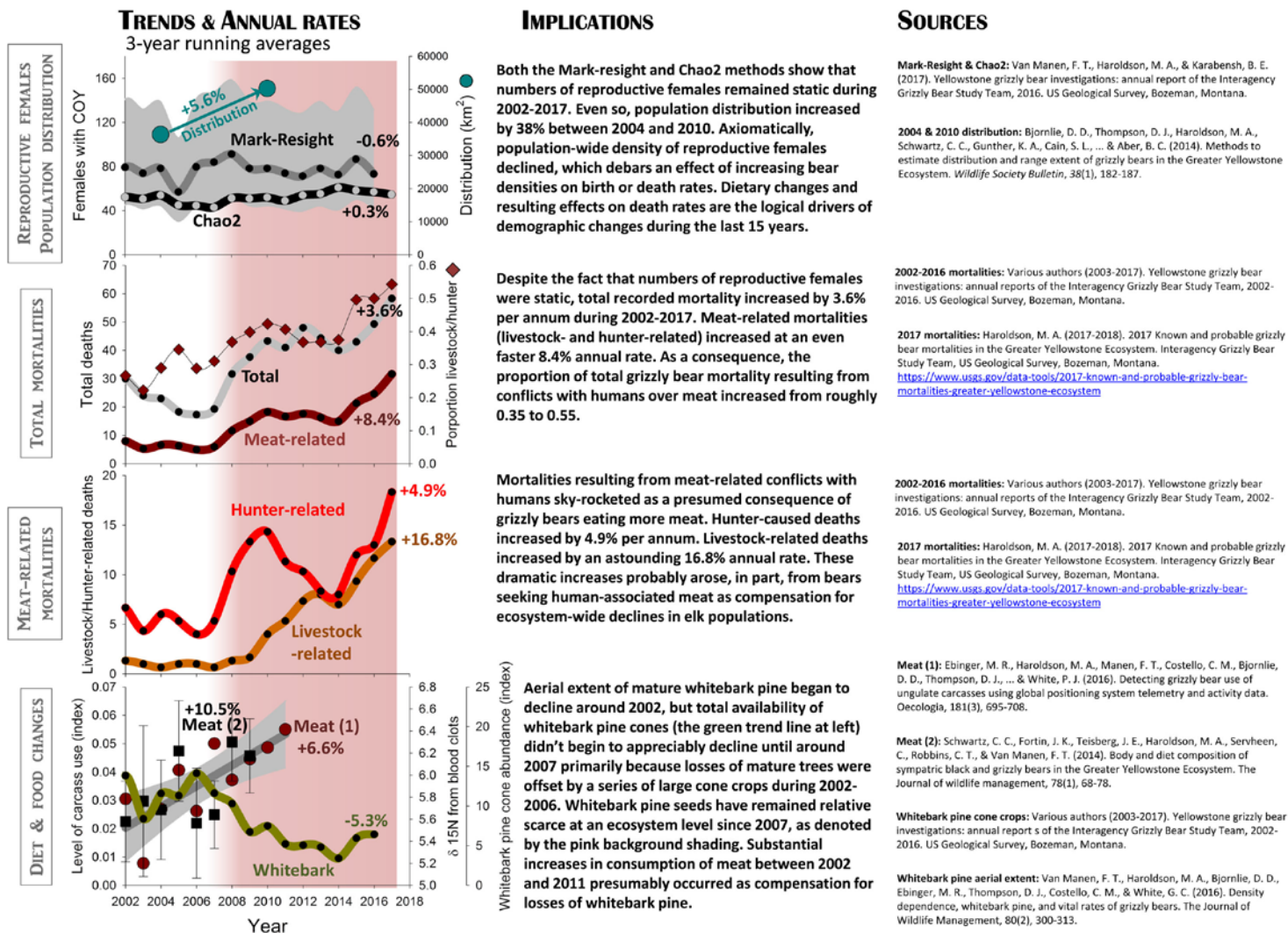


Figure 5. Synopsis of population, mortality, and dietary trends of Greater Yellowstone Ecosystem grizzly bears relevant to dynamics unfolding from 2002 to 2017. Sources for each data time series are provided farthest right, with a brief discussion of implications provided in the middle column. The pink-shaded background spanning all time series denotes the onset and subsequent persistence of whitebark pine losses caused by mountain pine beetles.

This collective evidence renders implausible central claims made by the FWS about Greater Yellowstone Ecosystem grizzly bears and their habitat, largely based on complicated, flawed models (see my comments submitted to the FWS dated 5 May (FWS_Pub_CMT_004008) and 7 October, 2016 (FWS_Pub_CMT_001630)). FWS argues that the population has grown, reached a static, invariable carrying capacity, and has thus spread-out commensurate to increases in population size, fully compensating for losses of key foods by eating other largely unspecified foods, without any explicit demographic consequences.

By contrast, the weight of evidence more defensibly suggests that losses of cutthroat trout and whitebark pine precipitated shifts to more hazardous diets comprised increasingly of human-associated meat, resulting in more dead grizzly bears, stalled growth in numbers of reproductive females, and burgeoning conflicts between people and grizzly bears on an ever-expanding population periphery (e.g., Van Manen et al. 2012, 2013). Moreover, theoretical (Doak 1995) and empirical (McLellan 2015) evidence of lagged responses by grizzly bear populations to deteriorating environmental conditions suggests that negative demographic trends will continue, especially given declines in future recruitment caused by the recent increases in mortality rates of young bears (Van Manen et al. 2016).

The picture painted by a clear-eyed comprehensive look at all of the available evidence is of a population in trouble, largely as a consequence of low reproductive rates, isolation and small population size, deleterious habitat changes – including the loss of important food sources – caused directly or indirectly by humans, compounded by lethal human responses to emerging arenas of conflict. The plight of such a population will be unambiguously worsened by the additional

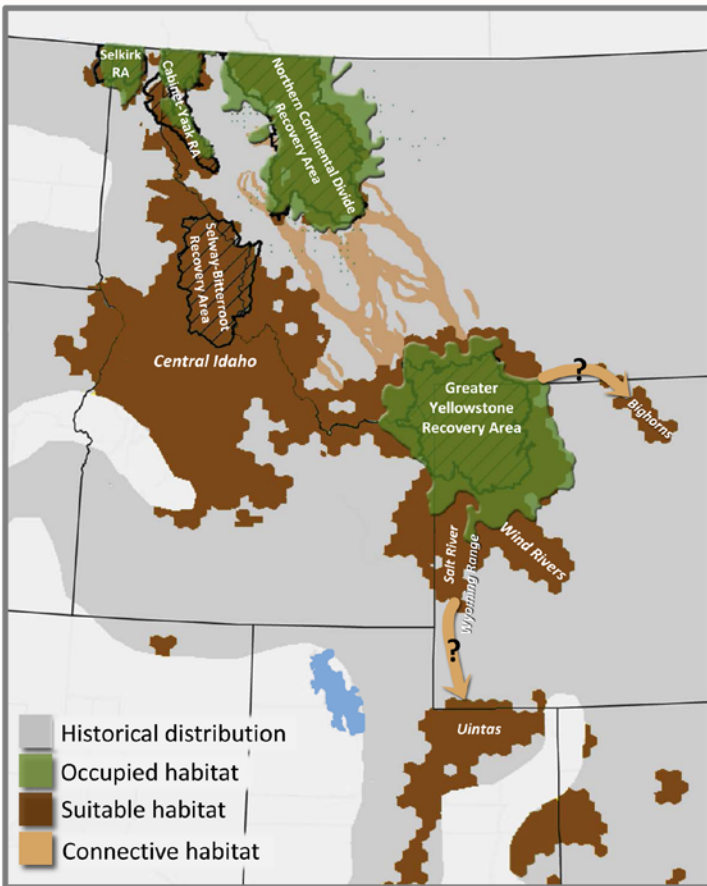
burden of deaths caused by sport hunting.

7. Given the magnitude of historical losses (98 percent), comparatively small subsequent gains (approximately 2 percent), and current environmental deterioration, management of Greater Yellowstone Ecosystem grizzly bears would logically seek to accelerate rather than curtail expansion of this population into adjacent as-yet-unoccupied suitable habitat. Yet sport hunting in the fall of 2018 promises to do the opposite and, given the problematic context described in ¶ 6, this is likely to result in irreversible negative consequences.

With connectivity and colonization of suitable adjacent habitat, Greater Yellowstone bears would have access to more foods in more areas to compensate for unfolding losses; long-term genetic health would be assured; the population would be more resilient to future environmental changes simply because of larger size; colonization of currently unoccupied potential habitat in the Selway-Bitterroot Recovery Area of central Idaho would be facilitated; and colonization of other suitable areas farther south, in expanses depopulated during the heyday of human lethality, would be more likely.

Achieving such goals is obviously contingent on whether suitable habitat and connective corridors are located contiguous to or nearby occupied grizzly bear habitat. Figure 6 summarizes the results of research conducted by numerous researchers designed to identify potential corridors and other habitat suitable for long-term occupancy by grizzly bears in the U.S. Rocky Mountains, including areas farther south. There is clearly ample contiguous habitat with potential to sustain resident grizzly bears to the west of the Greater Yellowstone Ecosystem

into central Idaho, thence north through the Selway-Bitterroot Recovery Area, and, further north yet, connecting with the Cabinet-Yaak Recovery Area. Substantial potential habitat also extends south in Wyoming into the Wind River, Wyoming, and Salt River Ranges.



SOURCES

Historical distribution:

Mattson, D. J., & Merrill, T. (2002). Extirpations of grizzly bears in the contiguous United States, 1850–2000. *Conservation Biology*, 16(4), 1123-1136.

Suitable habitat:

Merrill, T., Mattson, D. J., Wright, R. G., & Quigley, H. B. (1999). Defining landscapes suitable for restoration of grizzly bears *Ursus arctos* in Idaho. *Biological Conservation*, 87(2), 231-248.

Carroll, C., Noss, R. F., & Paquet, P. C. (2001). Carnivores as focal species for conservation planning in the Rocky Mountain region. *Ecological applications*, 11(4), 961-980.

Merrill, T., & Mattson, D. (2003). The extent and location of habitat biophysically suitable for grizzly bears in the Yellowstone region. *Ursus*, 171-187.

Mattson, D. J., & Merrill, T. (2004). A model-based appraisal of habitat conditions for grizzly bears in the Cabinet–Yaak region of Montana and Idaho. *Ursus*, 15(1), 76-89.

Singleton, P. H., Gaines, W. L., & Lehmkuhl, J. F. (2004). Landscape permeability for grizzly bear movements in Washington and southwestern British Columbia. *Ursus*, 15(1), 90-103.

Carroll, C. (2005). Unpublished analysis of habitat suitable for grizzly bears in the western United States. Klamath Center for Conservation Research, Orleans, CA.

Connective habitat, GYE to NCDE:

Peck, C. P., Manen, F. T., Costello, C. M., Haroldson, M. A., Landenburger, L. A., Roberts, L. L., ... & Mace, R. D. (2017). Potential paths for male-mediated gene flow to and from an isolated grizzly bear population. *Ecosphere*, 8(10).

Figure 6. Currently occupied grizzly bear habitat in the northern U.S. Rocky Mountains (green) in relation to suitable, but unoccupied, habitat (dark brown) and potential dispersal routes between the Greater Yellowstone and Northern Continental Divide ecosystems (tan). Probable dispersal routes to the Bighorn Mountains and Uinta Mountains are also identified.

Additional but disjunct potential habitat occurs in the Uinta and Bighorn Mountains to the south and east of habitat contiguous with current grizzly bear distribution in the Greater Yellowstone Ecosystem. As research by Peck et al.

(2017) and others have shown, independent of capacity to sustain resident bears, corridors sufficient to host transient grizzly bears also exist between the Greater Yellowstone Ecosystem and Northern Continental Divide Ecosystem, suggestive of additional corridors south and east of the Greater Yellowstone Ecosystem able to support colonizing dispersers.

However, all of this research makes a critical assumption: that human lethality is constant, and that the only features varying from one location to another are habitat productivity and remoteness from humans. Lethality can be understood as the probability that, given an encounter with a human, the involved bear will end up dead (Mattson et al. 1996a, 1996b). In other words, lethality can vary independent of habitat productivity and remoteness from humans, with landscapes becoming more or less deadly for grizzly bears depending on how lethality is managed — most notably, whether killing of grizzly bears is licensed or otherwise encouraged by those with authority over grizzly bear management. If management regimes become more lethal, as would be the case with sport hunting, even the most remote and productive wilderness can become inhospitable for grizzly bears, debarring colonization.

8. The Memorandum of Agreement (MOA) that governs management of Greater Yellowstone's grizzlies after removal of Endangered Species Act (ESA) protections virtually guarantees that conditions will become more lethal for bears, and that sport hunting, as per what is planned starting September 1, 2018, will be an ingredient. Even though each state's commission has expressly reserved the right to deviate from the MOA, this agreement nonetheless will govern — if not

dictate — grizzly bear management now and until at least the end of FWS’s five-year post-delisting oversight of state management in June 2022.

Of particular relevance here, the MOA’s protocols are expressly designed to prevent growth of the grizzly bear population within the DMA (as estimated by the Chao2 population estimation method; Fig. 5a) above levels observed from 2002 to 2014. If, as during 2017, estimated population size exceeds the 2002-2014 average, prescribed mortality rates will be increased to reduce bear numbers, with prospectively much of the differential between so-called “discretionary” and “non-discretionary” mortality allocated to sport hunting.

The Final Rule describes provisions putatively designed to guard against post-delisting population declines within the Greater Yellowstone DMA, including statements averring that state managers will adaptively decrease mortality rates as population estimates drop below triggering thresholds, and disallowing sport hunting if estimated bear numbers drop below 600. However, neither provision is binding on the states — both are discretionary. The only substantive population-related trigger for authoritative FWS intervention occurs when estimated bear numbers drop below 500 (“The Service will initiate a formal status review and could emergency re-list the GYE grizzly bear population ... If the population falls below 500 in any year”).

However, all these provisions, discretionary or otherwise, are compromised by uncertainties, lags, and deficient assumptions built into the MOA’s methods. These methods assume that males can be killed at roughly twice the rate as females (e.g., 15% versus 7.6% annually at a population of 674), even though males and females are born in roughly equal numbers (Schwartz et al. 2006; Van Manen et al.

2016). This alone guarantees decline in numbers and average ages of males, especially in non-Park areas that will exclusively bear the burden of sport hunting (see ¶ 10). Yet numbers of males are not directly monitored. Adolescent and adult males are numerically added to total population estimates proportional to retrospective estimates of their fractions in the population, based, in turn, on assumption-ridden model-contingent estimates of comparative mortality rates using data collected during the previous five to ten years. In other words, even if estimates of comparative mortality rates are unbiased, male population dynamics

will be viewed through an out-of-focus rearview mirror, with relevant estimates lagging well behind unfolding real-time conditions.

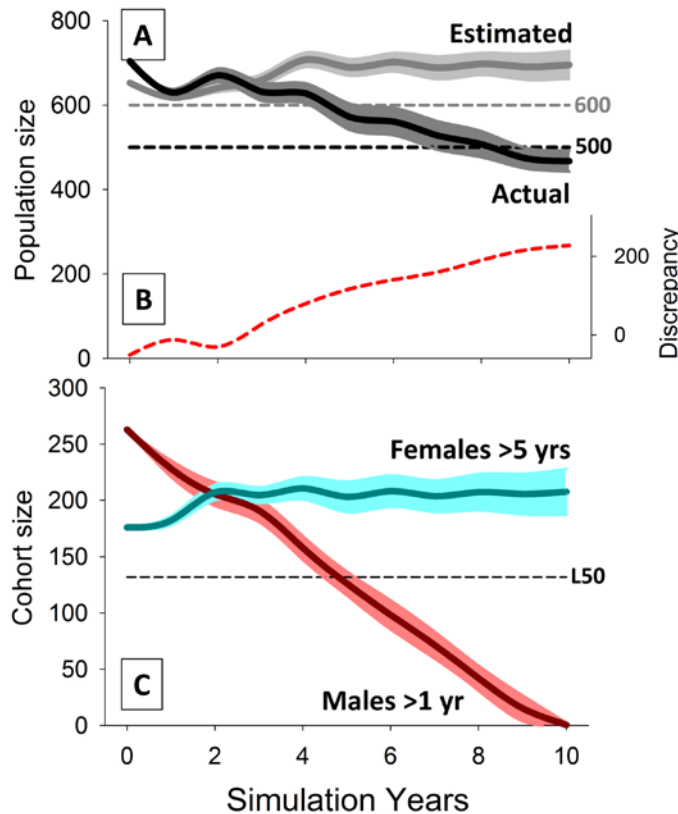


Figure 7. 10-year population projections simulating implementation of MOA protocols for management of grizzly bears inside the Yellowstone DMA. Estimated population size increasingly exceeds real population size over time (A), with over-estimates reaching near 200 bears by 10 years out (B), largely because the male segment >1-year-old crashes outside of National Park jurisdictions. Roughly 50% of adult males are killed within 5 years, corresponding to L50.

Figure 7 visually summarizes projections simulating the implementation of protocols specified by the Tri-state MOA. These projections take the protocols at face value and, in the absence of any enforceable specifics, do not credit assertions by wildlife managers that untoward trends

will somehow be detected and corrected. Succinctly, if fully implemented, the MOA protocols—including the sport hunting—will likely lead to an undetected crash in the DMA’s male population segment outside National Park jurisdictions (Fig. 7c), at the same time that estimated population size increasingly exceeds true population size (Fig. 7a). By ten-years out, the population could be over-estimated by >200 animals (Fig. 7b). As a consequence, managers would not detect a population decline below 600, and then 500 (Fig. 7a), the putative trigger for a formal status review by FWS. Instead, state managers would be erroneously applying mortality rates designed to further depress a population assumed to be near 700, but actually nearer 500.

As an upshot, the near- and long-term effects of a male-biased sport hunt, as planned for fall 2018, will likely remain undetected and thereby debar timely correctives on the part of GYE grizzly bear managers—at the same time that managers are purposefully instituting a hunt designed to reduce the bear population.

9. The spatial configuration and extent of planned sport hunting in Wyoming and Idaho warrants emphasis, and is particularly relevant to understanding the extent to which hunting-caused mortality will harm the Greater Yellowstone grizzly bear population both near- and long-term.

The map in Figure 8 shows the location and extent of zones within which sport hunting of grizzly bears will occur in the GYE relative to the current distribution of the population. Several key patterns and related implications are evident. For one, sport hunting will affect Greater Yellowstone grizzlies in the

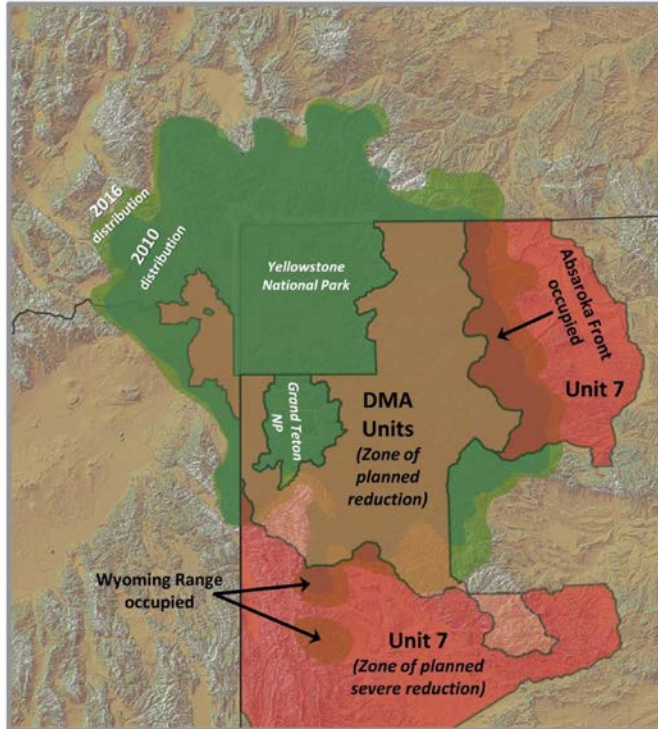


Figure 8. Map showing the estimated 2010 and 2016 distributions of the Greater Yellowstone grizzly bear population overlain by Wyoming and Idaho hunting units within which grizzlies will be sport hunted beginning September 1, 2018. Hunting units within the Demographic Monitoring Area (DMA) are differentiated by Wyoming’s Hunting Unit 7 outside. Stated objectives are to reduce the size of the grizzly bear population within the DMA and sharply reduce bear numbers outside, in Unit 7, largely through sport hunting.

majority of their current distribution. In other words, hunting will directly and indirectly affect (see ¶ 12 & 13) most bears in this population. For another, the portion of the DMA within which the states of Wyoming and Idaho intend to reduce grizzly bears numbers, in part through hunting, likewise entails the majority of current distribution. As problematic, areas outside the DMA where Wyoming plans to sharply reduce bear numbers (see ¶ 10), notably the

Wyoming Range and the eastern front of the Absaroka Mountains, are non-trivial in extent and coincident with habitat that is sufficiently productive and remote from humans to support resident grizzly bears (Fig. 6).

It is clear from this that the spatial configuration of sport hunting planned by Wyoming and Idaho will harm the majority of the Greater Yellowstone grizzly bear population, with harm disproportionately concentrated in areas outside National Parks. Moreover, this harm will be especially severe in peripheral areas supporting the bears most likely to colonize adjacent and nearby suitable habitat.

10. State plans for managing grizzly bears outside the DMA compound

the deficiencies in protocols for managing grizzly bear mortalities within the DMA boundaries. These plans matter because FWS explicitly states in the Final Rule that: “Mortalities outside the DMA are the responsibility of each State and do not count against total mortality limits,” 82 Fed. Reg. 30,502, 30,531 (table 3) (June 30, 2017), which functionally gives state managers *carte blanche*. Of relevance here, the three involved states either intend to limit or even prevent occupancy of areas outside the DMA by grizzly bears — as in the case of Wyoming — or, at best, allow for expansion in highly ambiguous and qualified terms — as in the case of Montana.

To quote the Wyoming Grizzly Bear Management Plan: “Habitats that are biologically and socially suitable for grizzly bear occupancy are the portions of northwestern Wyoming within the DMA that contain large tracts of undisturbed habitat, minimal road densities, and minimal human presence;” and: “Although grizzly bears will not be actively discouraged from occupying all areas outside the DMA, management decisions will focus on minimizing conflicts and may proactively limit occupancy where potential for conflicts or public safety issues are very high.” (emphasis added).

As direct evidence of its intent, the State of Wyoming plans to sport hunt as many as twelve grizzly bears in areas outside the DMA during its fall 2018 hunting season. Two of these bears will prospectively be adult females. Given that there are almost certainly no more than 90-100 bears outside the DMA, the sport hunt alone will prospectively kill 12-13% of all extralimital grizzly bears in Wyoming, and this on top of other mortality that will likely be of equal magnitude (see Point 20.1 in my May 5, 2016, comments on Proposed Rule (FWS_Pub_CMT_004076). No

research has ever shown that an annual mortality rate near 25% can be sustained by any interior North American grizzly bear population (see also ¶ 4). More commonly, as posited by the MOA, sustainable mortality rates are less than half such a rate, nearer 7-10% at maximum.

With reference to key linkages in Montana (see ¶ 7), the Final Rule merely states: “To increase the likelihood of occasional genetic interchange between the [Greater Yellowstone Ecosystem] grizzly bear population and the [Northern Continental Divide Ecosystem] grizzly bear population, the State of Montana has indicated they will manage discretionary mortality in this area in order to retain the opportunity for natural movements of bears between ecosystems.” (emphasis added). The Grizzly Bear Management Plan for Southwestern Montana (Montana Fish, Wildlife & Parks, 2013) states throughout that “non-conflict” grizzlies will be accommodated in potential linkage zones, but then specifies measures for dealing with “conflict” grizzly bears, all of which history has shown lead to a high likelihood of death for the involved bear. As a consequence, and as the Plan itself acknowledges, connectivity between the Greater Yellowstone Ecosystem and other grizzly bear populations will depend on widespread effective efforts to prevent conflict and curb detrimental private land development—sufficient in part to mitigate, if possible, the effects of a hunt—all of which require ample funding.

11. Despite laudable language in various planning documents, FWS and the States of Wyoming, Montana, and Idaho are demonstrably ill-equipped to prevent or non-lethally mitigate escalating human-grizzly bear conflicts concentrated on the periphery of the Greater Yellowstone Ecosystem in ways that

might mitigate harm from a sport hunt. As noted in ¶ 6, grizzly bear deaths have been increasingly linked since the mid-2000s to human-associated meat — notably livestock and the remains of hunter-killed big game, which together account for near 55% of known and probable grizzly bear fatalities. The fact that meat-associated grizzly bear deaths have been increasing at rates of 5% (hunter-related) and 17% (livestock-related) per annum (Fig. 5a) during a period of stalled population growth is a self-evident verdict on the deficiency of measures taken by managers to non-lethally address these burgeoning causes of human-grizzly bear conflict—a circumstance that will only be aggravated by sport hunting.

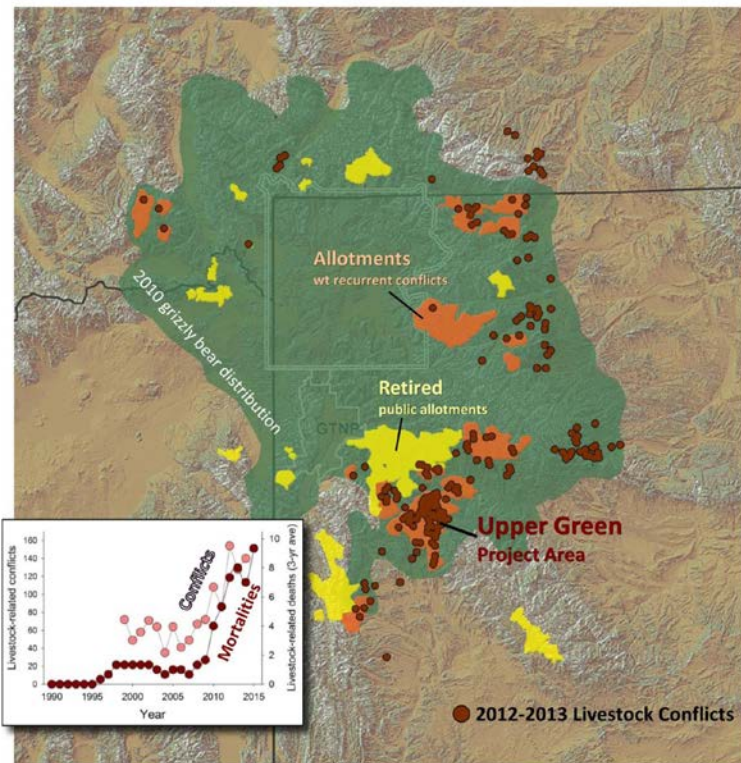


Figure 9. Distribution of grizzly bear depredation on livestock and related conflicts in the GYE during 2012-2013 (dark red dots) along with *circa* 2010 grizzly bear distribution (green), recently retired public land grazing allotments (yellow) and active allotments identified as having chronic conflicts. The inset graph shows trends in grizzly bear-livestock conflicts (pink) and related grizzly bear mortalities (dark red).

The 2016 Conservation Strategy (FWS_LIT_016978) along with state grizzly bear management plans, furthermore explicitly call for maintenance of the status quo, which will likely institutionalize an inadequate conflict prevention regime. A pointed example can be found in the Upper Green River Area Rangeland Project Final Environmental Impact Statement completed by the

Bridger-Teton National Forest in October 2017. This project area contains the highest concentrations of grizzly bear depredations on livestock — mostly cattle — in the entire Greater Yellowstone Ecosystem.

Figure 9 shows the Upper Green River grazing allotments along with the ecosystem-wide locations of grizzly bear depredations during two emblematic years (2012 and 2013; mapped locations for more recent years are not publicly available). Despite the fact that these allotments continue to account for much of the livestock-related conflict in the Greater Yellowstone Ecosystem, the Final Environmental Impact Statement essentially enshrines the status quo. There is no provision for substantive changes in husbandry practices, stocking rates, or allotment delineations and infrastructure. Unmitigated conflict and resulting bear deaths will likely continue here and elsewhere, with localized sport hunting adding to the toll (see ¶ 13).

This prognosis is rendered even more plausible by the fact that state grizzly bear conflict specialists will likely be further under-resourced this year as well as in the near future. Appendix F of the 2016 Conservation Strategy summarizes the prospective annual costs of implementing mandated human/grizzly bear conflict management, estimated to be \$650,000 for the U.S. Forest Service; \$735,000 for the State of Wyoming; and \$246,000 for the State of Montana. On top of this, the Montana state plan also asserts the importance of “[s]ecuring important linkage habitats through purchase or easement....” Few of the requisite operating funds are currently available, much less funds for purchasing easements or fee simple titles. Out-year budgets for the Forest Service and state wildlife management bureaus suggest a worsening rather than improving fiscal situation.

Funding deficiencies are fully acknowledged in state grizzly bear management plans. For example, the 2013 Montana plan states “a funding mechanism to support Montana’s responsibilities for Yellowstone grizzly bear management is necessary.” Since then, the agency’s wildlife-related budget has been essentially static after accounting for inflation, with no increased allocations to support grizzly bear conflict prevention. Likewise, the 2016 Wyoming Grizzly Bear Management Plan states that “costs associated with data collection and conflict management will vastly exceed any revenue generated by the grizzly bear program.” The Wyoming Game and Fish Department’s budget has concurrently declined by a net \$6 million since 2016 (Wyoming Game & Fish Department 2017). There is little prospect that shortfalls will be covered by grants from the federal government, given that proposed 2018-2019 budgets for the FWS and Forest Service call for major cuts in programs supporting recovery of endangered and threatened species.

12. This picture of a population in trouble becomes even clearer upon examination of grizzly bear mortality trends in the Greater Yellowstone Ecosystem during the last three years, which have only accelerated during 2018. Figure 10 illustrates the pace at which known and probable grizzly bear mortalities accrued each year in the GYE from 2013 to 2017, and so far during 2018. Year-end totals broke records in 2015, 2016, and 2017, representing a dramatic jump from totals for the period between 2013 and 2014. As suggested by population trends in Figure 5a, this increase cannot be explained by either the non-existent increase in population size or modest increase in population distribution since 2014. And, of

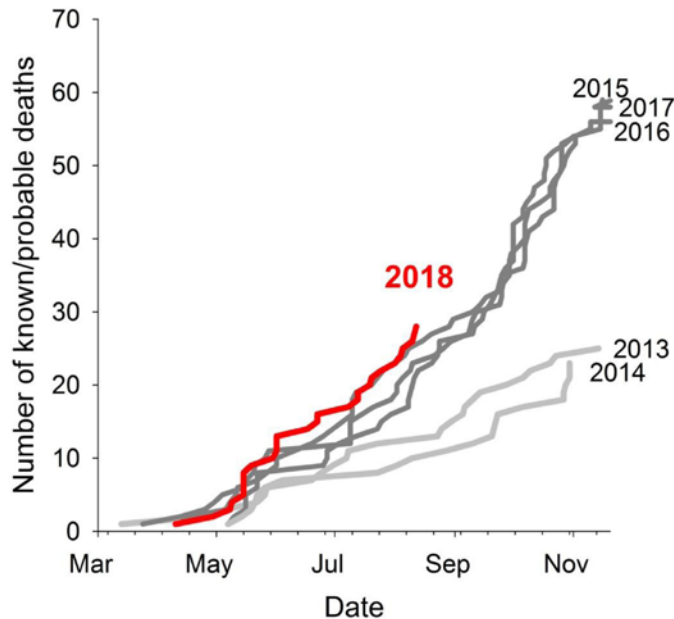


Figure 10. Annual accumulation curves for known and probable grizzly bear deaths in the GYE during 2013-2018. Deaths are attributable to all causes both inside and out of the DMA. The accumulation curve for 2017 in includes four deaths that occurred late in 2017 but were not detected until spring 2018. State wildlife managers treat these deaths as having *de facto* occurred during 2018 and plan to account for them in calculations of allowable mortality for 2019, which merely puts off the day of reckoning for record-setting mortality during 2017-2018.

import here, the pace at which grizzly bears are dying in the Greater Yellowstone Ecosystem during 2018 already exceeds that of 2015-2017, and this represents a period during which state wildlife managers have been *de facto* in charge of conflict management. At a minimum, data from 2018 (see <https://www.usgs.gov/data-tools/2018-known-and-probable-grizzly-bear-mortalities-greater-yellowstone-ecosystem>)

demonstrate that exceedingly high levels of mortality this year are, in part, a continuation of trends in livestock-related deaths that drove high levels of mortality from 2015 to 2017. These trends are a tacit verdict on the inadequacy of conflict prevention measures in the ecosystem and the current lethality of state-administered management of grizzly bears. Moreover, the trend unfolding during 2018 is alarming, with the promise of irrevocable harm, even prior to the advent of the planned, September 2018 sport hunts in Wyoming and Idaho.

12. Hunting will irrefutably harm Greater Yellowstone grizzly bears by, at a minimum, adding to, magnifying, and compounding dynamics heretofore described that already sorely compromise future prospects of this isolated

population. But, even more problematic, this harm is likely to be irreparable, not only for the directly affected bears, but also for surviving bears, through a cascade of subsequent indirect effects.

Most obviously the grizzly bears killed by sport hunters will be irreparably harmed. These bears' lives will be irreversibly ended in ways definitively linked to hunting. They will, moreover, be unambiguously removed from the pool of potential reproductive individuals.

Beyond the obvious, there is the question of whether bears that will be killed by hunters would have likely died for other reasons during the subsequent year. If yes, then these hunting-related mortalities would have "compensated" for other causes of death. If no, then hunting-related mortalities would be in addition to any that would have otherwise occurred. This is the distinction in technical ecological literature between "compensatory" and "additive" mortality. If hunting-related mortality is fully compensatory, then at a population level there are no direct numeric effects incurred during a seasonal cycle. However, if mortality is additive, then population numbers will axiomatically be reduced below levels that would have otherwise been sustained. This is a key consideration because it sets the stage for determining whether, aside from irrefutable harm to individual bears, hunting this fall is likely to cause irreparable harm to the population and its long-term prospects—compounded by any hunting that might occur during subsequent years.

In fact, there is little doubt that most hunting-caused mortality will be additive, not compensatory. Deductively, sport hunters who deliberately seek out bears to kill them will be far more lethal than humans under virtually any other circumstances. Absent hunting, a certain number of independent-aged grizzly bears

in the Yellowstone ecosystem would survive even the existing relatively lethal environments. At present, their exposure to such environments occurs largely because of choices *they* make, for example, by seeking out gut piles that bring them into close contact with elk hunters or by seeking out and either killing or scavenging livestock on public lands grazing allotments.

But, even more, these endemic scenarios do not translate into the near-certain death of the involved bears upon encountering the involved humans — which would be the case with a grizzly bear sport hunt. The point here is that sport hunting by its very nature is, deductively, *per capita* much more lethal to grizzly bears. By first principles, many deaths from sport hunting will be additive — that is, would not have otherwise occurred.

The weight of empirical evidence supports this conclusion. Without being exhaustive, research by Bishof et al. (2009) and Frank et al. (2017) has definitively shown additive effects of hunting in *Ursus arctos* populations, and is consistent with the additive effects shown for wolves by Creel & Rottella (2010), for American black bears by Obbard & Howe (2008), and for cougars by Weilgus et al. (2013), Robinson et al. (2014), and Wolfe et al. (2015). By contrast, no credible investigation of any species of large carnivore has shown that hunting-related mortality wholly, or even largely, merely compensates for other causes of mortality; i.e., there is no credible evidence that hunting-related mortality is *not* additive.

13. The toll of sport hunting will not be limited to direct numeric effects on the Greater Yellowstone grizzly bear population. Other indirect effects —

manifested in decreased production, survival, and recruitment of cubs — will likely transpire during subsequent months.

Some mammalian populations have been shown to increase reproduction and recruitment in the aftermath of elevated human-caused mortality. These responses have the potential to indirectly compensate for mortality caused by sport hunting. However, in other instances, human-caused mortality depresses reproduction during subsequent months, which amplifies and exacerbates direct numeric effects—a phenomenon termed ‘depensatory’. These sorts of depensatory effects have been most consistently shown for carnivore species in which males kill offspring of reproductive females to enhance their own reproductive opportunities — a phenomenon known as sexually-selected infanticide, or SSI (Ebensperger, 1998, Milner et al. 2007).

A priori, SSI is likely to be common in brown and grizzly bear populations, given the large average difference in size of male and female bears (i.e., sexual dimorphism) and the fact that females, as in the Greater Yellowstone ecosystem, have three-year reproductive cycles (Schwartz et al. 2006). Synthetic analyses by researchers such as Harano & Kutsukake (2018) have shown the SSI correlates with the same intense competition among males that leads to selection for increasingly large comparative size. Moreover, rough parity between numbers of adult males and females slaved to a three-year reproductive cycle, as in Greater Yellowstone (Schwartz et al. 2006), means that there are approximately three reproductive males for every breeding female. Such a skew by itself predictably leads to intense competition among males; a substantial portion of cubs unrelated to the males battling to reproduce; and significant incentive for males to kill cubs

as a means of inducing premature estrus in the targeted female (Bunnell & Tait 1981). Even a lesser ratio of reproductive males to breeding females predictably generates such a dynamic.

Amplification of SSI by sport hunting that disproportionately targets adult males would entrain several deleterious consequences. Cub and yearling death rates would likely increase with an influx of non-sire males triggered by the disruption of a social structure otherwise maintained by mature resident males. Longer-term, reproductive females would likely abandon productive habitats to seek refuge in more spartan environs (for example; Mattson et al. (1987, 1992); Ben-David et al. (2004); Gardner et al. (2014)), with resulting depression of fecundity. All of this could exacerbate, longer-term, the direct and additive numeric effects arising from hunter-caused deaths.

In addition to a strong deductive case, there is overwhelming empirical support for the existence of SSI and related dynamics among grizzly bears, and for the amplification of these phenomena by human persecution. Without being exhaustive, there are more than twenty publications reporting evidence from investigations of brown and grizzly bears that: SSI is amplified by sport hunting (Bellemain et al. 2006; Gosselin et al. 2015, 2017; Bischof et al. 2018), including compensatory effects on birth and death rates (Stringham 1980, Swenson et al. 1997, Wielgus et al. 2013, Gosselin et al. 2015, Frank et al. 2017, Bischof et al. 2018); that deleterious social restructuring occurs, including an influx of potentially infanticidal males (Swenson et al. 1997; Wielgus et al. 2001; Ordiz et al. 2011, 2012; Gosselin et al. 2017; Leclerc et al. 2017; Bischof et al. 2018; Frank et al. 2018); and that foraging efficiencies of adult females decrease (Wielgus & Bunnell

2000; Ordiz et al. 2011, 2012; Hertel et al. 2016; Bishof et al. 2018) in tandem with increased physiological stress (Bourbonnais et al. 2013, Støen et al. 2015).

These results specific to *Ursus arctos* are in context of compendious research showing the same spectrum of results for large carnivores more broadly (e.g.; Milner et al. 2007, Packer et al. 2009, Harano & Kutsukake 2018), as well as more specifically for American black bears (Czetwertynski et al. 2007, Stillfried et al. 2015, Treves et al. 2010), mountain lions (Robinson et al. 2008, Peebles et al. 2013, Wielgus et al. 2013, Maletzke et al. 2014, Keehner et al. 2015, Teichman et al. 2016), and wolves (e.g.; Murray et al. 2010, Wielgus et al. 2014).

By contrast, research specific to *Ursus arctos* that calls into question the potential amplification of SSI and other depensatory effects by hunting amounts to essentially two publications (Miller et al. 2003, McLellan 2005). Even so, Miller et al. do not cover conditions of particular relevance to Greater Yellowstone's grizzly bear population, where, unlike what they considered, hunting would perturb social dynamics of a population hard up against a declining carrying capacity; and McLellan premises a regime where "some" adult males might be killed, which does not concur with the regime being proposed by Wyoming and Idaho entailing the hunting of twenty-one males in addition to others of the same sex that will have died from other human causes. Moreover, this paucity of findings casting doubt on the aggravating effects of sport hunting is consistent with a continent-wide deficit pertaining to other large carnivores. Only a handful of authors, notably Czetwertynski et al. (2007) and Murray et al. (2010), call into question depensatory effects of sport hunting on black bears and wolves, respectively, and, even so, with significant qualifications.

Deductive logic and the available evidence leaves little doubt that male-biased sport hunting will entrain longer-term compensatory effects that amplify the more immediate negative effects of elevated mortality among grizzly bears occupying hunting units managed by the States of Wyoming and Idaho.

14. The post-delisting regime for managing Yellowstone's grizzly bear population is designed to prevent numeric increases within the heart of the ecosystem (i.e., the DMA); discourage, if not prevent, dispersal to and colonization of most of the adjacent or farther distant suitable habitat; and promulgate inadequate conflict prevention programs. Moreover, this insufficient if not punitive management is being implemented using methods that not only engender considerable uncertainty, but also stand a good chance of leading to unintended undetected population declines.

This inauspicious regime is being imposed at a time when long-term conservation goals and on-the-ground conditions create an imperative to encourage — not discourage — occupancy of all adjacent suitable habitat; connectivity with central Idaho and the Northern Continental Divide Ecosystem; and colonization of novel, yet suitable, habitats to the south and east by grizzly bears in the Greater Yellowstone ecosystem.

Compounding these manifold stressors and problems, the States of Idaho and Wyoming have moved aggressively forward with instituting a sport hunt designed to kill the maximum number of bears allotted for this purpose. And these hunting-caused deaths will almost certainly be additive to the toll taken by humans for other reasons, and likely compounded by longer-term indirect, but compensatory,

effects on female reproduction and recruitment.

Taken altogether, these problematic environmental dynamics coupled with uncertain monitoring methods and purposefully lethal post-delisting management promise irreparable harm to grizzly bears in the Greater Yellowstone population, and possibly other extant or potential grizzly bear populations in the Northern U.S. Rocky Mountains. As a consequence, prospects for meaningful recovery and restoration will be potentially fatally compromised, which is of all the greater consequence given that grizzly bears in this region represent a globally unique genetic and behavioral lineage, as well as an imperiled remnant of bears that once occupied most of the western contiguous United States.

Regarding the fall 2018 grizzly bear sport hunts being planned in Wyoming and Idaho, it is my professional opinion that, if allowed to occur, these hunts will likely result in irreparable harm to the Greater Yellowstone population and that, even if federal ESA protections are eventually restored after the hunt concludes, the allowed mortality will have likely caused irreversible damage. I am not alone in this conclusion. Seventy-two other scientists raised similar concerns in a recent letter to Governor Matt Mead of Wyoming (see Attachment 3).

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 22nd day of August, 2018.

A handwritten signature in black ink, reading "David J. Mattson". The signature is written in a cursive style with a large, looped initial "D".

David J. Mattson

Attachment 1. Literature Cited, Exclusive of Literature Fully Cited in Figures 4, 5, & 6.

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Attachment 2. Research Scientist Record for David Mattson, Ph.D., as of 2011, the most recent year of record

Attachment 3. Letter to Matt Mead, Governor of Wyoming, dated April 25, 2018, signed by 73 scientists.

RESEARCH SCIENTIST RECORD

NAME: **David J. Mattson**

DATE PREPARED: **15 July 2011**

(9) EDUCATION

Ph.D., 2000, Fish & Wildlife Resources, *Causes and Consequences of Dietary Differences among Yellowstone Grizzly Bears*, University of Idaho (1993-2000)

M.S., 1984, Forest Ecology, *Classification and Environmental Relationships of Wetland Vegetation in Central Yellowstone National Park*, University of Idaho (1980-1984)

B.S., 1979, Forest Resource Management, University of Idaho (1972-1979)

(10) TECHNICAL TRAINING RECEIVED

7. *Leadership 201*, 36 hrs, USGS Leadership Training Program, Sheperdstown, WV, 2007 (Action Learning Scenario Team Leader).

6. *Leadership 101*, 36 hrs, USGS Leadership Training Program, Sheperdstown, WV, 2006.

5. *Leadership Intensive*, 16 hours, USGS Leadership Training Program, Seattle, WA, 2005.

4. *Basics of Working with the News Media*, 16 hours, National Conservation Training Center, 2000.

3. Course on principles and use of geographic information systems, 8 hours, Montana State University, 1991.

2. Course on bear trapping and handling, 20 hours, Yellowstone National Park, 1991.

1. *Buck Brannon Horse Training Clinic*, 18 hours, Yellowstone National Park, 1989.

(11) PROFESSIONAL EXPERIENCE

a. PRESENT ASSIGNMENT

DATES From: 28 February 1997 To: Present

DESCRIPTION OF POSITION

The scientist investigates the ecology and conservation of large carnivores and other animals, including diet, habitat use, movements, and range, and relations between these factors and demography, effects of climate change, relations with humans, methods for evaluating habitat, and the nature and effectiveness of large-carnivore and other natural resources management. This research occurs throughout the United States, emphasizing the southwestern states of Arizona, New Mexico,

Utah, and Nevada, as well as occupied or potential grizzly bear (*Ursus arctos*) habitat in the Rocky Mountains and cougar (*Puma concolor*) habitat elsewhere. For ecological studies the scientist uses data from radio-marked animals, transect- and point-based studies, and remote imagery, using advanced technology such as GPS-satellite linkages and remote thermally-activated cameras. Analytic methods entail innovations in model-building and related statistical techniques, including development of state-of-the-art geospatial models and agent-based approaches. The scientist also uses grounded theory and methods of the policy sciences to analyze conservation and management policies for natural resources. Current research provides managers with insights into dynamics of natural resources management, crucial to improving the design of related policy- and decision-making processes in service of democratic outcomes; information about key factors limiting large-carnivore and other animal populations, with relevance to instituting management needed to conserve nationally and internationally important populations; information to minimize risks posed to humans by large carnivores in areas of co-habitation, thereby minimizing harm to humans and increasing prospects for coexistence; and information on the extent and location of areas capable of supporting extant or prospectively repatriated populations of large carnivores important to the survival of valued species. The scientist works closely with numerous managers and other stakeholders in natural resources management throughout the United States providing advice and technical input on a multitude of issues germane to maximizing beneficial uses of science in service of durable outcomes.

DESCRIPTION & TITLES OF PROJECTS

1. Cougars of the Colorado Plateau — 30% of time: This large-scale and logistically and technically complex project addresses the ecology of cougars on and near the southern Colorado Plateau, in northern Arizona, southern Utah, and southeastern Nevada. The project focuses on behaviors of cougars in wild and human-impacted environments, with the goal of generating insight that will allow managers to conserve regional cougar populations and their prey, while providing for human safety. More specifically, the study provides insight into the effects of highways, railroads, urbanized areas, protected areas, and prey concentrations on the behavior and demography of radio-marked cougars, drawing on data from a wide range of biogeophysical conditions. To date, *c.* 70 cougars have been radio-collared and tracked by GPS locations that are downloaded daily via Argos satellites. Locations are visited soon after to build a detailed record of habitat use and predation, including >900 documented kills so far. Information is incorporated into innovative geospatial models that explain human and other habitat effects and predict distributions of cougars and related risks to humans. *The scientist is responsible for all facets of this long-term project, which began in 2002.* The project involves many collaborators and has been funded by numerous supporters, including the U.S. National Park Service, U.S. Department of Energy, Grand Canyon National Park Foundation, USGS Southwest Biological Science Center, USGS Fire Program, and several private foundations. Collaborators have included the National Park Service (Grand Canyon, Zion, and Capitol Reef National Parks), USGS Western Ecological Research Center, USDA Wildlife Services, Arizona Game & Fish Department, NSTec, Northern Arizona University, and the Grand Canyon Trust.

2. Trophic Ecology of Predators and Prey on the Colorado Plateau — 25% of time: This newly-initiated study entails the analysis of numerous datasets from across the Colorado Plateau to build integrated models of trophic dynamics, involving vegetation, herbivores, and a top predator. The goal is to create state-of-the-art spatial models of time-series data depicting ecosystem dynamics across trophic levels, which will then be coupled to ensembles of downscaled global circulation model (GCM) projections to forecast future conditions on and near the Colorado Plateau. Explanatory and predictive models of vegetation will use cutting-edge analyses of remotely-sensed imagery. Focal

animals will include mule deer (*Odocoileus heminous*), elk (*Cervus elaphus*), desert bighorn sheep (*Ovis canadensis nelsoni*), and cougars. Hierarchical Bayesian methods will be used to estimate parameters and track uncertainty within and among models, including state-space models of animal movements. *The scientist is Principal Investigator and Leader of this project*, which involves investigators from the University of Maryland, The Max Planck Institute, The Smithsonian, Duke University, Utah State University, and the USGS Western Ecological Research Center. Collaborators so far include Colorado Division of Wildlife, Utah Division of Natural Resources, and Arizona Game & Fish Department. Initiation of this project has been supported by a \$2 million grant from the NASA ROSES program, with prospects for leveraging additional funds to support related work.

3. Natural Resources Policy & Conservation — 20% of time: This challenging project entails the analysis of natural resources management to foster improved performance of decision-making processes. The scientist has analyzed a number of complex cases throughout the West, including grizzly bear conservation in the Rocky Mountains, cougar management in the Southwest, and management of human-origin waters for wildlife, at scales ranging from specific development proposals to regional social processes. These innovative analyses provide participants and academic observers with critical insights into factors that govern the achievement of policy goals, often by reframing how participants understand their problems, with relevance to improving the design of decision-making processes. Leadership, large-carnivore conservation in North America, and the science-policy-management interface are current foci of attention. The scientist has collaborated with a number of colleagues from Canada and the United States on this program, including internationally-recognized experts in Q-methodology and the policy sciences. *The scientist has held primary responsibility for analysis, for conceptualizing approaches, and for teaching*, including classes at Yale and MIT. The scientist works closely with numerous stakeholders from government, academe, and the private sector to foster high-performance natural resources management. This wide-ranging project was initiated in 1993 and has been funded or otherwise supported by the USGS Southwest Biological Science Center, USGS Forest & Rangeland Ecosystem Science Center, U.S. National Biological Service, Northern Rockies Conservation Cooperative, numerous private foundations, MIT Department of Urban Studies & Planning, and the Yale School of Forestry & Environmental Studies.

4. Modeling and Projecting Species Ranges — 10% of time: This thematic project focuses on developing geospatial models of ranges and habitat use by avian, reptile, and amphibian species in the southwestern United States, to inform mitigation and restoration management at multiple scales. The main part of this work has focused on modeling the current ranges of bird and herp species, and coupling these models with ensembles of downscaled regional GCMs to forecast future distributions under climate change. This forecasting project is unique among others of its type by relying on conceptual models that encapsulate current ecological knowledge of modeled species, incorporation of static geophysical effects such as terrain and solar insolation, assiduous tracking of conceptual and quantitative uncertainties arising from sampling processes and numerous analytic decisions, and involvement of a stakeholder advisory group to inform all aspects of design. *The scientist serves as co-Leader of this project, and has played a major role in its overall conceptualization and design*. A \$2 million grant from the USGS National Climate Change and Wildlife Science Center (NCCWSC) has supported this work. A related project has focused on modeling finer-scale habitat use by yellow-billed cuckoos (*Coccyzus americanus occidentalis*), which are a threatened species being managed for restoration under the Lower Colorado River Multi-Species Conservation Program. *The scientist helped design and manage this project*, which is supported by a \$250 thousand grant from the Bureau of Reclamation.

5. Ecology of Upland Waters in the Semi-Arid West — 5% of time: This project addresses the effects of ponded natural and human-origin waters on upland ecosystems of the West. There is a current dearth of information about the ecology of upland waters and the impacts of often dramatically human-altered hydrologic regimes on wildlife in uplands, which this project intends to address. Results of this study will be important to anticipating the consequences of climate change and judging the impacts of water management outside National Parks on Park resources that cross boundaries. Data on water-focused wildlife activity have been collected using state-of-the-art remote cameras as well as sign transects. Wildlife activity is explained in terms of habitat features, activity levels of other species, and availability of water as snow, preformed in vegetation, and in natural or artificial basins. Sub-projects conducted in close collaboration with the National Park Service have focused on natural and artificial water sources paired along boundaries of National Parks in the southern Colorado Plateau, including Walnut Canyon and Wupatki National Monuments. *The scientist supervised all facets of this work beginning in 2003*, including a Master's degree project lasting from 2004-2007. Funding and other support have been provided by the U.S. National Park Service, Western National Parks Association, and the USGS Southwest Biological Science Center.

6. Modeling Demography and Habitat Suitability for Grizzly Bears — 5% of time: This project focuses on building robust regional-scale models for assessing the capability of habitat to support large carnivores, with an emphasis on grizzly bears. Such an approach has required coarse filter analysis and the development of metrics that efficiently denote human activity. To provide a frame of reference stable across regions, these metrics have been developed in such a way as to be robust to the vagaries of data specification and resolution. Analyses of grizzly bear habitat capability have been completed for the state of Idaho and for trans-boundary regions including British Columbia, Idaho and Montana. Additional analyses have been undertaken for the Yellowstone-to-Yukon region and for the states of Arizona and New Mexico. Research is currently focused on developing robust measures of habitat productivity and related predictors of bear density that are comparable across regions. *The scientist has been responsible for conceptualizing the approach, statistical analyses, and manuscript preparation.* This project began in 1995 and has been funded or otherwise supported by the U.S. National Biological Service, USGS Forest & Rangeland Ecosystem Science Center, USGS Southwest Biological Science Center, Idaho Cooperative Fish & Wildlife Research Unit, Hornocker Wildlife Institute, Yellowstone-to-Yukon Initiative, The Wilderness Society, and The Wilburforce Foundation.

7. Diet & Behavior of Grizzly Bears — 5% of time: This project focuses on explaining diet and habitat use of Yellowstone's grizzly bears to guide conservation of this and other internationally important populations. The scientist elucidates the effects of diet on movements, body size, condition, and fecundity of grizzly bears, with implications for managing to mitigate the impacts of global climate change and invasive non-native species such as blister rust (*Cronartium ribicola*). Data were collected from several-hundred radio-marked animals distributed throughout the Yellowstone ecosystem and during extensive long-duration studies involving transects and random points. Sub-projects have been a basis for models that predict and explain grizzly bear use of individual foods, including spawning cutthroat trout (*Oncorhynchus clarki*), ungulate carrion on winter ranges, whitebark pine (*Pinus albicaulis*) seeds from red squirrel (*Tamiasciurus hudsonicus*) middens, and biscuitroots (*Lomatium cous*). This long-term integrated study, aspects of which began in 1977, has generated a data-set for grizzly bears unparalleled in the world. The project is close to completion, contingent on preparation of several journal manuscripts. *The scientist designed and immediately supervised all facets of ground work for this study beginning in 1984, and was directly involved with data collection, 1979-1992.* Parts of this research constituted three Master's degree projects. Funding has been provided by the U.S. National Park Service, U.S. National Biological

Service, USGS Forest & Rangeland Ecosystem Science Center, and USGS Southwest Biological Science Center.

b. PREVIOUS PROFESSIONAL POSITIONS

Wildlife Biologist, 0486, GS-11, U.S. Department of the Interior, Interagency Grizzly Bear Study Team, University of Idaho Cooperative Park Studies Unit, and USGS Forest & Rangeland Ecosystem Science Center

DATES From: 17 May 1992 To: 10 May 1997

The scientist held primary responsibility for investigating habitat relations of grizzly bears in the Yellowstone ecosystem and investigated grizzly bear demography and conservation.

Wildlife Biologist, 0486, GS-9, U.S. Department of the Interior, Interagency Grizzly Bear Study Team

DATES From: 1 February 1986 To: 16 May 1992

The scientist held primary responsibility for investigating habitat relations of grizzly bears in the Yellowstone ecosystem.

Biological Technician, 0404, GS-7, U.S. Department of the Interior, Interagency Grizzly Bear Study Team

DATES From: 19 May 1984 To: 30 January 1986

The scientist held primary responsibility for fieldwork related to investigations of grizzly bear habitat relations in the Yellowstone ecosystem and collaborated with other team scientists on analysis and reporting of related scientific results.

(12) SIGNIFICANT RESEARCH ACCOMPLISHMENTS

a. & b. RECENT AND OTHER CAREER ACCOMPLISHMENTS

A. The scientist has successfully fostered and led collaboration among cougar researchers and other scientists to address research and management issues that transcend the inferential scope of single study areas or the limited sample sizes of single studies. These issues include functional responses of cougars to the full spectrum of variation in geomorphology, vegetation, prey availabilities, and human impacts; responses to climate; and variation in vital rates with differences in landscape lethality and productivity. The scientist convened and led 6 workshops during the last 8 years expressly designed to foster collaboration and integration among cougar researchers on and near the Colorado Plateau, including a National Park Service-sponsored workshop to synthesize information relevant to human safety management, a workshop that was part of the 10th *Biennial Conference of Research on the Colorado Plateau* in Flagstaff, AZ, and another as part of the 17th *Annual Meeting of the Wildlife Society* in Snowbird, UT. These workshops and related efforts have borne considerable fruit. Researchers from the National Park Service and two USGS offices have formally integrated their cougar field studies in northern Arizona and southeastern Nevada as a result of the scientist's efforts. Of greater importance, a team led by the scientist was successful in securing a \$2 million grant from NASA to model trophically-defined dynamics of vegetation, herbivores, and top predators on the Colorado Plateau. This project

brings modelers, experts in remote sensing, and field researchers together to geospatially analyze numerous datasets for cougars, mule deer, elk, and bighorn sheep from on and near the Colorado Plateau. One product will be the first-ever spatially-explicit model of cougar survival applicable to the entire intermountain West. This product alone will have considerable management relevance.

B. The scientist initiated, designed and found funding for an on-going programmatic study of cougar ecology on the southern Colorado Plateau which has developed into a large-scale regional project. Starting with a widely-recognized but largely unaddressed need to understand the ecology of cougars living near people in predominantly wildlands environments, the scientist has grown a diversely-funded research program that currently encompasses both remote and human-impacted study areas around Flagstaff, AZ, Grand Canyon, Zion, and Capital Reef National Parks, the Arizona Strip, and the Nevada National Security Site and Desert Wildlife Range in southeastern Nevada. Working with Telonics Inc, which billed this project “a guinea pig,” the scientist pioneered use of GPS/Argos satellite collars on cougars and parlayed the near real-time data available from satellite transmissions into new insights and new hypotheses regarding predatory behaviors of cougars, which are providing new research directions for this and other projects. Initial products have included pioneering fine-scale maps of predicted seasonal cougar activity for use in managing human impacts and human safety, and, in collaboration with ESRI, a pioneering application of cougar data to development of a software extension to ArcGIS for agent-based modeling. The project has also entailed working with numerous cooperators from the public and private sector. Like virtually all field studies of large mammals, definitive products await completion of this long-term study. Even so, the scientist has so far delivered 48 talks to public, agency, and academic audiences, 38 of which were invited, to increase public awareness and knowledge of cougars and to expedite dissemination of technical information. The scientist has also published four fact sheets, one paper in the 8th *Mountain Lion Workshop Proceedings*, and a major progress report which provide peer-reviewed updates on research progress and important findings such as unprecedented predation by cougars on coyotes (*Canis latrans*), rare road crossings controlling for effects of other habitat features, and different life strategies of sex, age, and reproductive classes. The project is viewed as a ground-breaking effort by managers and other researchers, who have used it as a model for subsequent studies in Arizona, Nevada, and Colorado.

C. The scientist has emerged as one of the foremost practitioners of the policy sciences analytic framework applied to natural resources cases. The policy sciences offer a conceptually comprehensive set of tools for understanding the behaviors of people and organizations involved in complex management cases. Compared to other analytic approaches, these tools offer a more efficient and functional way to orient to policy problems and, from that, gain useful insights into social- and decision-making processes organized around the development and implementation of natural resources policies. The goal is to upgrade policy processes to better serve widely-recognized social values such as human dignity and democratic principles. The scientist has integrated knowledge from ethics, organizational behavior, science studies, and social-psychology under the policy sciences framework in service of this end, with application to cases as diverse as the Glen Canyon Dam Adaptive Management Program, USGS Biological Resources Discipline, management of anthropogenic waters in the Southwest, and management of cougars in the West and polar bears in the arctic. The scientist’s mastery of the policy sciences has been recognized in many ways, including invitations to instruct seven demanding graduate-level classes (four at Yale, four at MIT, and one at Northern Arizona University), election to the Society for Policy Sciences, prestigious academic appointments at the Yale School of Forestry & Environmental Studies, MIT Department of Urban Studies & Planning, and Northern Arizona University Center for Environmental Sciences & Education, and appointment as Western Field Director for the MIT-USGS Science Impact Collaborative (MUSIC). The scientist has given numerous lectures in professional and academic venues demonstrating policy sciences, 70 all told and 60 since 2000, as well as publishing 16

related articles as book chapters or in journals such as *BioScience*, *Policy Sciences*, *Environmental Science & Policy*, and *Journal of Energy, Natural Resources & Environmental Law*.

D. The scientist has been a pioneer in developing and applying methods for modeling the geospatial distribution and abundance of a wide range of species, including large carnivores, birds, reptiles, and amphibians. Together with a collaborator, the scientist developed methods for assessing broad-scale habitat suitability and meta-population structure for grizzly bears. The approach emphasized human impacts and the use of coarse-scale qualitative and quantitative information to bring systematic analysis to management-relevant issues. The methods were applied to grizzly bear restoration in Idaho, Montana, and the Southwest, to the appraisal of umbrella effects for carnivores in the Rocky Mountains (as reported on by *Science*), and to the appraisal of unoccupied habitat in the Yellowstone region. This team also investigated historical extirpations of grizzly bears in the contiguous U.S., which was reported in *Conservation Biology* and an associated press release by the journal. This research has had significant effects on the framework for managing grizzly bears throughout their range. More recently, the scientist has played a leadership role in teams modeling habitat use and distributions of avi- and herpeto-fauna, funded by major grants from the USGS National Climate Change and Wildlife Science Center and the Bureau of Reclamation. These projects have focused on projecting future distributions under climate change, but employing uniquely sophisticated approaches that were largely conceptualized by the scientist. The scientist has played a major role in communicating the framework of these projects to stakeholders, including USGS leadership and a project Advisory Team. Results of this body of work have been reported in 11 peer reviewed publications and three technical reports, and were part of 20 presentations in technical or other public venues.

E. The scientist has recently developed a research program focused on leadership. This program inquires into the context-specific elements of effective leadership, including the expectations of those being led, and elucidates implications for public order and natural resources governance. This research is relevant to the development of effective leadership in not only natural resources governance, but also in USGS itself. One major result to date has been the identification of multiple narratives regarding “good” or “effective” leadership that are associated with different expectations regarding leader behaviors. These narratives are associated with personality traits and value orientations. To date, results of this program have been reported in one journal article that studied perspectives of leaders on the challenges of an environmental movement at a key moment in its history (the Yellowstone to Yukon Conservation Initiative), as well as in one conference presentation and four seminars.

F. The scientist developed theoretical models that describe and explain relations among human and biological factors affecting the demography of grizzly bears and other large carnivores, with relevance to conservation of imperiled species and populations throughout the world. These models and related analyses identify factors with primary effects on outcomes of interest to society. This holistic framework thereby provides those interested in large-carnivore management with insights that can improve management and facilitate attainment of policy objectives. This research has been reported in 24 talks to scientific societies or in other scientific venues, 29 talks to university classes and seminars, 17 public or other general informational talks, and 14 papers or chapters published in prestigious journals or books. Much of this work was by invitation of organizations such as the Yale School of Forestry & Environmental Studies, University of Michigan, the International Association for Bear Research and Management, the Society for Conservation Biology, Parks Canada, the Royal Zoological Society, the Denver Zoo Conservation Biology Department, the American Museum of Natural History, and the Smithsonian, and has been reported in journals such as *Conservation Biology*, *International Journal of Wilderness*, *Biological Conservation*, *International Conference on Bear Research & Management*, and books such as *Carnivore Conservation*, *Coexisting with Large Carnivores*, and *Predators and People*.

G. Together with a collaborator, the scientist established the importance of behavioral structuring and food availability to explaining death rates of grizzly bears in the Yellowstone region. This was the first time that

behavioral differences had been invoked to explain vital rates for bears. This research entailed demographic modeling of messy radio-telemetry data that advanced the state of knowledge and analytical ability in this field. The approach was demonstrated using grizzly bear data, but has application to any species and radio-telemetry data set. The scientist was responsible for a major part of conceptualizing the general approach and applying it to the grizzly bear data set, whereas the collaborator bore equal responsibility for conceptual development and sole responsibility for programming and specifying the mathematical basis of the model. Results of this effort were published in *Ecology*, included in two presentations at scientific meetings, and featured in reports by the Ecological Society of America and *Science*. The scientist has also substantially contributed to conceptualizing a mathematically explicit theory that incorporates the effects of habituation into a birth- and death-process model, reported in a talk to the Annual Meeting of the Animal Behavior Society. Such a model will help scientists to better appreciate the effects of behavior on demography and to better design future demographic research and analysis. The collaborator bore sole responsibility for specifying the mathematics of this model. A co-authored manuscript is in preparation.

H. Using data from a long-term integrated study, the scientist described and explained in unprecedented depth and detail the diet, habitat use, and foraging behavior of Yellowstone's internationally significant grizzly bear population. He also elucidated relations of their diet to diets of other brown bear populations, implications of diet to seasonal foraging strategies, and implications of dietary variation to research and habitat management. Of relevance to long-term conservation of grizzly bear habitats and conservation-relevant mitigation of conflicts with humans, the scientist also documented July-September as a critical foraging period, the major foods consumed during this time, and the relative and absolute importance to bears of whitebark pine seeds, ungulates, and army cutworm moths (*Euxoa auxiliaris*). This information not only strongly influences management of grizzly bears in the Yellowstone area, as evidenced by frequent citation in numerous management documents, but also, through general conclusions regarding variability of diet and habitat use, the design of research and management worldwide. The level of detail and scope of analysis in this research are unprecedented for bears. Moreover, this research was the first to analyze, in detail, bear behaviors such as geophagy, rubbing, and the consumption of wasps, earthworms, and fungal sporocarps. Results of this research were reported in 19 talks at scientific meetings, in 18 peer-reviewed journal articles, four technical reports, and in more than a dozen invited talks to students, managers, and the interested public.

I. The scientist described the effects of humans and human facilities on grizzly bear habitat use and major causes of human-bear conflicts in the Yellowstone ecosystem using a long-term ecosystem data set collected from several-hundred radio-marked bears. He described the degree and nature of impacts, specific to season, type of year, and type of bear. The scientist also addressed, in detail, the roles of whitebark pine seed crop variation, interspecific interactions, and conditioning to humans in human-bear conflicts and related grizzly bear deaths. Information from these papers continues to provide a seminal foundation for managers understanding human-bear conflicts and the effects of humans and their facilities on bear populations, as well as key to appraising management effectiveness and identifying causes amenable to management intervention. This research has had a major effect on the design of grizzly bear management and research in the Yellowstone ecosystem, as evidenced by references in virtually every document germane to establishing management policies and practices for Yellowstone's grizzly bear population. Results of this research have been reported at two scientific meetings, in three peer-reviewed papers, and in more than a dozen talks to students, managers, and the interested public.

J. The scientist completed a long-term study, designed and directed with two collaborators, that described relations among fire, whitebark pine, red squirrels, and grizzly bears. Whitebark pine seeds are one of the most important foods of Yellowstone's grizzly bears. Results of this study continue to be a basis for management of habitats on National Park Service and U.S. Forest Service lands where bears feed on pine seeds, primarily through attention to red squirrel requirements for mixed-species old growth stands. Given the potential vulnerability of whitebark pine to global climate change, mountain pine beetles (*Dendroctonus ponderosae*), and white pine blister rust (*Cronartium ribicola*), the results of this study are an important basis for anticipating the effects of these agents of change on grizzly bears. This study also clearly demonstrated the nature and degree of human and fire impacts on grizzly bear use of this food, avoiding several of the biases affecting radio-telemetry data. This study additionally demonstrated the benefits of using transect methods to address more refined hypotheses about bear habitat use. Results pertaining to red squirrels and bears were reported in progress reports and five papers presented at scientific

meetings, as well as in three peer-reviewed journal articles, three papers in conference proceedings, and one book chapter. Management implications are summarized in a set of recommendations that were solicited by managers in the Yellowstone ecosystem.

K. The scientist and two collaborators completed a long-term study that provided definitive insight into spring availability and bear use of ungulate carcasses on three ungulate winter ranges in Yellowstone National Park. Meat from carrion is the most important spring food of Yellowstone grizzly bears. Winter ranges in this study spanned conditions represented by the Park, and results provided a basis for identifying critical carcass types, foraging times, and foraging areas for bears; for developing explanatory models of carcass use and depletion; and for understanding relations among black bears (*Ursus americanus*), grizzly bears, and humans. This study provided essential information to managers attempting to mitigate for effects on bears of ungulate sport harvests, management of bison for control of brucellosis, and recently reintroduced wolves. This unique study also demonstrated the efficacy of survey-type studies in addressing hypotheses related to bear use of specific foods and habitat complexes. The scientist was fully responsible for design and direction of this study and collaborated on execution, analysis and reporting of this research. Results were presented in progress reports, a workshop proceedings, a technical report related to wolf reintroduction, and a peer-reviewed journal article.

L. The scientist and a collaborator completed a long-term pioneering study of grizzly bear use of cutthroat trout spawning streams in Yellowstone National Park. Trout were at one time the most important early-summer food of grizzly bears in southern and central parts of the Yellowstone ecosystem. The parameters of heavily used streams, the extent of stream influence on bear movements, the relative consumption of trout by bears, time periods when spawning streams were heavily used, and inter- and intraspecific interactions among black bears, grizzly bears and humans were described and explained. This information is important to and has shaped the management of Yellowstone's grizzly bears because of the large number of bears potentially fishing at spawning streams and because of the increasing effects of drought and non-native lake trout (*Salvelinus namaycush*) on cutthroat trout in Yellowstone Lake. Predation by lake trout has dramatically reduced numbers of cutthroat trout available to Yellowstone grizzly bears. This study established a benchmark for more recent studies attempting to judge impacts of these and other changes in fisheries and habitats. Results were presented at a scientific meeting, in progress reports, and in two peer-reviewed journal articles. The scientist was primarily responsible for design, and collaborated on execution, analysis and reporting of this research.

(13) SCIENTIFIC LEADERSHIP

A. The scientist has been invited to take a significant leadership role in setting strategic science direction for the USGS at the national and Center levels. He is viewed as and routinely sought out to be a leader in this regard on numerous issues within the Southwest Biological Science Center (SBSC). At the national level, he was part of the Science Advisory Group for the USGS Science Strategy Team and Team Leader (Large Mammals & Predators) for the USGS Wildlife Program Five-year Strategic Plan. At the Center level, the scientist has twice served as an invited member of the SBSC Strategic Planning Core Team. These seminal planning efforts occurred shortly after creation of the SBSC and during its current fiscal uncertainties, and have been instrumental in setting the Center's scientific and science management direction. The scientist is also routinely consulted on an informal basis about strategic science issues and directions by Center leadership.

B. The scientist has exercised considerable initiative and leadership in creating venues to foster exchanges among researchers, managers, and traditionally conflicted stakeholders involved with large-carnivore research and management throughout the West, with a focus on grizzly bears and cougars in the Rocky Mountains. For example, these exchanges have occurred in venues designed by the scientist to integrate regional research efforts for cougars (six different workshops during an 8-year period), foster civil exchanges of information and perspectives about cougar management (a special session of the 7th Biennial Conference of Research on the Colorado Plateau, resulting in two papers in a book edited by

the scientist), increase knowledge among regional managers about managing for human safety around cougars and black bears (the workshop *Large Carnivores on the Plateau*; resulting in a report to regional managers and scientists during the 6th *Biennial Conference of Research on the Colorado Plateau*), and foster discovery of common ground among stakeholders in grizzly bear and cougar management in the Northern U.S. Rocky Mountains (the workshop *Perspectives on Large Carnivore Conservation*; resulting in an article in the journal *Environmental Science & Policy*). These venues have served to enhance the role of science in management through fostering the discovery and building of common ground.

C. The scientist has demonstrated leadership in pursuing professional directions and undertaking organizational analyses directly relevant to enhancing overall performance of the former USGS Biological Resources Discipline (BRD), typically at his own initiative and often entailing professional risk. For example, the scientist recently used Science Center venues to critique the practice of peer review within USGS, our agency's approach to climate change science, and the maladies of scientific management. He also undertook appraisals of the high-profile Glen Canyon Dam Adaptive Management Program (GCDAMP) and of the BRD at his own initiative. Both appraisals were subsequently well-received by those authoritatively involved in GCDAMP and BRD, with prospects of the scientist's continued engagement with and potential contribution to improving the performance of both institutions. In a similar vein, the scientist has worked toward developing a different paradigm of practice for biological sciences within USGS, involving the critique of *status quo* conventions and the promotion of collaboration among scientists, managers and other stakeholders. The scientist's efforts and innovations have resulted in several internal USGS awards (e.g., the *Paradigm Shifter* and *Exploding Head* awards), as well as appointments with the Yale School of Forestry & Environmental Studies and the MIT-USGS Science Impact Collaborative (MUSIC). The scientist was Western Field Director for MUSIC through 2010, with a focus on fostering integrated collaborative science in the Western Region. These leadership efforts are potentially important to the future direction of USGS, and have required that the scientist operate with sophistication and nuance organizationally, exercise considerable vision, and demonstrate a willingness to take professional risks.

D. The scientist has been effective as a leader in developing research programs from scratch on the Colorado Plateau, framed by a "gap analysis" that the scientist undertook soon after his arrival in this region in 1999. This analysis focused on unaddressed research needs and resulted in the development of programs featuring cougar-human relations, cougar-prey relations, and the ecology of upland waters. A seminal aspect of the scientist's approach has been the rational development of needs-based programs rather than the opportunistic pursuit of funds. This particular demonstration of leadership has required effective communication with DOI clients and state-level and private cooperators, the garnering of funds from diverse sources, and the encouragement and inspiration of collaborators and employees to achieve their creative potential and professional vision. Despite an initial dearth of resources, these research programs have grown, especially the program featuring cougar ecology which, to date, has garnered nearly \$3 million from numerous governmental and private sources. The scientist's effective internal leadership of science programs was evident in exceptionally high marks received from two "360" appraisals by peers and employees, one each during 2006 and 2007.

E. The scientist has taken a leadership role at the local level as part of the SBSC Colorado Plateau Research Station (CPRS), both by invitation and initiative. Based on demonstrated abilities, the scientist was designated Chair of the Information Resources Management (IRM) Committee at a time when IRM issues and related personality conflicts were particularly contentious. The scientist also took the initiative to develop an alternative management structure for the CPRS at a time of corrosive friction, for which the scientist received a Star Award. Later, the scientist successfully chaired the *Biennial*

Conference of Research on the Colorado Plateau at a particularly difficult time when institutional support had waned, and insured that this important regional venue for connecting researchers and managers survived to flourish when institutional support reemerged. The scientist received a Star Award for his efforts with the *Biennial Conference*. In a similar vein, the scientist was able to successfully reenergize Client's Day for the *5th Biennial Conference of Research on the Colorado Plateau* within a few months of arriving at a new duty station, for which he received a Star Award, and on another occasion took the initiative to act as 3rd party to negotiate a settlement for access to sensitive data, for which he received a Special Act Service Award. This history of service to CPRS continued when the scientist took on the duties of Station Leader/Liaison, 2008-2011, during which he dealt with a number of sensitive organizational and personnel issues, including renegotiating a 5-year cooperative agreement with Northern Arizona University. The scientist received two Star Awards for this service as Station Leader.

(14) SCIENTIFIC AND PUBLIC SERVICE

a. MEMBERSHIPS IN PROFESSIONAL SOCIETIES

The American Society of Mammalogists
The Society for Conservation Biology
American Association for the Advancement of Science
The Society for Policy Sciences
Wild Felid Research & Management Association

b. TECHNICAL PRESENTATIONS

not including public, classroom, training or information transfer presentations

151. "Effects of conspecifics on habitat selection by grizzly bears in the southwest Yukon, Canada," 2nd author with R. Maraj, C. Cormack Gates, & R.K. McCann at *20th International Conference on Bear Research & Management*, Ottawa, Canada, July 2011.

150. "Sex matters: Dietary strategies of male and female cougars on the southern Colorado Plateau," 2nd author with B. Holton at *10th WAFWA Mountain Lion Workshop*, Bozeman, MT, June 2011.

149. "The discourses of incidents: Cougars on Mt. Elden and in Sabino Canyon, Arizona," 1st author with S. Clark at *10th WAFWA Mountain Lion Workshop*, Bozeman, MT, June 2011.

148. "An explanation of cougar-related behaviors and behavioral intentions among northern Arizona residents," 2nd author with E.J. Ruther at *10th WAFWA Mountain Lion Workshop*, Bozeman, MT, June 2011.

147. "Two paradigms of climate change science: In service of greenhouse politics and pragmatic adaptation," at *2010 USGS Southwest Biological Science Center All Hands Meeting*, Flagstaff, AZ, December 2010. (INVITED)

146. "The many faces of peer review," at *2010 USGS Southwest Biological Science Center All Hands Meeting*, Flagstaff, AZ, December 2010. (INVITED)

145. "Leadership as social relationship: Perspectives on good leadership and implications for social

order,” 1st author with S. Clark at *2010 Policy Sciences Annual Institute*, Yale University Law School, New Haven, CT, October 2010.

144. “Scale: Refining the concept in policy sciences,” at *2010 Policy Sciences Annual Institute*, Yale University Law School, New Haven, CT, October 2010.

143. **“WORKSHOP:** Opportunities for collaborative mountain lion research in the interior western United States,” 1st organizer with M. Wolfe at *17th Annual Conference of The Wildlife Society*, Snowbird, UT, October 2010.

142. “Grizzly bears and pine seeds: Complexity and contingency,” 1st author with D. Reinhart at *High-Five Symposium: The Future of High-Elevation Five-Needle White Pines in Western North America*, Missoula, MT, June 2010. (INVITED)

141. “Restoring an extirpated species: Grizzly bears in the Southwest?,” at *25th Annual Meeting of the Southwest Region Native American Fish & Wildlife Society*, Scottsdale, AZ, July 2010. (INVITED)

140. “The USGS National Climate Change and Wildlife Science Center,” 2nd author with K. Kitchell at *25th Annual Meeting of the Southwest Region Native American Fish & Wildlife Society*, Scottsdale, AZ, July 2010. (INVITED)

139. “Development of mountain lion habitat selection models using ArcGIS Model Builder,” 2nd author with T.R. Arundel, B. Holton, K. Ironside, & J. Hart on POSTER for 2009 ESRI International User Conference, San Diego, CA, June 2010.

138. “The status of mountain lion research in the southwestern United States,” 2nd author with T.R. Arundel, B. Holton, & K. Ironside on POSTER for 2009 ESRI International User Conference, San Diego, CA, June 2010.

137. “Cougar management on the Colorado Plateau,” at *2010 Annual Utah Chapter of the Wildlife Society Meeting*, Moab, UT, March 2010. (INVITED PLENARY)

136. “College and university programs as a policy problem: Integrating knowledge, education, and action for a better world,” 4th author with S. Clark, M. Auer, & M. Rutherford at *2009 Policy Sciences Annual Institute*, Boulder, CO, October 2009.

135. “Roots of cougar-related human behaviors and behavioral intentions,” 1st author with L. Ruther at *Carnivores 2009*, Denver, CO, November 2009.

134. “The discourse of incidents: Cougars and people on Mt. Elden and in Sabino Canyon,” 1st author with S. Clark at *Carnivores 2009*, Denver, CO, November 2009.

133. “Factors affecting risk of puma attacks on humans,” 1st author with L. Sweanor & K. Logan on POSTER for *Carnivores 2009*, Denver, CO, November 2009.

132. “PANEL: Mountain lions, people, and policy: Improving our prospects for effective conservation of a keystone predator,” Panel member with J. Apker, T. Dunbar, R. Hopkins, G. Koehler, & R. Thompson at *Carnivores 2009*, Denver, CO, November 2009.

131. “WORKSHOP: Opportunities for collaborative mountain lion research on and near the Colorado Plateau,” at *10th Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, October 2009.

130. “No park is an island: Mountain lions on the southern Colorado Plateau,” 1st author with B. Holton at *10th Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, October 2009. (INVITED)

129. “The social-psychology of dominant frames: ‘Thresholds’ in natural resources management,” at *10th Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, October 2009. (INVITED)

128. “We talk about science and traditional knowledge, but are we not really talking about human dignity?,” at *10th Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, October 2009. (INVITED)

127. “Effects of simulated mountain lion caching on prey-like carcasses,” 2nd author with Z. Bischoff-Mattson on POSTER for *10th Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, October 2009.

126. “Roots of cougar-related human behaviors and behavioral intentions,” 1st author with L. Ruther on POSTER for *10th Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, October 2009.

125. “The discourse of incidents: Cougars and people on Mt. Elden and in Sabino Canyon,” 1st author with S. Clark on POSTER for *10th Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, October 2009.

124. “Predatory behavior of mountain lions on the southern Colorado Plateau,” 1st author with B. Holton at *24th Annual Meeting of the Southwest Region of the Native American Fish & Wildlife Society*, Isleta, NM, July 2009.

123. “‘For the good of the resource’: Nature as a constructed and contested participant” at *2008 Policy Sciences Annual Institute*, University of Colorado, Boulder, CO, October 2008.

122. “The witch craze: Natural resources parable and policy sciences interpretation” at *2008 Policy Sciences Annual Institute*, University of Colorado, Boulder, CO, October 2008.

121. “The virtues of Q methodology in natural resources planning and decision making,” 2nd author with N. Sexton, T. Cheng, & J. Clement, at *14th International Symposium on Society & Natural Resources Management*, Burlington, VT, June 2008.

120. “What is the problem?: Some orientation for the Global Climate Change Collaborative (G3C)” at *Inaugural Meeting of the Global Climate Change Collaborative*, Massachusetts Institute of Technology, Cambridge, MA, March 2008.

119. Mattson, D., “Improving professional practice in resource management agencies: Experiences, patterns and possible insights” at *2007 Policy Sciences Annual Institute*, Claremont-McKenna College, Claremont, CA, October 2007.

118. “Conflict over cougars: A window on natural resources governance” at *2007 Policy Sciences Annual Institute*, Claremont-McKenna College, Claremont, CA, October 2007.

117. “Managing for human safety in mountain lion range,” 1st author with K. Logan & L. Sweanor at 9th *Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, October 2007.
116. “PANEL: Future of conservation biology on the Colorado Plateau,” 2nd author with E. Grumbine, T. Fleischner, J. Belnap, & E Aumack, at 9th *Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, October 2007.
115. “USGS science and the ‘scientization’ of policy: Thoughts from the East Coast,” at *USGS Southwest Biological Science Center Annual All-Hands Meeting*, Flagstaff, AZ, February 2008.
114. “A model of a behaviorally-structured wildlife population,” 2nd author with C. Pease for 44th *Annual Meeting of the Animal Behavior Society*, Burlington, VT, July 2007.
113. “USGS BRD: A modern organization in a post-modern world,” for *Seminar series*, USGS Flagstaff Science Center, Flagstaff, AZ, May 2007. (INVITED)
112. “Polar bear conservation policy: Conservation hunting and climate change,” 3rd author with D. Clark, D. Lee, S. Clark & M. Freeman for *ArticNet Annual Science Meeting*, Victoria, BC, Canada, December 2006.
111. “Conservation hunting, climate change, and polar bear policy in Nunavut, Canada,” 3rd author with D. Clark & D. Lee for *2006 Policy Science Annual Institute*, sponsored by the Society for Policy Sciences, Yale Law School, New Haven, CT, November 2006.
110. “Knowledge integration: An exploration of psychological frames for understanding personality and perspectives in natural resources cases,” for *2006 Policy Science Annual Institute*, sponsored by the Society for Policy Sciences, Yale Law School, New Haven, CT, November 2006.
109. “Whitebark pine, grizzly bears and climate change,” 2nd author with K. Kendall for *Carnivores 2006*, sponsored by Defenders of Wildlife, St. Petersburg, FL, November 2006. (INVITED)
108. “Upland free water and wildlife: Past, present and future on the Colorado Plateau,” 3rd author with B. Holton & J. Hart for 33rd *Natural Areas Conference*, sponsored by the Natural Areas Association, Flagstaff, AZ, September 2006.
107. “Lions on the Plateau: A research program for the Colorado Plateau,” 2nd author with J. Hart & T. Arundel for *Learning from the Land 2006 Science Symposium*, sponsored by Grand-Staircase Escalante NM, Cedar City, UT, September 2006.
106. “Upland free water: Past, present and future in Grand Staircase-Escalante NM?,” 2nd author with J. Hart & B. Holton for *Learning from the Land 2006 Science Symposium*, sponsored by Grand-Staircase Escalante NM, Cedar City, UT, September 2006.
105. “Conflict over carnivores: A window on natural resources governance,” for Symposium on Integrative Problem Solving, 20th *Annual Meeting of the Society for Conservation Biology*, San Jose, CA, June 2006. (INVITED)
104. “The importance of gatherings,” 1st author with M. Johnson for workshop on *Capacity-Building for SCB Chapters in the 21st century*, 20th *Annual Meeting of the Society for Conservation Biology*, San Jose, CA, June 2006. (INVITED)
103. “Science and politics in high stakes natural resource decisions,” Plenary for *Multidisciplinary Approaches to Recovering Caribou in Mountain Ecosystems*, sponsored by the Columbia Mountains Institute, Revelstoke, BC, May 2006. (INVITED)

102. “Cougars of the Colorado Plateau: A multi-park investigation,” for *1st Workshop of the Colorado Plateau Mountain Lion Working Group*, sponsored by USGS Southwest Biological Science Center, Flagstaff, AZ, January 2006.
101. “Cougars of the Flagstaff Uplands: Preliminary results 2003-2005,” 1st author with J. Hart and T. Arundel for *1st Workshop of the Colorado Plateau Mountain Lion Working Group*, sponsored by USGS Southwest Biological Science Center, Flagstaff, AZ, January 2006.
100. “Human dimensions of mountain lion management: Value orientations and policy preferences of northern Arizona residents,” 3rd author with E.J. Ruther & D.M. Ostergren *8th Biennial Conference of Research on the Colorado Plateau*, sponsored by USGS Southwest Biological Science Center, Flagstaff, AZ, November 2005.
99. “Wildlife water developments and the social construction of conservation conflict,” 1st author with N. Chambers *8th Biennial Conference of Research on the Colorado Plateau*, sponsored by USGS Southwest Biological Science Center, Flagstaff, AZ, November 2005.
98. “The ecological effects of artificial water sources in a changing hydrologic regime,” 2nd author with P.B. Holton for *8th Biennial Conference of Research on the Colorado Plateau*, sponsored by USGS Southwest Biological Science Center, Flagstaff, AZ, November 2005.
97. “Predation by cougars in the Flagstaff Uplands 2003-2005,” 1st author with J. Hart & T. Arundel for *8th Biennial Conference of Research on the Colorado Plateau*, sponsored by USGS Southwest Biological Science Center, Flagstaff, AZ, November 2005. .
96. “Conflict over carnivores: A window on natural resources governance,” Plenary for conference on *Governance and Decision-Making in Mountain Areas*, sponsored by Parks Canada and The Banff Centre, Banff, AB, Canada, June 2005. (INVITED)
95. “Cougars of the Flagstaff uplands: Cougar-informed spatial frames for analyzing habitat selection,” 1st author with T. Arundel & J. Hart, POSTER for *8th Mountain Lion Workshop*, sponsored by the Washington Department of Fish & Wildlife, Leavenworth, WA, May 2005. .
94. “Cougars of the Flagstaff uplands: Results of 2003-2004 predation studies,” 1st author with J. Hart & T. Arundel, for *8th Mountain Lion Workshop*, sponsored by the Washington Department of Fish & Wildlife, Leavenworth, WA, May 2005.
93. “Harvesting lessons of inventorying biological resources: Thoughts on design from the Colorado Plateau,” 1st author with C. Drost, E. Nowak, T. Persons, M. Johnson, G. Rink, & J. Holmes, for *2005 George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites*, sponsored by the George Wright Society, Philadelphia, PA, March 2005. (INVITED)
92. “A multi-park design for investigating cougar-related risks to humans in the Southwest,” 1st author with J. Hart, T. Arundel, E. Garding, H.S. Kim, & E. Leslie, for *2005 George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites*, sponsored by the George Wright Society, Philadelphia, PA, March 2005.
91. “The psycho-sociology of integrating conservation science and management,” for the conference *A Bright Future for Biodiversity Conservation on the Colorado Plateau*, sponsored by the Colorado Plateau Chapter of the Society for Conservation Biology, Prescott College, Prescott, AZ, March 2005.
90. “Perspectives on wildlife, water, and humans in uplands of the Colorado Plateau,” 1st author with B. Holton, T. Arundel, & J. Hart, for the *Wildlife Water Development Workshop*, sponsored by the ASU Law School, BLM, US Fish & Wildlife Service, and Arizona Game & Fish Department, Arizona State University Law School, Phoenix, AZ, November 2004.

89. “The right values at the wrong time?: A functional explanation of factors and participant responses,” as part of panel on The Yellowstone to Yukon Conservation Initiative, for *2004 Policy Sciences Annual Institute*, sponsored by Society for Policy Sciences, Yale Law School, New Haven, CT, October 2004.
88. “Implementing impact-assessment models in bear management,” for an informal workshop with Japanese bear research and management specialists, sponsored by the Japan Ecosystem Conservation Society, Tokyo, Japan, September 2004. (INVITED)
87. “Using habitat evaluation models for conservation design,” Plenary for *The International Symposium on Habitat Evaluation*, sponsored by the Japan Ecosystem Conservation Society, Tokyo, Japan, September 2004. (INVITED)
86. “Seeing the elephant: Holistic intelligence for solving wildlife-related problems,” for *Interdisciplinary Research and Management in Mountain Areas* conference, sponsored by Parks Canada and the Banff Centre, Banff, AB, September 2004. (INVITED)
85. “Effects of humans and black bears on the post-Pleistocene invasion of grizzly bears,” 1st author with S. Herrero for *2004 Ecological Society of America Annual Meeting*, sponsored by the Ecological Society of America, Portland, OR, August 2004.
<http://abstracts.co.allenpress.com/pweb/esa2004/document/35283>. (INVITED)
84. “Values, myths and narrative in conservation,” for the conference *Views of the Elephant: Lessons Learned from Personal Experiences in Conservation*, sponsored by the Colorado Plateau Chapter for Conservation Biology, Marble Canyon, AZ, April 2004.
83. “Policy-oriented conservation design,” for workshop *Policy-Oriented Conservation Design*, sponsored by the Wilburforce Foundation and Y2Y Conservation Initiative, Pender Island, BC, February 2004. (INVITED)
82. “Consumption of voles and vole food caches by Yellowstone grizzly bears: Exploratory analyses,” POSTER for *15th International Conference of Bear Research and Management*, sponsored by the International Bear Association, San Diego, CA, February 2004.
81. “Consumption of pondweed roots by Yellowstone grizzly bears,” 1st author with S. Podruzy & M. Haroldson POSTER for *15th International Conference of Bear Research and Management*, sponsored by the International Bear Association, San Diego, CA, February 2004.
80. “Natural landscape features, human-related attractants, and conflict hotspots: A spatial analysis of human-grizzly bear conflicts,” 3rd author with S. Wilson, M.J. Madel, J.M. Graham, J.A. Burchfield, & J.M. Belsky for *15th International Conference of Bear Research and Management*, sponsored by the International Bear Association, San Diego, CA, February 2004.
79. “Are black bears a factor in the restoration of North American grizzly bear populations?,” 1st author with S. Herrero & T. Merrill for *15th International Conference of Bear Research and Management*, sponsored by the International Bear Association, San Diego, CA, February 2004.
78. “Spatial analysis of puma (*Puma concolor*) habitat use relative to topographic roughness in northern Arizona,” 3rd author with T.R. Arundel, S.T. Arundel & J Hart POSTER for *7th Biennial Conference of Research on the Colorado Plateau*, sponsored by the 7th Biennial Conference Committee, Flagstaff, AZ, November 2003.
77. “A conceptual model and appraisal of research related to interactions between humans and pumas,” 1st author with J. Hart & P. Beier for *7th Biennial Conference of Research on the Colorado Plateau*, sponsored by the 7th Biennial Conference Committee, Flagstaff, AZ, November 2003.

76. “Clarification of perspectives and pursuit of the community interest: Carnivore conservation in the Northern Rockies,” 4th author with S.R. Brown, K.L. Byrd, T.W. Clark, & M. Rutherford for *2003 Policy Sciences Annual Institute*, sponsored by Society for Policy Sciences, Yale Law School, New Haven, CT, October 2003.

75. “Coefficients of productivity for Yellowstone’s grizzly bear habitat,” for *Workshop on evaluating the Yellowstone grizzly bear cumulative effects model*, sponsored USGS Interagency Grizzly Bear Study Team, Bozeman, MT, September 2003. (INVITED)

74. “Grizzly bear use of whitebark pine habitats,” 1st author with D. Reinhart for *Whitebark Pine Committee 2003 Workshop*, sponsored by the Greater Yellowstone Coordinating Committee, Lake Village, Yellowstone National Park, WY, June 2003. (INVITED)

73. “A conceptual model and appraisal of existing research related to interactions between humans and pumas,” 1st author with J. Hart, P. Beier, & J. Millen-Johnson for *7th Mountain Lion Workshop*, sponsored by Wyoming Game & Fish Department and The Wildlife Society, Jackson, WY, May 2003.

72. “Bridging scales, bridging to conservation practice: Grizzly bear science in Y2Y,” Plenary for *Making Science, Making Change in Y2Y: Four Years of Research and Collaboration on Ecological Connectivity*, sponsored by the Yellowstone-to-Yukon Conservation Initiative and Wilburforce Foundation, Calgary, AB, May 2003. (INVITED)

71. “The Southern Colorado Plateau Network inventory: Where to from here?,” for *Southern Colorado Plateau Network Inventory & Monitoring Workshop*, sponsored by the U.S. National Park Service, Southern Colorado Plateau Network, Farmington, NM, April 2003. (INVITED)

70. “How well do different approaches address rare species, biologically and ecologically?,” as speaker and panel member for *Innovations in Species Conservation Symposium: Integrative Approaches to Address Rarity & Risk*, sponsored by the U.S. Forest Service, USGS, and etc., Portland, OR, April 2003. (INVITED)

69. “Why grizzly bears?,” for *Central Rockies Ecosystem Grizzly Bear Management Workshop*, sponsored by the Central Rockies Ecosystem Interagency Liaison Group, Radium, BC, April 2003. (INVITED)

68. “Promises and pitfalls of models in science and management,” for *Central Rockies Ecosystem Grizzly Bear Management Workshop*, sponsored by the Central Rockies Ecosystem Interagency Liaison Group, Radium, BC, April 2003. (INVITED)

67. “Thoughts on transboundary monitoring and management of grizzly bears,” for *Kluane National Park and Reserve Grizzly Bear Symposium*, sponsored by Parks Canada Yukon Field Unit, Haines Junction, Yukon Territory, March 2003. (INVITED)

66. “A model-based appraisal of grizzly bear habitat conditions in northwestern Montana,” 1st author with T. Merrill for the *Border Bears Workshop*, sponsored by the National Wildlife Federation and U.S. Fish and Wildlife Service, Sandpoint, ID, December 2002. (INVITED)

65. “Perspectives in grizzly bear conservation: Representations from newspaper and magazine articles,” 1st author with S. Wilson for *Carnivores 2002*, sponsored by Defenders of Wildlife, Monterey, CA, November 2002.

64. “Conditions of grizzly bear policy implementation: An inside view,” 1st author with T. Clark for *2002 Policy Sciences Annual Institute*, Yale Law School, New Haven, CT, October 2002.

63. “Umbrella effects,” 2nd author with T. Merrill for *CERI Meeting on Conservation Area Design*, sponsored by the Craighead Environmental Research Institute, B-Bar Ranch, MT, September 2002.

62. “Conservation of mountain carnivores: Living with mountain carnivores?,” for *Ecological and Earth Sciences in Mountain Areas* conference, sponsored by Parks Canada and the Banff Centre, Banff, AB, September 2002. (INVITED)
61. “Restoring an extirpated species: Grizzly bears in the Southwest?,” for *Second Annual Meeting of the Southwestern Carnivore Committee*, sponsored by U.S. Fish and Wildlife Service and the Turner Endangered Species Fund, Grand Canyon National Park, AZ, May 2002.
60. “Restoring an extirpated species: Grizzly bears in the Southwest?,” POSTER with T. Merrill for *6th Biennial Conference of Research on the Colorado Plateau*, sponsored by USGS Colorado Plateau Field Station, Flagstaff, AZ, November 2001.
59. “Report from a workshop on the biology and management of pumas and black bears in Colorado Plateau National Parks,” 1st author with E. Leslie for *6th Biennial Conference of Research on the Colorado Plateau*, sponsored by USGS Colorado Plateau Field Station, Flagstaff, AZ, November 2001. (INVITED)
58. “A conceptual framework for large carnivore conservation: The case of Yellowstone’s grizzly bears,” for *First Annual Meeting of the Southwestern Carnivore Committee*, sponsored by the Turner Endangered Species Fund and U.S. Fish and Wildlife Service, Albuquerque, NM, June 2001.
57. “Grizzly bears in the southwest: Some biophysical features of their extirpation and current prospects,” for *First Annual Meeting of the Southwestern Carnivore Committee*, sponsored by the Turner Endangered Species Fund and U.S. Fish and Wildlife Service, Albuquerque, NM, June 2001.
56. “The effects of fragmentation, edges and habitat loss on wildlife: A perspective for mountain environments,” for conference on *Human Use Management in Mountain Areas*, sponsored by Parks Canada and The Banff Centre, Banff, AB, June 2001. (INVITED)
55. “Consumption of earthworms by Yellowstone grizzly bears,” 1st author with M. French & S. French, POSTER for *13th International Conference on Bear Research and Management*, sponsored by the International Association for Bear Research and Management, Jackson, WY, May 2001.
54. “Consumption of fungal sporocarps by Yellowstone grizzly bears,” 1st author with S. Podruzny & M. Haroldson, POSTER for *13th International Conference on Bear Research and Management*, sponsored by the International Association for Bear Research and Management, Jackson, WY, May 2001.
53. “Defining habitat suitable for grizzly bears in the Greater Yellowstone Ecosystem,” 2nd author with T. Merrill for *13th International Conference on Bear Research and Management*, sponsored by the International Association for Bear Research and Management, Jackson, WY, May 2001.
52. “Conservation of grizzly bears in the northern U.S. Rockies: An explanatory hypothesis,” 1st author with T. Clark for *13th International Conference on Bear Research and Management*, sponsored by the International Association for Bear Research and Management, Jackson, WY, May 2001.
51. “Rationality or rationalization?: Science in the grizzly bear policy arena,” for *All Hands Meeting*, sponsored by the U.S.G.S. Forest and Rangeland Ecosystem Science Center, Corbett, OR, January 2001. (INVITED)
50. “Social process mapping for large carnivore conservation,” for *Managing Human Activities in Ecosystems in the Face of Large Uncertainties*, sponsored by the Science and Environmental Health Network, Missoula, MT, November 2000. (INVITED)
49. “Comparison of terrestrial and aquatic reserve designs: A northwest Montana pilot study,” 3rd author with T. Merrill & C. Frissell for *Annual Meeting of the Society for Conservation Biology*, sponsored by the Society for Conservation Biology, Missoula, MT, June 2000.

48. "Access management: Managing people not ecosystems," for *Roads and Zones: Balancing Human Access in Public Lands*, sponsored by the Miistakis Institute for the Rockies, Radium Hot Springs, BC, February 2000.
47. "Use of non-native clover and grass by Yellowstone grizzly bears," 2nd author with D.P. Reinhart & K.A. Gunther, POSTER for *Exotic Organisms in Yellowstone: Native Biodiversity Under Siege*, sponsored by Yellowstone National Park, Mammoth, WY, October 1999.
46. "The effect of exotic species on Yellowstone's grizzly bears," 3rd author with D.P. Reinhart, M. Haroldson, & K.A. Gunther for *Exotic Organisms in Yellowstone: Native Biodiversity Under Siege*, sponsored by Yellowstone National Park, Mammoth, WY, October 1999.
45. "Comprehensive analysis for successful carnivore conservation: A systematic framework for mapping key variables," 2nd author with T. Clark, R. Reading & B. Miller for the *Carnivore Conservation Symposium*, sponsored by the Royal Zoological Society, London, October 1998. (INVITED)
44. "Whitebark pine, red squirrels and grizzly bears," 1st author with K. Kendall & D. Reinhart for the symposium *Restoring Whitebark Pine Ecosystems*, sponsored by the U.S. Forest Service, U.S. Park Service, USGS Biological Resources Division and Society of American Foresters, Missoula, MT, September 1998. (INVITED)
43. "Fire, red squirrels, whitebark pine, and Yellowstone grizzly bears," 3rd author with S. Podruzney & D. Reinhart for *11th International Conference on Bear Research and Management*, Gatlinburg, TN, April 1998.
42. "Use of rub trees by Yellowstone grizzly bears," 2nd author with G. Green & R. Swalley for *11th International Conference on Bear Research and Management*, Gatlinburg, TN, April 1998.
41. "Geophagy by Yellowstone grizzly bears," 1st author with G. Green & R. Swalley, POSTER for *11th International Conference on Bear Research and Management*, Gatlinburg, TN, April 1998.
40. "Landscapes suitable for restoration of grizzly bears in Idaho," for *Annual Meeting of the Idaho Chapter of the Wildlife Society*, Moscow, ID, March 1998. (INVITED)
39. "Grizzly bear conservation in the Greater Yellowstone Ecosystem," for *Workshop on Conservation Problem Solving*, sponsored by the Northern Rockies Conservation Cooperative and U.S. Forest Service, Jackson, WY, September 1997. (INVITED)
38. "Assessing umbrella effects of grizzly bears in Idaho: Applying matrices of habitat sensitivities," 1st author with T. Merrill for *7th Annual Gap Analysis Principal Investigators' Meeting*, Reston, VA, August 1997.
37. "Defining suitable landscapes for reintroduction of grizzly bears in Idaho," 1st author with T. Merrill for *7th Annual Gap Analysis Principal Investigators' Meeting*, Reston, VA, August 1997.
36. "Are grizzly bears an umbrella species for Idaho?," 1st author with T. Merrill, R. Noss, & H. Quigley for *Annual Meeting of the Society for Conservation Biology*, Victoria, BC, June 1997.
35. "Fragmentation and large carnivores: An unconventional view of landscapes," 2nd author with T. Merrill & H. Quigley for the workshop *Landscape Alteration Effects on Fauna in the Americas: Establishing a Basis for Analysis Across Biomes*, sponsored by IAI-AMIGO, Maitencillo, Chile, December 1996. (INVITED)
34. "Extirpations of grizzly bear (*Ursus arctos*) populations: An analysis of historical landscape patterns," 2nd author with T. Merrill for the *Joint Annual Meetings of the Ecological Society of America and the Society for Conservation Biology*, Providence, RI, August 1996.
33. "The Alsek Pass Assessment" and "Interagency grizzly bear management," for *Kluane National Park and Reserve Grizzly Bear Research Project: Project Review and Workshop*, Vancouver, BC, March 1996. (INVITED)
32. "Impacts of the proposed New World Mine on Yellowstone's threatened grizzly bear population," for the World Heritage Committee hearings *Yellowstone National Park: World Heritage Site in Danger Designation*, Mammoth, WY, September 1995. (INVITED)
31. "Demography and behavior of the Yellowstone grizzly bears", 2nd author with C. Pease for *Conference on Greater Yellowstone Predators*, organized by Yellowstone National Park and the Northern Rockies Conservation Cooperative, Mammoth, WY, September 1995.

30. "The strange case of ethics and natural resource agency science," for the Plenary Session *Ethics, Science, and Public Policy*, at the American Institute of Biological Sciences annual meeting, San Diego, CA, August 1995. (INVITED)
29. "Demography and behavior of the Yellowstone grizzly bears," 2nd author with C. Pease for *10th International Conference on Bear Research and Management*, Fairbanks, AK, July 1995.
28. "Diet and morphology of northern bears: Some hypotheses," for *10th International Conference on Bear Research and Management*, Fairbanks, AK, July 1995.
27. "Changing mortality of Yellowstone grizzly bears," for *10th International Conference on Bear Research and Management*, Fairbanks, AK, July 1995.
26. "Assessing cumulative effects of human development on grizzly bears," for *Ecological Outlook Project: Cumulative Effects Assessment and Futures Modelling Workshop*, sponsored by the Banff Bow Valley Study Task Force, Banff, AB, June 1995. (INVITED)
25. "The New World Mine and grizzly bears: A window on ecosystem management," for the symposium *National Parks and Public Land Ecosystems: Meeting the Challenge of Common Boundaries and Conflicting Mandates*, sponsored by the College of Law, University of Utah, Snowbird, UT, April 1995. (INVITED)
24. "Kamchatkan brown bears and *Pinus pumila*," for the workshop *Management of Whitebark Pine Ecosystems — An International and Regional Perspective*, sponsored by the Society of American Foresters, Intermountain Research Station, and Gallatin National Forest, Bozeman, MT, April 1993. (INVITED)
23. "Implementing endangered species policy: Lessons from the Yellowstone grizzly bear recovery effort," for the workshop *Implementing Endangered Species Policy* sponsored by the University of Michigan School of Natural Resources and the Environment, Ann Arbor, MI, January 1993. (INVITED)
22. "Use of road density standards for management of Yellowstone grizzly bear habitat," for a meeting on road density and security area standards for grizzly bear management, sponsored by the Grizzly Bear Recovery Coordinator, Missoula, MT, January 25-26, 1993. (INVITED)
21. "Biology of the Yellowstone grizzly bear," for the symposium *Human-Bear Conflicts*, sponsored by the West Yellowstone Chamber of Commerce, West Yellowstone, MT, October 1992. (INVITED)
20. "Grizzly bear-whitebark pine relationships in North America," for *International Workshop on Stone Pines and their Environment*, sponsored by the Swiss Institute of Forest, Snow & Landscape Research, U.S. Forest Service, and University of Munster, Germany, at St. Moritz, Switzerland, September 1992. (INVITED)
19. "Conservation of the Yellowstone grizzly bear," for the seminar series *Conservation Biology and Public Land Management*, at University of Wyoming, AMK Ranch, Grand Teton National Park, August 1992. (INVITED)
18. "Whitebark pine-grizzly bear associations," for *Whitebark Pine Workshop on New Management Perspectives in the Greater Yellowstone Area*, sponsored by the Gallatin National Forest, U.S. Forest Service Intermountain Research Station, and the Eastern Montana Chapter of the Society of American Foresters, Bozeman, MT, January 1992. (INVITED)
17. "The Yellowstone experience: 'Between a rock and a hard place'," for *Grizzly Bear Management Workshop*, sponsored by the Canadian Parks Service and Friends of Revelstoke National Park, Revelstoke, BC, March 1991. (INVITED)
16. "Sensitivity of grizzly bear population indices to long-term change in habitat support capability," for the symposium *Forever Threatened?*, sponsored by the Wyoming Wildlife Federation, Dubois, WY, June 1990.
15. "Grizzly bears, roads, displacement and mortality: What does the research mean?," for *Grizzly/Wolf Technical Workshop*, sponsored by the National Wildlife Federation, Polebridge, MT, July 1989. (INVITED)
14. "Interactions among red squirrels, grizzly bears, and the whitebark pine cone crop," for the workshop *Review of Research on Whitebark Pine Ecosystems*, sponsored by the U.S. Forest Service, Forest Service Fire Lab, Missoula, MT, March 1989. (INVITED)

13. "Stone pines and bears," 1st author with C. Jonkel for the symposium *Whitebark Pine Ecosystems — Ecology and Management of a High-Mountain Resource*, sponsored by the U.S. Forest Service, National Park Service, Montana State University, and Society of American Foresters, Bozeman, MT, March 1989. (INVITED)
12. "Whitebark pine on the Mount Washburn massif, Yellowstone National Park," 1st author with D. Reinhart for the symposium *Whitebark Pine Ecosystems — Ecology and Management of a High-Mountain Resource*, sponsored by the U.S. Forest Service, National Park Service, Montana State University, and Society of American Foresters, Bozeman, MT, March 1989.
11. "Grizzly bear use of Yellowstone Lake cutthroat trout," 2nd author with D. Reinhart for the *8th International Conference on Bear Research and Management*, sponsored by the International Association for Bear Research and Management, Victoria, BC, February 1989.
10. "Human impacts on bear habitat use," Plenary for the *8th International Conference on Bear Research and Management*, sponsored by the International Association for Bear Research and Management, Victoria, BC, February 1989. (INVITED)
9. "Timbering and roading in grizzly habitat," for *Greater Yellowstone Coalition 1988 Annual Meeting and Scientific Conference*, Lake Lodge, Yellowstone National Park, WY, June 1988. (INVITED)
8. "Dynamics of ungulate carcasses and their use by bears on ungulate winter ranges," 1st author with G. Green & J. Henry for *First Annual Meeting of Research and Monitoring on Yellowstone's Northern Range*, sponsored by the National Park Service, Mammoth, WY, January 1988.
7. "Evaluation of grizzly bear habitat using standard classification systems," 1st author with R. Knight for the symposium *Land Classifications Based on Vegetation — Applications for Resource Management*, sponsored by the University of Idaho, U.S. Forest Service, and State of Idaho, Moscow, ID, February 1987. (INVITED)
6. "Significance of whitebark pine to wildlife," for workshop sponsored by the U.S. Forest Service, Montana State University, Bozeman, MT, February 1987. (INVITED)
5. "Food habits of the Yellowstone grizzly bear," 1st author with B. Blanchard & R. Knight for *7th International Conference on Bear Research and Management*, Williamsburg, VA, February 1986.
4. "The effects of developments and primary roads on grizzly bear habitat use in Yellowstone National Park, Wyoming," 1st author with B. Blanchard & R. Knight for *7th International Conference on Bear Research and Management*, Williamsburg, VA, February 1986.
3. One part of four part presentation, "A cumulative effects model for grizzly bear management in the Yellowstone ecosystem," for *Grizzly Bear Habitat Symposium*, sponsored by the Interagency Grizzly Bear Committee and University of Montana, Missoula, MT, April-May 1985.
2. "Derivation of habitat component values for the Yellowstone grizzly bear," 1st author with R; Knight and B. Blanchard for *Grizzly Bear Habitat Symposium*, sponsored by the Interagency Grizzly Bear Committee and University of Montana, Missoula, MT, April-May 1985.
1. "Classification and environmental relationships of wetland vegetation in Yellowstone National Park, Wyoming," for *55th Annual Meeting of the Northwest Science Association*, Walla Walla College, College Place, WA, March 1982.

c. RENDERING SCIENTIFIC JUDGMENT

External Scientific Review Panels & Consultation since 1992

49. Second-level USGS review of BLM Sonoran Desert and Colorado Plateau Rapid Ecoregional Assessment processes, for BLM National Operations Center, Denver, CO, 2010-present; *expert reviewer*.
48. Advice on and review of protocol for managing pocket gophers in grizzly bear habitat, for P. Durkin of SERA Inc., 2010; *topic expert and expert reviewer*.

47. Invited Participant in scoping meeting for USGS response to BLM Rapid Ecological Assessments, Salt Lake City, UT, January 2010; *topic expert*.
46. Invited Participant in *Manhattan Project II Workshop* to scope research needs related to desert bighorn sheep-mountain lion interactions, Armendaris Ranch, Truth or Consequences, NM, April 2010; *topic expert*.
45. Invited Panel Expert for *Human Dimensions of Carnivore Conservation: Experts Workshop* convened to advise the Florida Wildlife Commission and US Fish & Wildlife Service on new approaches to conserving the Florida panther, January 2010; *topic expert*.
44. Invited Participant in problem-solving workshop *Aboriginal People, Polar Bears, and Human Dignity*, Whitehorse, Yukon Territory, January 2009; *topic expert*.
43. Consultant and collaborator on development of ArcGIS Agent Analyst extension with Kevin Johnston, ESRI, 2008-present. This collaboration involved use of cougar data to motivate a seminal application of Agent Analyst used in an instructional book covering this extension: Johnston, K., ed. (2011). *Getting to Know ArcGIS Agent Analyst*. ESRI Press, Redlands, CA. Applications to cougars comprised the bulk of Chapters 5 & 8 entitled *Moving point agents based on multi criteria decision making* and *Adding complexity to moving discrete point agents over continuous surfaces*. The scientist was offered but turned down authorship on these chapters because of complications entailed by the USGS product review process.
42. Review of and reference for research proposal, “Conservation and management of an isolated remnant population of Moroccan Dorcas gazelles north and west of the Atlas Mountains,” to People’s Trust for Endangered Species, London, UK, for M. Znari, 2008; *expert reviewer & consultant*.
41. Invited Applicant for *Endangered Species Management Kenya*, US Department of Interior International Technical Assistance Program, 2008; Canceled because of political problems in host country
40. Review of research/handling protocol “Pilot study: Ecology of mountain lions in the badlands of southwestern North Dakota” for J. Austin, USGS Northern Prairie Wildlife Research Center, March 2008; *expert reviewer*.
39. Advice on structure and design of MUSIC and of associated curricula and programs in the MIT Department of Urban Studies & Planning, Environmental Policy & Planning Group for H. Karl, MIT-USGS Science Impact Collaborative—entailing numerous meetings, conversations, white papers, and memos, 2007-2008; *expert consultant*.
38. Advice on collaborative approaches to resolving contentious natural resources issues, for Karen Hardigg, Alaska Forest Program Manager, The Wilderness Society, Anchorage, AK, 2007; *expert consultant*.
37. Review of and advice on “Credit trading framework: Conceptual basis for quantifying credits and debits in the sagebrush ecosystem,” for J. Hestbeck, USGS Ft. Collins Science Center, 2007; *expert consultant and reviewer*.
36. Review and other input on proposal to the Natural Resources Conservation Service, Washington Office, regarding “Suggested metric for quantifying a positive zone of influence on grizzly bear habitat from non-lethal deterrent practices” for S. Wilson, Yale School of Forestry & Environmental Studies and Blackfoot Challenge, MT, 2006; *expert consultant*
35. Review of *Cougar Management Guidelines for North America*, for the authors and for Wild Futures, Earth Island Institute, Bainbridge Island, WA, 2004; *expert reviewer*.

34. Review of the *Muskwa-Kechika Wildlife Management Plan* for the Muskwa-Kechika Management Area Advisory Board, Fort St. John, BC, 2004; *expert reviewer*.
33. Review of the draft report *Analysis of Scientific Publications Related to the Florida Panther* for U.S. Fish & Wildlife Service and Florida Fish & Wildlife Commission, 2003; *expert reviewer*.
32. Review of web-served synopses of conservation biology literature and methods for Canadian Information System for the Environment, Environment Canada, 2003; *expert reviewer*.
31. Design and analysis for research program to model distribution of pre-historical Palouse Prairie vegetation in the Hangman Restoration Project area for Coeur d'Alene Tribe, Wildlife Program, Plummer, ID, 2002-present; *scientific advisor*.
30. Design of monitoring program for the U.S. National Park Service, Northern Colorado Plateau Network, Moab, UT, 2002; *scientific advisor*.
29. Methods for biological inventory and monitoring for the U.S. National Park Service, Southern Colorado Plateau Network, Inventory and Monitoring Program, Flagstaff, AZ, 2001-2005; *member of scientific advisory committee*.
28. Evaluation of impacts on large terrestrial vertebrates for alternatives regarding vehicular management in the Salt Creek Drainage of Canyon Lands NP, for U.S. National Park Service, Southeast Utah Group, Moab, UT, 2001; *member of the scientific review panel*.
27. Review of grizzly bear research program in and around Banff NP, for Parks Canada, Banff National Park, Banff, AB, 2001; *evaluated past research and proposed future directions for research and monitoring*.
26. Review of restoration plan for grizzly bear habitat in Jasper National Park (*Jasper National Park Three Valley Confluence Recovery Plan*) for Parks Canada, Jasper, AB, 2001; *expert reviewer*.
25. Review of plan for black bear research in Olympic National Park for USGS Forest & Rangeland Ecosystem Science Center, Corvallis, OR, 2001; *expert reviewer*.
24. Review of final report *A Study of New Mexico Black Bear Ecology with Models for Population Dynamics and Habitat Quality* for the New Mexico Fish & Wildlife Research Unit and New Mexico Department of Game and Fish, Santa Fe, NM, 2001; *expert reviewer*.
23. Review of research proposals for Grand Canyon National Park, Flagstaff, AZ, 2000; *expert reviewer*.
22. Review of *Sky Islands Wildlands Network and Conservation Plan* for The Wildlands Project, Tucson, AZ, 2000; *expert reviewer*.
21. Advice on methods for conservation planning and design for Yellowstone-to-Yukon Conservation Initiative, Canmore, AB, 1999-2005; *member of science advisory committee*.
20. Advice and other input on management standards for whitebark pine and relations among bears, red squirrels and whitebark pine, for U.S. Forest Service and U.S. National Park Service, Yellowstone ecosystem, 1999-present; *member of Yellowstone Ecosystem Whitebark Pine Working Group*.
19. Evaluate strategy for scientific research and conservation planning for Yellowstone-to-Yukon Conservation Initiative, Jasper, AB, 1999; *member of Scientific Advisory Forum*.
18. Provide overview of issues in large carnivore conservation for Canadian Ministry on Canadian Heritage Ecological Integrity Panel, 1999; *invited panel expert for Parks Canada*.
17. Advice on decision process and analysis methods related to conservation planning, for The Wildlife Network and Summerlee Foundation, Bainbridge Island, WA, 1998-present; *member of advisory committee for development of methods for bioregional conservation planning*.

16. Advice on development of an education course for hunters to prevent and respond appropriately to grizzly bear encounters, for Grizzly Bear Education Course Team, Wyoming Outfitters & Guides Association, 1998-2002; *member of steering committee.*
15. Advice on development of models and review of methods and products for World Wildlife Fund Canada and Conservation Biology Institute project: Modeling Carnivore Habitat in the Rocky Mountain Region, 1997-2000; *member of scientific advisory committee.*
14. Advice on development of the cumulative effects analysis process, and revision of methods and update of coefficients for mapped habitat types for Interagency Grizzly Bear Committee, Yellowstone subcommittee, 1997-2001; *member of grizzly bear cumulative effects modeling team for the Yellowstone Ecosystem.*
13. Development and review of grizzly bear research program in Kluane National Park, Yukon, for Canadian Parks Service, Western Region, Winnipeg, MB, 1991-2006; *member of the Kluane Grizzly Bear Study Working Group.*
12. Habitat-based population viability analysis for the East Slopes grizzly bear population in Alberta by the IUCN Conservation Biology Specialists Group (CBSG) and the East Slopes Grizzly Bear Project (ESGBP), University of Calgary, 1999; *scientific expert for the CBSG and ESGBP.*
11. Selection of wildlife projects for funding by Seattle City Light, City of Seattle, WA, 1999; *expert reviewer.*
10. Review of species distribution models for Idaho for the Idaho GAP Analysis project, 1998-1999; *scientific expert.*
9. Evaluation of and advice on methods and interpretation of conservation area design for coastal brown bears in British Columbia, for Round River Conservation Studies, Salt Lake City, UT, 1998; *member of scientific review panel.*
8. Evaluation of Tongass Land Management Plan alternatives for probable impacts on brown bears, for U.S. Forest Service, Tongass National Forest, Juneau, AK, 1996-1997; *member of the Brown Bear Panel.*
7. Advice on methods for impacts assessment and review of Environmental Impact Statement and Biological Assessment for the proposed New World Mine near Cooke City, MT, for U.S. Forest Service, Gallatin National Forest, Gardiner, MT, 1995-1998; *member of the scientific review committee.*
6. Development and review of research on current human impacts in the Bow Valley and participation in a futures modeling exercise for the region, for Secretariat of the Banff Bow Valley Task Force, Banff, AB, 1995-1996; *member of the scientific review committee for the Banff-Bow Valley.*
5. Assessment of the status of the Yellowstone National Park World Heritage Site by the World Heritage Committee, 1995; *expert witness for the US National Park Service.*
4. Assessment of proposed access development along the boundary of Kluane National Park, Yukon, 1994-1995; *scientific advisor for Axys Environmental Consultants and the Canadian Parks Service.*
3. Development of a carnivore conservation strategy for the Canadian and northern United States Rocky Mountains by the World Wildlife Fund, Canada, Toronto, ON, 1993; *scientific advisor.*
2. Assessment of the proposed expansion of the Sunshine Ski area in Banff National Park for Parks Canada, Calgary, AB, 1993; *scientific expert.*
1. Assessment of the proposed Westcastle ski development near Waterton National Park, Canada, for the Natural Resources Conservation Board of Alberta, 1993; *scientific expert for Parks Canada.*

Review of Journal or Book Manuscripts since 1998: The scientist reviewed **51 manuscripts** for the following journals since July of 1998. The number of manuscripts reviewed for each venue is given in parentheses in bold.

Ecology (4)

Ecological Applications (1)

Behaviour (1)

Conservation Biology (8; 2 as Assigning Editor)

Ecography (1)

Biological Conservation (1)

Journal of Mammalogy (1)

Journal of Wildlife Management (9)

Wildlife Society Bulletin (4)

Restoration Ecology (1)

Acta Theriologica (1)

Canadian Journal of Zoology (4)

Ursus (5)

Journal of Forest Ecology & Management (1)

Western North American Naturalist (2)

Northwest Science (1)

USFS General Technical Report Series (1)

Proceedings of the 5th Biennial Conference of Research on the Colorado Plateau (1)

Proceedings of the 8th Biennial Conference of Research on the Colorado Plateau, University of Arizona Press (2)

Proceedings of the 9th Biennial Conference of Research on the Colorado Plateau, University of Arizona Press (1)

Desert Bighorn Council Transactions (1)

d. LECTURESHIPS AND OTHER ACADEMIC SERVICE

Since 1992 the scientist has instructed **10 semester-long classes or intensives**, 4 at Yale University, 4 at the Massachusetts Institute of Technology, 1 at Northern Arizona University, and 1 at University of Idaho; and given **95 seminars or lectures** in academic venues, primarily graduate classes, but including departmental seminars and undergraduate classes at Yale University, University of Michigan, University of Idaho, Northern Arizona University, University of Montana, Montana State University, Boise State University, Prescott College, and The Yellowstone Institute.

Semester-Long Seminars & Courses since 1992

10. Instructor, 11.972, *Elements of Public Interest Leadership*, 24 hrs of class, MIT Department of Urban Studies & Planning, January 2009.

9. Instructor, 11.941 *Elements of Environmental Leadership*, 24 hrs of class, MIT Department of Urban Studies & Planning, Spring 2008.

8. Co-Instructor, 11.375 *Workshop on Collaborative Adaptive Management*, 40 hrs of class, MIT Department of Urban Studies & Planning, Spring 2008.

7. Co-instructor, *Foundations of Natural Resources Policy* (F&ES 85036), 42 hrs of class, Yale School of Forestry & Environmental Studies, New Haven, CT, January-May 2007

6. Co-instructor, *Society & Natural Resources* (F&ES 83049), 28 hrs of class, Yale School of Forestry & Environmental Studies, New Haven, CT, January-May 2007

5. Co-instructor, *Large Scale Conservation* (F&ES 83037), 42 hrs of class, Yale School of Forestry & Environmental Studies, New Haven, CT, January-May 2007

4. Co-instructor, *Reforming Natural Resources Governance* (IAP 11.959), 40 hrs of class, MIT Department of Urban Studies & Planning, Cambridge, MA, January 2007

3. Instructor, *Interdisciplinary Approaches to Large Carnivore Conservation* (F&ES 30023a), 39 hrs of class, Yale School of Forestry & Environmental Studies, New Haven, CT, September-December 2006

2. Co-Instructor, *The Policy-Science Interface* (ENV 555), 39 hrs of class, Center for Environmental Sciences & Education, Northern Arizona University, Flagstaff, AZ, August-December 2005

1. Instructor, *Senior Seminar: "What role does biology have in natural resources management?"* (WLF495), 13 hrs of class, Department of Fish and Wildlife Resources, University of Idaho, Moscow, August-December 1993

Lectures since 1992

95. "The existential roots of human dignity," *Yale Human Rights and Environment Dialogue*, Yale University, New Haven, CT, January 2011 (INVITED)

94. "Wildlife management in the Southwest: Maladies of scientific management," *Large Scale Conservation* (F&ES 83037b), Yale School of Forestry & Environmental Studies, New Haven, CT, January 2011 (INVITED)

93. "Existentialism," *Society & Natural Resources: Environmental Psychology* (F&ES 83049b), Yale School of Forestry & Environmental Studies, New Haven, CT, January 2011 (INVITED)

92. "The social-psychology of professional practice," *Western Resources Interest Group*, Yale School of Forestry & Environmental Studies, New Haven, CT, January 2011 (INVITED)

91. "Sex matters: The predatory strategies of male and female cougars," *Brigham Young University, Department of Plant & Wildlife Sciences Seminar*, Provo, UT, October 2010 (INVITED)

90. "Promise and pitfalls of models in science and management," *Biological Techniques: Species Distribution Modeling* (BIO 680), Department of Biology, Northern Arizona University, Flagstaff, AZ, September 2010 (INVITED)

80. "Sustainability, human dignity, and professionalism," *Society & Natural Resources* (F&ES 83049b), Yale School of Forestry & Environmental Studies, New Haven, CT, February 2010 (INVITED)

79. "Florida panthers: The social construction of a conservation problem," *Species & Ecosystem Conservation* (F&ES 33012b), Yale School of Forestry & Environmental Studies, New Haven, CT, February 2010 (INVITED)

78. "Leadership as relation: The led and their theories about good leadership," *Western Resources Interest Group*, Yale School of Forestry & Environmental Studies, New Haven, CT, February 2010 (INVITED)

77. "Mountain lions in ecosystems: Evidence and speculations about effects," *Species & Ecosystem Conservation* (F&ES 33012b) Field Trip, Yale School of Forestry & Environmental Studies, Flagstaff, AZ, March 2010 (INVITED)

76. "Psycho-, social, and political dynamics of cougar management," *Species & Ecosystem Conservation* (F&ES 33012b) Field Trip, Yale School of Forestry & Environmental Studies, Flagstaff, AZ, March 2010 (INVITED)

75. “Psycho-, social, and political dynamics of cougar management,” *Wildlife Management* (BIO478), Northern Arizona University, Flagstaff, AZ, October 2009 (INVITED)
74. “Mountain lions in ecosystems: Evidence and speculations about effects,” *Wildlife Management* (BIO478), Northern Arizona University, Flagstaff, AZ, October 2009 (INVITED)
73. “The Witch Craze: Parable and policy sciences interpretation,” for F&ES seminar *Professionalism & Human Dignity*, Yale School of Forestry & Environmental Studies, New Haven, CT, January 2009 (INVITED)
72. “Personality and perspectives on leadership,” for *Large Scale Conservation: Integrating Science, Management, and Policy* (F&ES 83037b), Yale School of Forestry & Environmental Studies, New Haven, CT, April 2009 (INVITED)
71. “Sustainability, dignity, and professionalism,” for F&ES seminar *Professionalism & Human Dignity*, Yale School of Forestry & Environmental Studies, New Haven, CT, April 2009 (INVITED)
70. “Sustainability, dignity, and professionalism,” for F&ES seminar *Professionalism & Human Dignity*, Yale School of Forestry & Environmental Studies, New Haven, CT, April 2009 (INVITED)
69. “Professionalism and human dignity: Foundational notions,” to *Seminar on Society & Natural Resources* (F&ES 83049b), Yale School of Forestry and Environmental Studies, New Haven, CT, January 2009 (INVITED)
68. “The Glen Canyon Dam AMP: An appraisal,” to *Large Scale Conservation* (F&ES 83037b), Yale School of Forestry and Environmental Studies, New Haven, CT, January 2009 (INVITED)
67. “Psycho-, social, and political dynamics of cougar management,” to *Foundations of Natural Resources & Management* (F&ES 85036b), Yale School of Forestry and Environmental Studies, New Haven, CT, November 2008 (INVITED)
66. “Psycho-, social, and political dynamics of cougar management,” to *Western Resource Group Luncheon Seminar*, Yale School of Forestry and Environmental Studies, New Haven, CT, November 2008 (INVITED)
65. “The witch craze: Parable and policy sciences interpretation,” to *Foundations of Natural Resources & Management* (F&ES 85036b), Yale School of Forestry and Environmental Studies, New Haven, CT, November 2008 (INVITED)
64. “Human dignity and natural resources professionalism,” to *Seminar on Human Dignity & Natural Resources Professionalism*, Yale School of Forestry & Environmental Studies, January 2008. (INVITED)
63. “Agitators, Theorists & Y2Y: Potential pitfalls of transformational leadership,” to *Combined MIT and Yale Seminars on Elements of Environmental Leadership*, MIT Department of Urban Studies & Planning, Cambridge, MA, March 2008. (INVITED)
62. “The once and future Yellowstone grizzly bears,” for *Society for Conservation Biology Spring Lecture Series*, Yale School of Forestry and Environmental Studies, New Haven, CT, February 2007 (INVITED)
61. “An introduction to David Mattson,” for *Faculty Lunch Seminar*, Yale School of Forestry & Environmental Studies, New Haven, CT, December 2006 (INVITED)
60. “Y2Y conservation area design,” for *Conservation Biology* (E&EB 315a/515a), Yale Department of Ecology & Evolutionary Biology, New Haven, CT, November 2006 (INVITED)

59. "Living with fierce creatures: Cougars on the southern Colorado Plateau," for *Environmental Studies Colloquium*, Prescott College, Prescott, AZ, April 2006 (INVITED)
58. "Psycho-sociology of the science-policy interface," for Joint session of *Natural History and Ecology of the Southwest* and *Behavior and Conservation of Mammals*, Prescott College, Prescott, AZ, April 2006 (INVITED)
57. "A personal perspective on change-oriented leadership," for *Large Scale Conservation: Integrating Science, Management & Policy* (F&ES 909), Yale School of Forestry and Environmental Studies, New Haven, CT, April 2006 (INVITED)
56. "Agitators, theorists and Y2Y: Potential pitfalls of transformational leadership," for *Large Scale Conservation: Integrating Science, Management & Policy* (F&ES 909), Yale School of Forestry and Environmental Studies, New Haven, CT, March 2006 (INVITED)
55. "The grizzly bear policy process: 'Conservation is like warfare'," *Species and Ecosystem Conservation* (F&ES 520b), Yale School of Forestry and Environmental Studies, New Haven, CT, October 2005 (INVITED)
54. "Conflict over cougars: A window on the institution of wildlife management," for *Foundations of Natural Resources and Management* (F&ES 891b), Yale School of Forestry and Environmental Studies, New Haven, CT, October 2005 (INVITED)
53. "Professional practice in natural resources research," for *Luncheon Seminar of the Western Natural Resources Interest Group*, Yale School of Forestry and Environmental Studies, New Haven, CT, October 2005 (INVITED)
52. "Agitators, theorists and Y2Y: Potential pitfalls of transformational leadership," for *Large-Scale Conservation: Integrating Science, Management and Policy* (FES 909b), Yale School of Forestry and Environmental Studies, New Haven, CT, March 2005 (INVITED)
51. "The dogma of conservation area design," for *Seminar on Western Natural Resources*, Western Natural Resources Interest Group, Yale School of Forestry and Environmental Studies, New Haven, CT, October 2004 (INVITED)
50. "The grizzly bear policy process: 'Conservation is like warfare'," for *Species and Ecosystem Conservation* (FES 520a), Yale School of Forestry and Environmental Studies, New Haven, CT, October 2004 (INVITED)
49. "Information ecology in grizzly bear management," for the *Environmental Sciences and Policy Graduate Seminar*, Center for Environmental Sciences and Education, Northern Arizona University, Flagstaff, AZ, September 2004 (INVITED)
48. "Cougars on the edge...of Flagstaff," for the *Forestry Seminar Series*, School of Forestry, Northern Arizona University, Flagstaff, AZ, September 2004 (INVITED)
47. "Y2Y and conservation design: Problematic doctrines and an evolving formula," for the graduate seminar *Large-Scale Conservation: Integrating Science, Management, and Policy* (FES 909b), sponsored by the Yale School of Forestry and Environmental Studies, New Haven, CT, February 2004 (INVITED)
46. "Human dimensions of wildlife management," for undergraduate class *Wildlife Management* (BIO333), Northern Arizona University, Flagstaff, AZ, October 2003 (INVITED)
45. "The practice of grizzly bear conservation," for the *Western Resources Special Interest Group*, Yale School of Forestry and Environmental Studies, New Haven, CT, February 2003 (INVITED)

44. "Values and perspectives in grizzly bear conservation." for graduate class *Foundations of Natural Resources Policy and Management* (F&ES 891), Yale School of Forestry & Environmental Studies, New Haven, CT, February 2003 (INVITED)
43. "Conservation is like warfare': Phantom common ground in grizzly bear conservation," for seminar *Society & Natural Resources: Sustaining the Common Interest* (F&ES 746), Yale School of Forestry & Environmental Studies, New Haven, CT, February 2003 (INVITED)
42. "Conditions of grizzly bear policy implementation," for graduate class *Species and Ecosystem Conservation* (F&ES 520), Yale School of Forestry and Environmental Studies, New Haven, CT, October 2002 (INVITED)
41. "The Yellowstone grizzly bear: prospects for the future," for the *Western Resources Special Interest Group*, Yale School of Forestry and Environmental Studies, New Haven, CT, October 2002 (INVITED)
40. "Conduct, misconduct and the structure of science," for Dr. Charles van Riper III's graduate lab seminar, Department of Biology, Northern Arizona University, Flagstaff, AZ, April 2002 (INVITED)
39. "Decision processes in grizzly bear conservation," for graduate class *Species and Ecosystem Conservation* (F&ES 520), Yale School of Forestry and Environmental Studies, New Haven, CT, October 2001 (INVITED)
38. "Grizzly bear conservation," for the *Western Resources Special Interest Group*, Yale School of Forestry and Environmental Studies, New Haven, CT, October 2001 (INVITED)
37. "Foraging behavior of Yellowstone grizzly bears," for *Biological Sciences Departmental Seminar Program*, Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ, February 2001 (INVITED)
36. "Grizzly bears in Yellowstone," for *Wildlife Management* class, Bozeman High School, Bozeman, MT, October 2000 (INVITED)
35. "Human dimensions of carnivore management," for *Human Dimensions of Wildlife Management* (WLF520), Department of Fish & Wildlife Resources, University of Idaho, Moscow, ID, March 2000 (INVITED)
34. "Decision processes in grizzly bear conservation," for graduate class *Species and Ecosystem Conservation* (F&ES 520), Yale School of Forestry and Environmental Studies, New Haven, CT, October 1999 (INVITED)
33. "Conservation of Yellowstone's grizzly bears," for graduate/undergraduate class *Conservation Biology*, Department of Biology, Boise State University, Boise, ID, May 1999 (INVITED)
32. "Viability analysis and monitoring techniques for grizzly bears," for undergraduate class *Fish & Wildlife Ecology, Management, & Conservation* (WLF 290), Department of Fish & Wildlife Resources, University of Idaho, Moscow, ID, May 1999 (INVITED)
31. "Professional practice in the grizzly bear arena," for undergraduate *Wildlife Seminar* (FISH 495), Department of Fish & Wildlife Resources, University of Idaho, Moscow, ID, March 1999 (INVITED)
30. "Grizzly bear science and management in the Yellowstone ecosystem," for graduate/undergraduate class *Northwest Environmental Issues* (HIST 404/504), Department of History, University of Idaho, Moscow, ID, March 1999 (INVITED)
29. "Conservation of grizzly bears in Idaho," for graduate class *Conservation Biology* (WLF 440), Department of Fish & Wildlife Resources, University of Idaho, Moscow, ID, May 1998 (INVITED)
28. "Policy analysis of grizzly bear conservation," for graduate class *Species and Ecosystem Conservation* (F&ES 520), Yale School of Forestry and Environmental Studies, New Haven, CT, March 1998 (INVITED)

27. "Human dimensions of grizzly bear science and management," for graduate class *Human Dimensions of Wildlife Management* (WLF 520), Department of Fish & Wildlife Resource, University of Idaho, Moscow, ID, March 1998 (INVITED)
26. "Conservation of Yellowstone's grizzly bears," for *Special Topics Senior Honors Seminar* (WLF 404), Department of Fish & Wildlife Resources, University of Idaho, January 1998 (INVITED)
25. "A contextual basis for methods of science," for the *Department of Philosophy Seminar*, sponsored by the University of Idaho Undergraduate Philosophy Organization, Moscow, ID, November 1997 (INVITED)
24. "The behavioral ecology of Yellowstone's grizzly bears," for undergraduate class *Behavioral Ecology* (WLF 441), Department of Fish & Wildlife Resources, University of Idaho, October 1997 (INVITED)
23. "Grizzly bear habitat relations in the Yellowstone ecosystem," for graduate class *Wildlife Habitat Ecology* (WLF 545), Department of Fish & Wildlife Resources, University of Idaho, September 1997 (INVITED)
22. "Use of demographic indices for monitoring wildlife populations: Grizzly bears as an example," for undergraduate class *Wildlife Management* (WLF 442), Department of Fish & Wildlife Resources, University of Idaho, April 1997 (INVITED)
21. "Policy-relevant science: Grizzly bears in Idaho," for workshop *Interdisciplinary Conservation Science*, sponsored by the Yale Student Chapter of the Society for Conservation Biology, New Haven, CT, April 1997 (INVITED)
20. "Professional practice in endangered species conservation," for graduate class *Natural Resource Policy and Management* (F&ES 891), Yale School of Forestry and Environmental Studies, New Haven, CT, April, 1997 (INVITED)
19. "Human dimensions of grizzly bear science and management," for graduate class *Human Dimensions of Wildlife Management* (WLF 520), Department of Fish & Wildlife Resource, University of Idaho, Moscow, ID, March 1997 (INVITED)
18. "Life histories of North American bears," for graduate class *Large Mammal Ecology* (WLF 544), Department of Fish & Wildlife Resources, University of Idaho, March 1997 (INVITED)
17. "Variation and pattern in the behavior of Yellowstone's grizzly bears," for *Department of Fish & Wildlife Resources Seminar*, University of Idaho, Moscow, ID, January 1997 (INVITED)
16. "The pitfalls of applied research," for undergraduate class *Wildlife Management* (WLF 442), Department of Fish and Wildlife Resources, University of Idaho, Moscow, ID, April 1996 (INVITED)
15. "Professional practice in endangered species conservation," for graduate class *Natural Resource Policy and Management* (F&ES 891), Yale School of Forestry and Environmental Studies, New Haven, CT, March 1996 (INVITED)
14. "Grizzly bear conservation," for graduate class *Species and Ecosystem Conservation* (F&ES 520), Yale School of Forestry and Environmental Studies, New Haven, CT, March 1996 (INVITED)
13. "Grizzly bear conservation," for graduate class *Species and Ecosystem Conservation* (F&ES520), Yale School of Forestry and Environmental Studies, New Haven, CT, March 1995 (INVITED)
12. "Professional practice in endangered species research," for graduate seminar *Society and Natural Resources* (F&ES524), Yale School of Forestry and Environmental Studies, New Haven, CT, March 1995 (INVITED)
11. "Sustaining grizzly bears in the Rocky Mountains," for *Departmental Seminar*, Department of Fish and Wildlife Resources, University of Idaho, Moscow, March 1995 (INVITED)
10. "Grizzly/brown bear ecology," for the graduate class *Large Mammal Ecology* (WLF544), Department of Fish and Wildlife Resources, University of Idaho, Moscow, February 1995 (INVITED)
9. "Calculation of sustainable grizzly bear mortality from unduplicated counts of females with cubs-of-the-year," for the graduate class *Fish and Wildlife Population Analysis* (WLF543), Department of Fish and Wildlife Resources, University of Idaho, Moscow, December 1994 (INVITED)

8. "Natural history of northern bears," for the undergraduate class *Natural History of Mammals* (ZOOL483), Department of Biological Sciences, University of Idaho, Moscow, ID, October 1993 (INVITED)
7. "Conservation of Yellowstone's grizzly bears," for *Conservation Biology Seminar*, Division of Biological Sciences, University of Montana, September 28, 1993 (INVITED)
6. "Grizzly bear habitat selection," for the graduate class *Wildlife Habitat Ecology* (WLF545), Department of Fish and Wildlife Resources, University of Idaho, Moscow, ID, September 20, 1993 (INVITED)
5. "Implementation of the endangered species act: Lessons from the Yellowstone grizzly bear population," for *Graduate Seminar*, Yale School of Forestry and Environmental Studies, New Haven, CT, April 8, 1993 (INVITED)
4. "Biology and management of the Yellowstone grizzly bear," for *Wildlife Forum*, sponsored by the Student Chapter of The Wildlife Society, Montana State University, Bozeman, MT, February 7, 1993 (INVITED)
3. "Lessons for improving endangered species conservation: The Yellowstone grizzly bear population," for the graduate seminar *Lessons for Improving Endangered Species Conservation*, and "Conservation and management of the Yellowstone grizzly," for the School of Natural Resources and Environment, University of Michigan, Ann Arbor, MI, November 1992 (INVITED)
2. "Implementation of grizzly bear research results," for the course *Ecology of Greater Yellowstone*, Yellowstone Institute, Yellowstone National Park, WY, July 1992 (INVITED)
1. "Grizzly bear food habits and habitat use," for the course *Bears: Folklore and Biology*, Yellowstone Institute, Yellowstone National Park, WY, June 1992-93 (2 presentations) (INVITED)

Graduate Student Committees & Interns: Since 1990 the scientist has been Committee Member, Faculty Advisor or Preceptor for **24 students** pursuing Ph.D. or M.S. degrees, Certificates or Special Credits.

20. Co-Committee Chair for Kirsten Ironside, *Movements and habitat selection by cougars on the Colorado Plateau*, Ph.D. Program, Department of Biology, Northern Arizona University, 2009-present.
19. Co-Advisor for, Erin Savage, *Mountain lion management in southeastern Arizona: A policy of lethal control*, M.S. Thesis, Yale School of Forestry & Environmental Studies, New Haven, CT, 2008-2010.
18. Advisor for Tanya Rosen, *Social and policy implications of bear reintroductions in Europe: The life and death of brown bear JJI*, submitted to *Human Dimensions of Wildlife*, Yale School of Forestry & Environmental Studies, New Haven, CT, 2007-2008.
17. Reader for Taijs van Maasackers, *Environmental restoration in the Atchafalaya Basin: Boundaries and interventions*, Masters of Conservation Planning, MIT Department of Urban Studies & Planning, Cambridge, MA, 2008.
18. Faculty Advisor for Maria Martin Rodriguez-Ovelleiro, Special Credit Project, Yale School of Forestry & Environmental Studies, New Haven, CT, September-December 2006.
17. Faculty Advisor for Avery Anderson, Special Credit Project, Yale School of Forestry & Environmental Studies, New Haven, CT, September-December 2006.
16. Faculty Advisor for Rebecca Watters, Special Credit Project, Yale School of Forestry & Environmental Studies, New Haven, CT, September 2005-December 2006.
15. Co-Chair for Brandon Holton, *Upland free water availability and wildlife*, M.Sc. Thesis, Northern Arizona University, Flagstaff, AZ, 2004-2007.
14. Faculty Advisor for Trevor Streng, *Cougar biology and policy in northern Arizona*, Senior Project, Center for Environmental Sciences and Education, Northern Arizona University, Flagstaff, AZ, 2004-2005.

13. Faculty Advisor for Conservation Ecology Graduate Certificate for Sarah Hartwell, *The African bushmeat crisis: A summary of the problem and its causes*, Conservation Ecology Graduate Certificate Program, Northern Arizona University, Flagstaff, AZ, 2004-2005.
12. Preceptor for Winter Study Project for Margaret Carr and David Allen, *Where the wild things are: A study of cougar response to the presence of humans*, Winter Studies Program (SPEC 99), Williams College, Williamstown, MA, 2004.
11. Committee Member for M.S. program for Suzanne Cardinal, *Home range, movement patterns and habitat use of southwestern willow flycatchers at Roosevelt Lake, Arizona*, Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ, 2003-2005.
10. Committee Member for M.S. program for Mark Weissinger, *Striped skunk (Mephitis mephitis) home range, seasonal and daily movements, and denning ecology in Flagstaff's urban environment*, Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ, 2003-2007.
9. Committee Member for Ph.D. program for Ramona Maraj, *Human land use and grizzlies in southwest Yukon*, Faculty of Environmental Design, University of Calgary, Calgary, AB, 2003-2006. *Two co-authored journal articles in preparation.*
8. Faculty Advisor for Conservation Ecology Graduate Certificate for Matt Clark, *Potential effects of gray wolf reintroduction on the carnivore community of the Grand Canyon ecoregion*, Conservation Ecology Graduate Certificate Program, Northern Arizona University, Flagstaff, AZ, 2003-2004.
7. Faculty Advisor for Conservation Ecology Graduate Certificate for Brandon Holton, *Ecological costs and benefits of artificial water sites, with special emphasis on potential prey traps*, Conservation Ecology Graduate Certificate Program, Northern Arizona University, Flagstaff, AZ, 2003.
6. Committee Member for M.S. program for Elizabeth Ruther, *Conflict & co-habitation: a survey of northern Arizona ponderosa pine ecosystem residents assessing nature views and cougar perceptions*, Environmental Science & Policy, Northern Arizona University, Flagstaff, AZ, 2002-2005. *One co-authored journal article in preparation.*
5. Preceptor for Intern Program for Jesse Millen-Johnson involving field work on a Flagstaff area mountain lion project, Bates College, Lewiston, ME, 2003.
4. *Ex officio* Committee Member for Ph.D. program for Seth Wilson, *Landscape features and attractants that predispose grizzly bears to risk of conflict with humans*, University of Montana, Missoula, MT, 1999-2003. *Two co-authored journal articles.*
3. *Ex officio* Committee Member for Ph.D. program for Kerry Murphy, *Ecology of mountain lions in Yellowstone National Park*, University of Idaho, Moscow, ID, 1993-1997.
2. Principal Agency Advisor for M.S. program for Gerald Green, *Use of spring carrion by bears in Yellowstone National Park*, University of Idaho, Moscow, ID, 1987-1994. *One co-authored journal paper.*
1. Principal Agency Advisor for M.S. program for Daniel Reinhart, *Grizzly bear use on cutthroat trout spawning streams in tributaries of Yellowstone Lake*, Montana State University, Bozeman, MT, 1985-1990. *Two co-authored journal papers.*

Appointments

11. Invited Member of *Large Carnivore Group*, Yale School of Forestry & Environmental Studies, New Haven, CT, 2008-present.

10. Lecturer & Visiting Senior Scientist, *Yale School of Forestry and Environmental Studies*, June 2006-present.
9. Western Field Director, *MIT-USGS Science Impact Collaborative*, Massachusetts Institute of Technology, April 2007-2010.
8. Adjunct Faculty, *Center for Environmental Sciences and Education* and *School of Earth Sciences and Environmental Sustainability*, Northern Arizona University, 2004-present.
7. Federal Agency Representative, Executive Board, *Colorado Plateau Chapter of the Society for Conservation Biology*, 2003-present.
6. Adjunct Faculty, *Department of Biology*, Northern Arizona University, 2002-present.
5. Scholar-in-residence, *MIT-USGS Science Impact Collaborative*, *MIT Department of Urban Studies and Planning*, June 2007-2008.
4. Associate, *Merriam-Powell Center for Environmental Research*, Northern Arizona University, 2002-present.
3. Steering Committee Member, *Center for Sustainable Environments*, Northern Arizona University, 2002-2004.
2. Co-chair, Arizona Chapter, Southwestern Carnivore Committee, 2002-2004.
1. Faculty Participant, Conservation Ecology Graduate Certificate, Center for Environmental Sciences and Education, Northern Arizona University, 2001-2006.

Conference Planning since 1992

15. Co-organizer, with M. Wolfe, of workshop, “Opportunities for collaborative mountain lion research in the interior western United States,” *17th Annual Conference of The Wildlife Society*, Snowbird, UT, January 2010-October 2010
14. Organizer of workshop, “Opportunities for collaborative mountain lion research on and near the Colorado Plateau,” *10th Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, April 2009-October 2009
13. Program Chair and part of core Planning Committee for *10th Biennial Conference of Research on the Colorado Plateau*, October 2008-October 2009
12. Member of Planning Committee for workshop, *Improving Prospects for Cougar Conservation: Clarifying Goals, Identifying Problems, Seeking Solutions*, Seattle, WA, August-November 2008
11. Member of Planning Committee, *Annual Meeting at Marble Canyon*, sponsored by the Colorado Plateau Chapter of the Society for Conservation Biology, Marble Canyon, AZ, April-August 2006.
10. Member of Interagency Committee for workshop on *Water Developments for Wildlife*, Arizona State University, Tempe, AZ, November 2004, sponsored by numerous stakeholder in the issues of water developments, 2004-2005.
9. Member of Advisory Committee for conference *Governance and Decision-Making in Mountain Areas*, June 2005, Banff, AB, sponsored by The Banff Centre and Parks Canada, 2004-2005.

8. Member of Advisory Committee for workshop on *Faunal Populations and Communities*, Northern Arizona University, Flagstaff, AZ, April 2004, sponsored by NPS Southern Colorado Plateau I&M Network, Flagstaff, AZ, 2004.

7. Member of Conference Committee for *Views of the Elephant: Lessons Learned from Personal Experiences in Conservation*, Marble Canyon, AZ, April 2004, sponsored by the Colorado Plateau Chapter for Conservation Biology, 2004.

6. Advisor for workshop *Policy-Oriented Conservation Design*, Pender Island, BC, February 2004, sponsored by the Wilburforce Foundation and Y2Y Conservation Initiative, 2004.

5. Member of Advisory Committee for workshop *Large-Scale Conservation: Exploring Challenges, Perspectives, and Opportunities in the Y2Y Case*, Yale University, New Haven, CT, April 2004, sponsored by Yale School of Forestry & Environmental Studies, New Haven, CT, and Kent State University, Kent, OH, 2003-2004.

4. Member of Scientific Advisory Committee for *Carnivores 2004* conference, Santa Fe, NM, November 2004, for Defenders of Wildlife, Washington, D.C, 2003-2004.

3. Conference Chair, oversaw all aspects of 7th *Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, November 2003, 2002-2003.

2. Program Chair, planned and organized program for 6th *Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, November 2001, 2000-2001.

1. Client's Day Chair, developed and organized Client's Day for 5th *Biennial Conference of Research on the Colorado Plateau*, Flagstaff, AZ, November 1999, 1999.

e. TECHNICAL TRAINING & INFORMATION TRANSFER PROVIDED since 1992

45. "Project background and context: Or, what we did and why, and how to interpret and use our results," for *NCCWSC Forecasting Climate Impacts on Wildlife in the Arid Southwest*, Advisory Team meeting, Flagstaff, AZ, June 2011.

44. "Selection of species, conceptual models, model complexity, and approaches for spatially displayed uncertainty in model outcomes," for *NCCWSC Forecasting Climate Impacts on Wildlife in the Arid Southwest*, Advisory Team meeting, Flagstaff, AZ, September 2010.

43. WORKSHOP convened and led to develop study plan and proposal (*Source-sink dynamics of arid-land mammals: Desert bighorn sheep and their predators in southeastern Nevada*) in response to DoD SERDP rfp, Henderson, NV, February 2010.

42. WORKSHOP convened and led to scope research related to loss of whitebark pine in the northern Rocky Mountains and modeling changes in grizzly bear density under global change, Denver Zoo, Denver, CO, February 2010.

41. "Predatory behavior of mountain lions on the southern Colorado Plateau," 1st author with B. Holton, Staff Briefing for the Coconino National Forest, Peaks RS, Flagstaff, AZ, June 2010. (INVITED)

40. "Climate change effects on plant and animal species in the Southwest," for *Flagstaff Science Center Climate Change Workshop*, USGS Flagstaff Science Center, Flagstaff, AZ, May 2010. (INVITED)

39. "NCCWSC project: Forecasting climate impacts on wildlife in the arid Southwest – Module 3," 1st author with et al., for *NCCWSC Forecasting Climate Impacts on Wildlife in the Arid Southwest*, Stakeholder Advisory Group, Phoenix, AZ, April 2010.

38. “Thinking outside the box,” for *Human Dimensions of Carnivore Conservation: Experts Workshop*, Florida Wildlife Commission and Florida Defenders of Wildlife, White Oak Plantation, FL, January 2010. (INVITED)
37. “USGS mountain lion studies in the interior Southwest,” briefing for Sue Hazeltine and Bruce Jones, University of Arizona, Tucson, AZ, December 2009. (INVITED)
36. “NCCWSC project: Forecasting climate impacts on wildlife in the arid Southwest,” 1st author with et al., briefing for Sue Hazeltine and Bruce Jones, University of Arizona, Tucson, AZ, December 2009. (INVITED)
35. “Lion research in the Flagstaff area,” for *All Regional Staff Meeting, Region II, Arizona Game & Fish Department*, Flagstaff, AZ, October 2009. (INVITED)
34. “Interdisciplinary problem-solving (IPS) skills-upgrading workshop,” WORKSHOP for Banff National Park Grizzly Bear IPS Group, Banff, Alberta, October 2009. (INVITED)
33. “Forecasting effects of climate change on focal wildlife species within Sonoran desert and Colorado Plateau ecosystems,” for *NCCWSC Forecasting Climate Impacts on Wildlife in the Arid Southwest*, Advisory Team, Flagstaff, AZ, October 2009. (INVITED)
32. “USGS-National Park Service mountain lion studies on the southern Colorado Plateau,” 1st author with B. Holton, T. Arundel, K. Ironside, R.V. Ward, & C. Crow, briefing for DOE & USGS Nevada Test Site personnel, Las Vegas, NV, October 2009.
31. “Upland free water on the Colorado Plateau: Past, present, and future?,” for USGS Water Resources Discipline, *National Research Program Research Committee Meeting*, Flagstaff, AZ, May 2009. (INVITED)
30. “Mountain lions of Zion NP: 2006-2008,” 1st author with J. Hart, T. Arundel, & B. Holton for Staff of Zion National Park, Springdale, UT, May 2009. (INVITED)
29. “Managing for human safety in mountain lion range,” 1st author with K. Logan & L. Sweanor for Staff of Zion National Park, Springdale, UT, May 2009. (INVITED)
28. “Living with large fierce creatures: Cougars and humans on the southern Colorado Plateau,” 3rd author with T. Arundel & B. Holton for *2008-2009 Flagstaff Leadership Program*, Flagstaff, AZ, May 2009. (INVITED)
27. “Mountain lions in ecosystems: Evidence and speculations about effects,” 1st author with B. Holton for workshop on *Landscape-Scale Management Strategies for Wide-Ranging Mammals*, Grand Canyon NP, AZ, June 2009. (INVITED)
26. “USGS BRD: A modern organization in a post-modern world,” for *Seminar Series*, USGS Flagstaff Science Center, Flagstaff, AZ, May 2007. (INVITED)
25. “The Glen Canyon Dam Adaptive Management Program: A preliminary appraisal,” briefing for the USGS Southwest Biological Science Center Management Team and Grand Canyon Monitoring & Research Center Program Leaders, Flagstaff, AZ, May 2007. (INVITED)
24. “Why Yale? What at Yale?,” for *Brown Bag Seminar*, USGS Colorado Plateau Research Station, Flagstaff, AZ, April 2007. (INVITED)
23. “Monitoring wildlife in wilderness,” INSTRUCTOR for *Class on Natural and Cultural Monitoring in Wilderness*, sponsored by Arthur Carhart National Wilderness Training Center, Las Vegas, NV, March 2006. (INVITED)

22. “Cougars of the Flagstaff Uplands: Preliminary results 2003-2005,” 1st author with J. Hart & T. Arundel for staff of the Flagstaff Area National Monuments, Flagstaff, AZ, March 2006. (INVITED)
21. “Wildlife, water, and humans in uplands of the Southwest,” 1st author with M. Miller, briefing for the USGS Western Regional Executives Team, Seattle, WA, February 2006. (INVITED)
20. “Wildlife water developments and the social construction of conservation conflict,” for staff of USGS Grand Canyon Monitoring and Research Center, Flagstaff, AZ, February 2006. (INVITED)
19. “Wildlife water developments and the social construction of conservation conflict,” 1st author with N. Chambers for staff of the BLM State Office and BLM Phoenix Field Office, Phoenix, AZ, January 2006. (INVITED)
18. *1st Workshop of the Colorado Plateau Mountain Lion Working Group*, ORGANIZER and CONVENER, sponsored by USGS Southwest Biological Science Center, Flagstaff, AZ, January 2006.
17. “Cougars of the Colorado Plateau: A multi-park investigation,” 1st author with J. Hart, T. Arundel, R. Stevens, E. Garding, RV Ward, J. Bradybaugh, & E. Leslie for *USGS Southwest Biological Science Center All Hands Meeting*, Flagstaff, AZ, November 2005. (INVITED)
16. “Safety in Red Rock’s lion country,” for *Safety Meeting*, USFS Coconino NF, Sedona Ranger District, Sedona, AZ, October 2005. (INVITED)
15. “Perspectives on wildlife water developments: An analysis of documents, quotes, and materials from the November 2004 workshop,” for Staff of the BLM Phoenix Field Office, sponsored by the Sonoran Institute and the BLM Phoenix Field Office, Phoenix, AZ, June 2005. (INVITED))
14. “Cougars of the Colorado Plateau: A multi-park investigation, Zion National Park and environs,” 1st author with J. Hart, T. Arundel, & J. Bradybaugh for Zion NP staff, Zion NP Headquarters, UT, December 2005. (INVITED)
13. “Cougars of the Flagstaff Uplands: An introduction and results of the 2003-2004 field season,” 1st author with J. Hart & T. Arundel for *August Staff Meeting, Region 2 Arizona Game & Fish Department*, sponsored by Region 2, Arizona Game & Fish Department, August 2004. (INVITED)
12. “Foraging behavior of Yellowstone’s grizzly bears: Consumption of whitebark pine seeds and ungulates,” for *2004 State Meeting of the Arizona Wildlife Services Program*, sponsored by USDA Wildlife Services, Hawley Lake, AZ, July 2004. (INVITED)
11. “Cougars of the Flagstaff Uplands: An introduction and results of the 2003-2004 field season,” 2nd author with J. Hart & T. Arundel for *2004 State Meeting of the Arizona Wildlife Services Program*, sponsored by USDA Wildlife Services, Hawley Lake, AZ, July 2004. (INVITED)
10. “Y2Y conservation design: A framework for judging the sufficiency of Y2Y science,” for *Y2Y Conservation Science and Planning Meeting*, sponsored by the Yellowstone-to-Yukon Conservation Science and Planning Program, Canmore, AB, January 2002. (INVITED)
9. “People, bear science and decision making,” for *Grizzly Bear Research and Monitoring in Banff and Other Mountain National Parks: Where Do We Go From Here?*, sponsored by Parks Canada, Banff, AB, March 2001. (INVITED)
8. “Large Carnivores on the Plateau: a Workshop on the Biology and Management of Pumas and Black Bears in Colorado Plateau National Parks,” ORGANIZER and CONVENER with E. Leslie for Utah, New Mexico, and Arizona state game and fish agencies and U.S. National Park Service, sponsored by the U.S. National Park Service and USGS, Flagstaff, AZ, March 2001.

7. "Modeling regional habitat suitability for large carnivores," for *Yellowstone-to-Yukon Council Meeting*, sponsored by Y2Y Council, Helena, MT, April 1998. (INVITED)
6. "Cumulative effects model: History, interpretation and future," for Interagency Grizzly Bear Committee Yellowstone Cumulative Effects Modeling Team, Mammoth, WY, June 1997. (INVITED)
5. "Suitability of habitat in the Bitterroot Recovery Area," for *Workshop and Briefing on Grizzly Bear Habitat in the Bitterroot Recovery Area*, sponsored by the Idaho Department of Fish & Wildlife, Boise, ID, May 1997. (INVITED)
4. "Grizzly bear use of ungulates and whitebark pine middens," for *Grizzly Bear Seminar for Yellowstone National Park Staff*, Center for Resources, Mammoth, WY, June 1996. (INVITED)
3. "Grizzly bear science," as part of panel *Journey to Recovery*, for *Summer Meeting of the Interagency Grizzly Bear Committee*, Gardiner, MT, June 1996. (INVITED)
2. "Cumulative effects analysis for the Yellowstone grizzly bear population," for *Cumulative Effects Workshop*, sponsored by Canadian Parks Service, Energy Resources Conservation Board, Natural Resources Conservation Board, Shell Canada Ltd., Alberta Resource Planning Branch, and Environment Council of Alberta, Calgary, AB, March 1993. (INVITED)
1. "Experiences of Yellowstone in Ecosystem Management," for *Kananaskis Workshop for the Ecosystem Management Task Force*, sponsored by Canadian Parks Service, Kananaskis, AB, February 1992. (INVITED)

f. SPECIAL ASSIGNMENTS

15. Member of the *USGS Southwest Biological Science Center Strategic Planning Core Team*, June 2011-present.
14. Chair of *Hiring Committee for GS-13 Landscape Ecologist*, USGS Southwest Biological Science Center, September-November 2010.
13. Member of *USGS Research Grade Evaluation Panels*, Milwaukee, WI, 2010, and for Sasha Reed, USGS Southwest Biological Science Center, February-March 2010.
12. Principal USGS Agent for renewal of 5-year *Memorandum of Understanding and Cooperative Agreement* between USGS and Northern Arizona University governing operations of the Colorado Plateau Research Station at Northern Arizona University, 2008-2009.
11. Station Leader/Liaison for USGS Colorado Plateau Research Station, Southwest Biological Science Center, Flagstaff, AZ, 2009-2011.
10. Acting Center Director for USGS Southwest Biological Science Center, Flagstaff, AZ, as requested, 2003-present; *performed routine duties of Center Director in the absence of official Director*.
9. Member of Steering Committee, *Global Climate Change Collaborative (G3C)*, MIT-USGS Science Impact Collaborative, Cambridge, MA, 2007-2008.
8. Member of the *Science Advisory Group* for the *USGS Science Strategy Team*, February-June 2006.
7. Member of *USGS Research Grade Evaluation Panels*, Reno, NV, 2001, and Columbus, OH, 2006.
6. Member of the *USGS Southwest Biological Science Center Strategic Planning Core Team*, November 2005-February 2006.

5. Reporter for *Workforce Planning Break-Out Group 4, USGS Southwest Biological Science Center All Hands Meeting*, Flagstaff, AZ, November 2005.
4. Team Leader for *Large Mammals and Predators, USGS Wildlife Program Five Year Strategic Plan*, August 2004-January 2005.
3. Acting Station Leader for USGS Colorado Plateau Research Station, Flagstaff, AZ, as needed 2000-2008; *performed routine duties of Field Station Leader in the absence of official Leader*.
2. Committee Chair, USGS Colorado Plateau Field Station Information Resources Management Committee, 2000-2004; *provided oversight for resolution of IRM issues at the Field Station*.
1. Special Project, Interagency Grizzly Bear Study Team, Bozeman, MT, 1982-1983; *developed procedures for and mapped habitat and cover types on 300,000 acres of National Forest lands delineated by the scientist in core grizzly bear range*.

g. OTHER TECHNICAL ACTIVITIES since 1998, but earlier accomplishments where appropriate

A. By invitation, the scientist advised nationally important programs, reviewed nationally important projects, or participated in advanced disciplinary workshops. He was among a few nationally recognized bear scientists to serve on a review panel for the controversial *Tongass National Forest Land Management Plan*. The scientist was also one of three internationally recognized grizzly bear scientists invited by the IUCN Conservation Biology Specialists Group to serve as an advisor and technical specialist for a population viability workshop in Canada. Also of relevance to Canada, the scientist was engaged to review the controversial and potentially influential *Muskwa-Kechika Wildlife Management Plan*. He was invited as one of the foremost conservation biologists in North America to attend a workshop that reviewed and advanced concepts of regional conservation design and contributed to two chapters of a book that reported the results of this endeavor. The scientist was similarly invited as one of the nation's foremost carnivore researchers and conservation biologists to participate in a workshop and serve on an advisory committee for development of a national bioregional conservation planning process. More recently the scientist has been recognized as an authority in the field of cougar research and management, most notably by his engagement to review the authoritative *Cougar Management Guidelines for North America* and the high-profile *Analysis of Scientific Publications for the Florida Panther*, as well as to advise the Florida Panther Recovery Team on methods for public engagement. The scientist has also advised key BLM personnel on BLM's recently constituted Rapid Ecoregional Assessment (REA) program, including reviews of two seminal planning documents for the Colorado Plateau and Sonoran Desert REAs.

B. On the basis of specific requests, 1986-present, the scientist provided substantial technical assistance to numerous Master's and Doctoral-level graduate students in domestic academic institutions such as Yale University, Massachusetts Institute of Technology, Brown University, Northern Arizona University, University of New Mexico, Tufts University, the University of Utah, University of Nevada-Reno, and the University of Georgia, (and more) as well as international universities such as the University of Calgary, Wilfrid Laurier University and the University of Waterloo in Canada, Sinchu University in Japan, the University of León in Spain, and the University of Helsinki in Finland. This assistance was primarily in the form of advice on project design and methods, as well as information about policy analysis and bear and cougar ecology. The assistance served to enhance the quality of academic research programs, built good will between the USGS and academic institutions, and contributed to durable professional relations. This technical assistance was based on the scientist's general knowledge and personal research.

C. On the basis of specific requests, 1992-present, the scientist provided substantial technical assistance to Parks Canada regarding management of grizzly bears in Canada. Some of these grizzly bear populations are of potentially great importance to the future conservation of grizzly bears in the adjacent U.S. This assistance pertained to specific management plans or issues (*e.g.*, proposed expansion of the Westcastle development north of Waterton National Park, expansion of the Sunshine Ski Area west of the Townsite of Banff, and construction of roads near Kluane National Park) and to general management issues such as the implementation of ecosystem management or the assessment of current and foreseeable human impacts on large carnivores in the Bow River Valley of Banff National Park and the Greater Kluane ecoregion in the Yukon. Recently this assistance took the form of leading a skills-enhancement workshop during 2009 for a multi-stakeholder Interdisciplinary Problem-Solving (IPS) group involved in management of grizzly bears in Banff National Park. This technical assistance was based on the scientist's general knowledge and personal research.

D. On the basis of specific requests, the scientist provided substantial technical assistance to educational media and organizations, including *National Geographic*, *National Geographic Television*, *Audubon* magazine, *Encarta Encyclopedia*, *Earth Notes* radio program, the Canadian Broadcasting Corporation, the British Broadcasting Corporation, Public Broadcasting System, National Public Radio, the Center for Image Processing in Education, ABC, CNN, and the Center for International Environmental Law. This assistance took the form of in-depth interviews, fact checking, verification of bear identification in photos, information on bear and cougar ecology, and provision of data or other teaching aids. The scientist's assistance contributed to enhancing the quality of information about bears and cougars reaching the general public through these educational venues. This assistance was based on the scientist's personal research.

E. On the basis of specific requests, 1985-present, the scientist advised and educated numerous private individuals and organizations on the ecology of grizzly bears. This advice was to organizations with commodity interests (*e.g.*, the Targhee Timber Association), organizations with environmental interests (*e.g.*, the Greater Yellowstone Coalition, Western Wildlands, Natural Resources Defense Council), non-partisan groups (*e.g.*, the Henry's Fork Watershed Council), and industry (*e.g.*, Crown Butte Mines). This technical assistance has helped benefit private efforts to conserve bears and cougars or helped to minimize the adverse impacts of human activities on private lands. More importantly, this technical assistance has helped increase the level of scientific knowledge among those in non-governmental capacities who are playing a major role in shaping grizzly bear and cougar management. This technical assistance was based on the scientist's personal research.

F. The scientist closely worked with National Park Service biologists, managers, and planners, as needed, 1999-2009, especially on design, execution and appraisal of the National Inventory and Monitoring (I&M) Program. He was intensively involved with the Northern and Southern Colorado Plateau and Mohave Networks. Advice, at times as invited technical papers, pertained to topics ranging from overall strategic direction and philosophy to details of statistical design. The scientist was co-author of an Inventory Plan that was rated by the NPS National I&M Office as 2nd-best for the entire country and contributed to the Plan rated 1st. The scientist was also involved in appraisal of I&M efforts, including a talk at the George Wright Society Meeting and plans for peer-reviewed journal papers. In 2000 the scientist also provided expert opinion to managers of Canyonlands National Park regarding the impacts of a controversial road. This technical assistance was based on the scientist's general knowledge and personal research.

G. The scientist closely worked with US National Park Service and US Forest Service biologists, managers, and planners, as needed, 1985-2008, on issues related to grizzly bear conservation and ecology. The scientist was engaged in development and review of specific plans pertaining to grizzly bear ecology primarily in the Yellowstone ecosystem (*e.g.*, planning and review of Bear Management Areas, Lake Development Concept Plan, Fishing Bridge Campsite Replacement Plan, various plans for road reconstruction, and others). He frequently

participated in training programs and advised individual District and Sub-district personnel on grizzly bear ecology and management (*e.g.*, regarding specific Bear Management Areas, or bear use of locally important foods such as ungulate carrion). He also assisted in the design of Park Service-sponsored grizzly bear research or monitoring (*e.g.*, as along cutthroat trout spawning streams, on ungulate winter ranges, or of whitebark pine cone production) and, up until 2008, was part of the Yellowstone Ecosystem Whitebark Pine Working Group. This technical assistance was based on the scientist's personal research.

H. On the basis of specific requests, 1986-2008, the scientist provided substantial technical advice to those involved with management and research of brown bears worldwide. This involved the review of research and the revision of manuscripts concerning brown bear conservation in Norway for Dr. Kåre Elgmork, the development of a research program regarding the monitoring of brown bear populations in Kamchatka for Igor Revenko, the development of a program to reintroduce brown bears into two areas of France, for the French Bear Group and Dr. Pascal Wick, the development of research in Kluane National Park, Yukon, for Parks Canada, the status of grizzly bears in Yellowstone National Park for the World Heritage Committee, advice to the Japan Ecosystem Conservation Society on restoration of black and brown bear in the Japan, the development of community-based grizzly bear conservation for Steve Primm and Dr. Tim Clark of the Northern Rockies Conservation Cooperative, the development of a conservation plan for black and grizzly bears in the Yukon for Dr. Brian Horejsi, the development, implementation and reporting of habitat research for scientists on the Interagency Grizzly Bear Study Team, the status of grizzly bear habitat in Idaho for the Idaho Department of Fish and Game, and the development of approaches to planning and implementing bear conservation for teams working with the IUCN. The scientist's assistance has enhanced the prestige of U.S. Department of Interior research programs and has aided the general cause of brown bear conservation. This technical assistance was based on the scientist's general knowledge and personal research.

Reports since 1992

- 21. Mattson, D.** (2011). *Research needs and opportunities related to cougars and their prey on Grand Staircase-Escalante NM (GSENM) and the BLM Kanab District. Parts 1 & 2.* USGS Southwest Biological Science Center, Flagstaff, AZ. 10 pp.
- 20. Mattson, D.** (2011). *Comments on BLM Colorado Plateau Rapid Ecoregional Assessment Final Workplan 1-4-a.* USGS Southwest Biological Science Center, Flagstaff, AZ. 5 pp. (**INVITED** technical report)
- 19. Johnson, M.J., J.R. Hatten, J.A. Holmes, & D.J. Mattson.** (2011). *Development of a GIS-based Model of Yellow-Billed Cuckoo Breeding Habitat with the Lower Colorado River Multi-Species Conservation Area, San Pedro River and Verde River, AZ: Project Update.* USGS Southwest Biological Science Center, Flagstaff, AZ.
- 18. Mattson, D., M.J. Matthew, J.R. Hatten, J.A. Holmes, & T. Arundel.** (2010). *Development of a GIS-based Model of Yellow-Billed Cuckoo Breeding Habitat with the Lower Colorado River Multi-Species Conservation Area, San Pedro River and Verde River, AZ: Project Update.* USGS Southwest Biological Science Center, Flagstaff, AZ.
- 17. Mattson, D.** (2010). *Comments on the BLM Colorado Plateau and Sonoran Desert REA Identification of Conservation Elements, Change Agents, and Management Questions.* USGS Southwest Biological Science Center, Flagstaff, AZ. 5 pp. (**INVITED** technical report)
- 16. Mattson, D.J.** (2010). *Cougars of Zion and Capitol Reef: 2006-2008 project update.* USGS Southwest Biological Science Center, Flagstaff, AZ. 19 pp.

15. **Mattson, D.**, & L. Swenor. (2009). *Report on the workshop: Opportunities for collaborative mountain lion research on and near the Colorado Plateau*. Wild Felid Association, Montrose, CO, and USGS Southwest Biological Science Center, Flagstaff, AZ. 5 pp.
14. **Mattson, D.** (2008). *Parting thoughts about MUSIC's approach to learning*. MIT-USGS Science Impact Collaborative, Cambridge, MA. 3 pp.
13. **Mattson, D.** (2008). *MUSIC as a boundary-spanning and social movement organization*. MIT-USGS Science Impact Collaborative, Cambridge, MA. 3 pp.
12. Johnson, M., J. Holmes, **D. Mattson**, L. Thomas, & N. Tancreto. (2004). *Summary of faunal populations and communities workshop April 6-7, 2004, Northern Arizona University, Flagstaff, Arizona NPS, Southern Colorado Plateau I&M Network*. U.S. National Park Service, Southern Colorado Plateau I&M Network, Flagstaff, AZ. 10pp. (INVITED technical white paper)
11. **Mattson, D.J.** (2004). *Some thoughts on evaluating the Yellowstone grizzly bear cumulative effects model*. For USGS Interagency Grizzly Bear Study Team, Bozeman, MT. USGS Southwest Biological Science Center, Flagstaff, AZ. 3pp. (INVITED technical white paper)
10. **Mattson, D.J.** (2003). *Thoughts on designing a monitoring program for the Southern Colorado Plateau Network (SCPN) National Park units*. For US National Park Service Southern Colorado Plateau Network, Flagstaff, AZ. USGS Southwest Biological Science Center, Flagstaff, AZ. 4pp. (INVITED technical white paper)
9. **Mattson, D.J.** (2003). *"Conservation is like warfare:" Phantom common ground in the grizzly bear case*. For Yale School of Forestry & Environmental Studies, Seminar on Society & Natural Resources (F&ES 746). 7pp. (INVITED seminar paper)
8. **Mattson, D.J.** (2002). *An approach to selecting vital signs for the Colorado Plateau National Park Service inventory and monitoring program*. For US National Park Service Northern Colorado Plateau Network, Moab, UT. USGS Forest & Rangeland Ecosystem Science Center, Colorado Plateau Field Station. 7pp. (INVITED technical white paper)
7. **Mattson, D.J.** (2001). *Comments on ecological effects of the four-wheel-drive route in Salt Creek, Canyonlands National Park, Utah*. For Southeast Utah Group National Parks & Monuments, Moab, UT. USGS Forest & Rangeland Ecosystem Science Center, Colorado Plateau Field Station. 14pp. (INVITED technical report)
6. **Mattson, D.J.** (2000). *Managing whitebark pine for grizzly bears: Preliminary recommendations*. For Interagency Grizzly Bear Study Team, Bozeman, MT. USGS Forest & Rangeland Ecosystem Science Center, Colorado Plateau Field Station. 3pp. (INVITED technical report)
5. Drost, C., **D.J. Mattson**, M.J. Johnson, A. Cully, M. Bogan, E. Nowak, T. Persons, J. Spence, K. Thomas, & M. Stuart (2000). *Biological inventory of National Park areas on the southern Colorado Plateau*. For US National Park Service Southern Colorado Plateau Network. Colorado Plateau Cooperative Ecosystem Studies Unit and USGS Colorado Plateau Field Station, Flagstaff, AZ. 209pp. (INVITED technical plan; rated second-best inventory plan nationwide).
4. **Mattson, D.J.** (1998). *Coefficients of productivity for Yellowstone's grizzly bear habitat*. USGS Forest & Rangeland Ecosystem Science Center, Corvallis, OR. 85pp. (Technical report).
3. **Mattson, D.J.** (1998). *Research problem analysis: Yellowstone's grizzly bear research program*. For Interagency Grizzly Bear Study Team, Bozeman, MT. USGS Biological Resources Division, Forest & Rangeland Ecosystem Science Center. 10pp. (INVITED technical paper).

2. **Mattson, D.J.** (1993). *Background and Proposed Standards for Managing Grizzly Bear Habitat Security in the Yellowstone Ecosystem*. U.S. National Biological Survey, University of Idaho Cooperative Park Studies Unit, Moscow. 17pp. (Technical report)

1. Reinhart, D.P. & **D.J. Mattson** (1992). *Grizzly Bear and Black Bear Habitat Use in the Cooke City, Montana, Area, 1990-1991*. U.S. National Park Service, Interagency Grizzly Bear Study Team, Bozeman, MT. 31pp. (Technical report)

Other Significant Technical Assistance since 1998: The scientist provided significant technical assistance to individuals on **more than 80 occasions** since 1998, including individuals from Spain, Greece, Italy, Russia, Japan and Canada, pertaining to a wide range of topics, including the design and execution of research, design of conservation efforts, and review of research or management efforts. These instances of technical assistance involved either (i) substantial written or verbal correspondence [generally >3 lengthy e-mail messages or a total of >1-2 hrs of conversation], (ii) significant (several pages) of written products by the scientist, (iii) hands-on analysis of data, (iv) the conveyance of substantive technical products, or (v) otherwise substantively important technical input. The scientist provided lesser technical assistance on many other occasions. Individuals receiving significant technical assistance were from the following organizations (more than one instance is indicated by a trailing bolded number in parentheses):

Yale School of Forestry & Environmental Studies, New Haven, CT **(10)**

Massachusetts Institute of Technology **(5)**

University of Calgary, Calgary, AB **(4)**

National Geographic, Washington, D.C. **(3)**

USGS Colorado Plateau Field Station, Flagstaff, AZ **(3)**

Interagency Grizzly Bear Study Team, Bozeman, MT **(2)**

Tigress Productions, Bristol, UK **(3)**

Brown University

Oregon State University, Corvallis, OR

Nature Conservancy magazine

Audubon magazine

Encarta Encyclopedia

Canadian Broadcasting Corporation, Toronto, ON

Earth Notes Radio Program, Flagstaff, AZ

Universidad de León, León, Spain

Shinshu University, Matsumoto, Japan

University of Helsinki, Helsinki, Finland

University of Waterloo, Ontario, Canada

Wilfrid Laurier University, Waterloo, ON

Yale School of Management, New Haven, CT

New Mexico State University, Las Cruces, NM

University of Utah, Salt Lake City, UT

Washington State University, Pullman, WA

Kent State University, Kent, OH

Marquette University, Milwaukee, WI

Tufts University, Boston, MA

Montana State University, Bozeman, MT

University of Georgia, Athens, GA

University of New Mexico, Albuquerque, NM

Parks Canada, Banff National Park

Grand Canyon National Park
 Yellowstone National Park
 US National Park Service, Great Basin National Park and Mojave Network, Ely, NV
 US National Park Service, Northern Colorado Plateau Network, Moab, UT
 USGS Grand Canyon Monitoring & Research Center, Flagstaff, AZ
 USFS Targhee National Forest, St. Anthony, ID
 USFS Gallatin National Forest, Gardiner, MT
 USGS Western Ecological Research Center, Sausalito, CA
 U.S. Fish and Wildlife Service, Helena, MT
 Idaho Fish & Game Department, Boise, ID
 Blackfoot Challenge, Missoula, MT
 The Banff Centre, Banff, AB
 American Museum of Natural History, New York, NY
 Denver Zoo, Conservation Biology Department, Denver, CO
 Royal Society, Biological Sciences, London, U.K.
 Y2Y Conservation Initiative, Canmore, AB
 The Grand Canyon Trust, Flagstaff, AZ
 Turner Endangered Species Fund, Bozeman, MT
 Sinapu, Boulder, CO
 WildFutures / Earth Island Institute
 San Juan Citizen's Alliance
 Colorado Grizzly Project
 Sierra Club Grizzly Bear Ecosystems Project, Bozeman, MT
 The Wilderness Society, Anchorage, AK
 World Wildlife Fund & Northern Rockies Conservation Cooperative, Ennis, MT
 Round River Conservation Studies, Salt Lake City, UT
 Center for Image Processing in Education, Tucson, AZ
 Center for Environmental Law, Washington, D.C.
 Western Wildlife Environments Consulting, Alberta, AB
 Great Divide Nature Interpretation, Lake Louise, AB

(15) OUTREACH AND INFORMATION TRANSFER AND DISSEMINATION

Technical Information Bulletins or Fact Sheets since 1998

4. **Mattson, D.**, J. Hart & T. Arundel (2005). *Kills by cougars in the Flagstaff uplands of northern Arizona, July 2003-February 2005*. USGS Southwest Biological Science Center, Flagstaff, AZ. 1 pp. (Fact sheet/Research Briefing)
3. **Mattson, D.**, T. Arundel, & J. Hart (2005). *Preliminary analysis of habitat selection by cougars in the Flagstaff uplands of northern Arizona*. USGS Southwest Biological Science Center, Flagstaff, AZ. 1 pp. (Fact sheet/Research Briefing)
2. **Mattson, D.J.**, J. Hart & T. Arundel (2004). *Kills by cougars in the Flagstaff Uplands of northern Arizona July 2003-May 2004*. USGS Southwest Biological Science Center, Flagstaff, AZ. 1 pp. (Fact sheet/Research Briefing)
1. **Mattson, D.J.**, J. Hart & T. Arundel (2002). *Cougars of the Flagstaff uplands*. USGS Southwest Biological Science Center, Flagstaff, AZ. 2 pp. (Fact sheet/Research Briefing)

Web Sites since 1998

2. White, L., & **D.J. Mattson** (2001). *Grizzly Bears*.
http://sbsc.wr.usgs.gov/cprs/research/projects/grizzly/grizzly_bears.asp
1. **Mattson, D.J.**, & L. White (2001). *Grizzly Bears in North America*.
http://sbsc.wr.usgs.gov/cprs/research/projects/grizzly/grizzly_na.asp

Invited Public Presentations since 1998

37. “Brother bear, sister bear: Connections between people and bruins,” *Lunch Lecture Series*, Arizona State Parks, Riordan Mansion State Park, Flagstaff, AZ, June 2010. (INVITED)
36. “Brother bear, sister bear: Cosmic connections between people and bruins,” for *2009 Flagstaff Festival of Science*, Flagstaff, AZ, October 2009. (INVITED)
35. “Psycho-, social, and political dynamics of cougar management,” for *Montana Mountain Lion Workshop*, sponsored by WildEarth Guardians, Bozeman, MT, April 2009. (INVITED)
34. “A little about lions and lion habitat in Montana,” for *Montana Mountain Lion Workshop*, sponsored by WildEarth Guardians, Bozeman, MT, April 2009. (INVITED)
33. “Improving prospects for conserving cougars,” for *Workshop on Cougar Conservation*, Dumas Bay Centre, Tacoma, WA, November 2008. (INVITED)
32. “Mountain lions of the Flagstaff Uplands,” booth for *Science in the Park*, Flagstaff Festival of Science, Flagstaff, AZ, September 2008. (INVITED)
31. “State-level wildlife management: With dignity for all,” for *2007 Animal Grantmakers’ Conference*, Napa, CA, November 2007. (INVITED)
30. “Bears in the backyard: Coexistence and the nature of bruins,” for public event sponsored by Jackson Hole Wildlife Foundation and Patagonia, Teton Science School, Jackson, WY, July 2007. (INVITED)
29. “Lions in the mountains: Coexistence and the nature of pumas,” for *Summer Speakers Series*, Willow Bend Environmental Center, Flagstaff, AZ, July 2006. (INVITED)
28. “Lions in the mountains: Co-existence and the nature of pumas,” for *Summer Speakers Series*, sponsored by Red Rock State Park, Sedona, AZ, June 2006. (INVITED)
27. “Living with large fierce creatures: Cougars and humans on the Southern Colorado Plateau,” for *Flagstaff Leadership Program*, sponsored by USGS Flagstaff Science Center, Flagstaff, AZ, May 2006. (INVITED)
26. “Living with fierce creatures: Cougars on the southern Colorado Plateau,” for *Environmental Studies Colloquium*, Prescott College, Prescott, AZ, April 2006. (INVITED)
25. “Cougars of the Colorado Plateau: A multi-park investigation, Zion National Park and environs,” 1st author with J. Hart, T. Arundel, and J. Bradybaugh for informational public presentation sponsored by Zion NP, Springdale, UT, December 2005. (INVITED)
24. “Cougars of the Flagstaff Uplands,” for *Flagstaff Festival of Science, Speakers Series*, Flagstaff, AZ, October 2005. (INVITED)
23. “Cougars of the Flagstaff Uplands,” 2nd author with J. Hart for *Community Forest Forum*, sponsored by the Greater Flagstaff Forest Partnership, Flagstaff, AZ, October 2004. (INVITED)

22. “Tools for understanding the dynamics and outcomes of complex conservation cases,” for the staff of the Japan Ecosystem Conservation Society, sponsored by the Japan Ecosystem Conservation Society, Tokyo, Japan, September 2004. (INVITED)
21. “Cougars of the Flagstaff Uplands,” 2nd author with J. Hart for *Science in the Park*, sponsored by Flagstaff Festival of Science, Flagstaff, AZ, September 2004. (INVITED)
20. “Cougars of the Flagstaff Uplands: An introduction and results of the 2003-2004 field season,” 1st author with J. Hart & T. Arundel for *2004 Flagstaff Field Center Open House*, sponsored by the USGS Flagstaff Field Center, July 2004. (INVITED)
19. “From bugs to bison: A grizzly bear’s view of the Greater Yellowstone,” for the *2004 Yellowstone Grizzly Bear Writer’s Workshop*, sponsored by the Natural Resources Defense Council, B-Bar Ranch, MT, May 2004. (INVITED)
18. “Rationality and information psycho-sociology in conservation,” for the *Grand Canyon Trust Luncheon Seminar Series*, sponsored by the Grand Canyon Trust, Flagstaff, AZ, March 2004. (INVITED)
17. “Conservation of Yellowstone grizzly bears,” for *Rocky Mountain College Annual Speaker Series*, sponsored by Rocky Mountain College, Billings, MT, January 2004. (INVITED)
16. “Cougars of the Flagstaff Uplands,” 2nd author with J. Hart for *Science in the Park*, sponsored by Flagstaff Festival of Science, Flagstaff, AZ, September 2003. (INVITED)
15. “Grizzly bears of Greater Yellowstone,” for *Greater Yellowstone Coalition 20th Anniversary Annual Meeting*, sponsored by the Greater Yellowstone Coalition, West Yellowstone, MT, June 2003. (INVITED)
14. “Connecting the dots: Bears, numbers, habitat & humans,” for the *Natural Resources Defense Council, Grizzly Bear Writer’s Workshop*, B-Bar Ranch, MT, May 2003. (INVITED)
13. “Thoughts on transboundary monitoring and management of grizzly bears,” for evening public presentation in conjunction with *Kluane National Park and Reserve Grizzly Bear Symposium*, sponsored by Parks Canada, Haines Junction, Yukon Territory, March 2003. (INVITED)
12. “Monitoring cougar movements near the Flagstaff urban interface,” POSTER and presentation as 2nd author with J. Hart for *Cougars and Human Safety Trailhead Workshop*, sponsored by the US Forest Service and Arizona Department of Game & Fish, Flagstaff, AZ, December 2002. (INVITED)
11. “Methods for monitoring grizzly bears,” for the *Sierra Club Grizzly Bear Ecosystems Project Writer’s Workshop*, B-Bar Ranch, MT, May 2002. (INVITED)
10. “Ecology and management of Yellowstone’s grizzly bears,” for the *Sierra Club Grizzly Bear Ecosystems Project Writer’s Workshop*, B-Bar Ranch, MT, May 2002. (INVITED)
9. “From bugs to bison: A grizzly’s view of the Greater Yellowstone,” for *Jackson Hole Chapter of the Sierra Club Speaker Series*, sponsored by the Jackson Hole Chapter of the Sierra Club, Jackson, WY, May 2001. (INVITED)
8. “Grizzly bears and the beauty of complexity,” for the *Predators, People and Places: Finding a Balance*, sponsored by the Predator Conservation Alliance, Mammoth, WY, October 2000. (INVITED)
7. “From bugs to bison: A grizzly’s view of the Greater Yellowstone,” for the *Mountains and Minds Lecture Series*, sponsored by the Montana State University Big Sky Institute for Science and Natural History, Big Sky, MT, October 2000. (INVITED)

6. “From bugs to bison: A grizzly’s view of the Greater Yellowstone,” for the *American Museum of Natural History Speaker’s Series*, New York, NY, April 2000. (INVITED)

5. “The Conservation of Yellowstone’s grizzly bears,” for the *Environmental Science and Research Foundation Annual Meeting*, sponsored by the Environmental Science and Research Foundation, Idaho Falls, ID, February 2000. (INVITED)

4. “Yellowstone’s grizzly bears,” for the *Greater Yellowstone Coalition Annual Meeting*, West Yellowstone, MT, June 1999. (INVITED)

3. “From bugs to bison: A grizzly’s view of the Greater Yellowstone,” for the *Denver Museum of Natural History Lecture Series*, sponsored by the Denver Zoo and the Sierra Club, Denver, CO, April 1999. (INVITED)

2. “From bugs to bison: A grizzly’s view of the Greater Yellowstone,” for the *National Zoo Speakers Series*, sponsored by The Smithsonian and the Sierra Club, Washington, D.C., April 1999. (INVITED)

1. “Grizzly bear conservation in the Yellowstone ecosystem,” for *Luncheon Seminar*, sponsored by the Endangered Species Coalition and Defender’s of Wildlife, Washington, D.C., April 1999. (INVITED)

Media interviews since 1998: Interest in and impact of the scientist’s work is indicated by high levels of national and even international media attention. Since July of 1998 the scientist was interviewed on **79 occasions** by journalists representing 54 media venues. Venues are listed below, with numbers in parentheses denoting the number of substantive interviews by each:

Science magazine (3)

by Bee Wuerthrich, 2000; *umbrella effects*; “When protecting one species hurts another.” *Science* 289: 383, 385.

by Jocelyn Kaiser, 1999; *research reported in an article on grizzly bear demography published by Ecology*.

by Bernice Wuerthrich, 1998; *results of an article in Biological Conservation and status of Yellowstone grizzly bear population*.

Ecological Society of America (1)

news release on co-authored article about grizzly bear demography in Ecology.

Environmental Review newsletter (1)

by Douglas Taylor, 1999; *ecology and management of Yellowstone grizzly bears*; featured interview in the August 1999 (Volume 6[8]) issue.

Science Times of the New York Times (3)

New York Times (1)

Los Angeles Times (5)

Toronto Globe & Mail (1)

Washington Post (1)

The Denver Post (2)

Salt Lake City Tribune (1)

Associated Press (1)

USA Today (2)

High Country News (2)

ABC News (2)

CNN (1)

National Geographic Television (3)

British Broadcasting Corporation, Natural History Unit (2)

Public Broadcasting Corporation, *Nature* (1)

Canadian Broadcasting Corporation (1)

Public Broadcasting System, *Focus West* (1)

Economist magazine (1)

Time magazine (2)

National Geographic magazine (1)

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Audubon magazine (2)
Backpacker magazine (2)
Outdoor Life magazine (1)
Billings Gazette, Billings, MT (4)
Casper Star Tribune, Casper, WY (1)
Idaho State Journal, Pocatello, ID (1)
Arizona Daily Sun, Flagstaff, AZ (3)
The Spokesman-Review, Spokane, WA (1)
Idaho Statesman, Boise, ID (1)
Mountain Living Magazine, Flagstaff, AZ (1)
Helena Independent Record, Helena, MT (1)
Idaho Falls Post Register, Idaho Falls, ID (2)
Bozeman Chronicle, Bozeman, MT (1)
Jackson Hole News & Guide, Jackson, WY (3)
Ventura County Star, Ventura, CA (1)
Teton Valley Top to Bottom magazine, Jackson, WY (1)
Rocky Mountain Outlook, Banff, AB (1)
Banff Craig and Canyon, Banff, AB (1)
 KNAU National Public Radio, Flagstaff, AZ (1)
 German Public Radio (1)
The Animal Show radio show, San Francisco, CA (1)
The Saturday Food Chain AM radio show, San Francisco, CA (1)
Defenders magazine (1)
National Parks & Conservation Association magazine (1)
National Wildlife magazine (1)
 WildFutures/Earth Island Institute, 'On Nature's Terms' (1)
 Environmental News Network (1)
Wildlife News Archives (1)
Greenlines (1)
 Endangered Species Productions (1)
Cascadia Times (1)

(16) INVENTIONS, PATENTS HELD

None

(17) HONORS, AWARDS, RECOGNITION, ELECTED MEMBERSHIPS

20. *Exploding Head Award* for “the man who has so many ideas it’s amazing his head doesn’t explode,” USGS Southwest Biological Science Center, December 2010.

19. *Star Award* for superior accomplishments as Research Wildlife Biologist and as Station Liaison for the Colorado Plateau Research Station, September 2010.

18. *Star Award* for superior accomplishments as Station Leader for the Colorado Plateau Research Station, September 2009.

17. *Star Award* for superior accomplishments during special assignments at Yale School of Forestry & Environmental Studies and MIT-USGS Science Impact Collaborative, August 2008.
16. *Paradigm Shifter Award*, USGS Southwest Biological Sciences Center, February 2008.
15. *Star Award* in recognition of service as Acting Station Leader for Colorado Plateau Research Station, August 2006.
14. *Star Award*, for sustained superior performance on a variety of projects and activities outside the normal scope of duties, from USGS Colorado Plateau Research Station, August 2004.
13. *Certificate of Appreciation*, for contributions to the 2004 Western Region Center Directors Meeting, from USGS Colorado Plateau Research Station, July 2004.
12. *Star Award*, for outstanding performance as Chair of the 7th Biennial Conference of Research on the Colorado Plateau, from USGS Colorado Plateau Research Station, November 2003.
11. *Certificate of Appreciation*, for activities in support of the 2003 Flagstaff Festival of Science, from USGS Colorado Plateau Field Station, October 2003.
10. *Rick Hutchinson Outstanding Scientific Research Award*, for outstanding scientific contributions to knowledge of grizzly bears in the Yellowstone Ecosystem, from the Greater Yellowstone Coalition, June 2003.
9. Elected to membership in *The Society for Policy Sciences*, 2001-present.
8. *Star Award*, for development of an alternative management structure for the Colorado Plateau Field Station, from USGS Biological Resources Discipline, 2001.
7. *Star Award*, for outstanding performance as Client's Day Chair for the 5th Biennial Conference of Research on the Colorado Plateau, from USGS Biological Resources Division, 1999.
6. Invitation to participate in "Conversations in the Wild," by The Murie Center, Moose, WY, 1999.
5. *Special Act Service Award*, for acting as 3rd party in negotiations for access to sensitive data to avoid litigation under the FOIA, from USGS Biological Resources Division, 1997.
4. Graduate tuition waived, 1980-1984, University of Idaho.
3. Graduation *summa cum laude*, B.S., 1979, University of Idaho.
2. Undergraduate Teaching Assistantship (\$1200), *General Botany*, 1979, College of Biology, University of Idaho.
1. Dean's List 1972-1979 (for semesters attended), College of Forestry, Wildlife & Range Sciences, University of Idaho.

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114. **Mattson, D.J.**, & E.J. Ruther. Accepted. An explanation of puma-related behaviors and behavioral intentions among northern Arizona residents. *Human Dimensions of Wildlife*.
113. **Mattson, D.**, H. Karl. & S. Clark (2011). Values in natural resources management and policy. In press in H. Karl, M. Flaxman, J.C. Vargas-Moreno, & P. Lynn-Scarlett (eds.). *Restoring lands: Coordinating science, politics, and action*. Springer, New York, NY.

112. Mattson, D.J. (2011). Snowbird workshop report: More on opportunities for collaborative mountain lion research. *Wild Felid Monitor* 4(2): in press.

111. Mattson, D.J., & S.G. Clark (2011). Human dignity in concept and practice. *Policy Sciences: Online First*.

110. Mattson, D.J., S.G. Clark, K.L. Byrd, S.R. Brown, & B. Robinson (2011). Leaders' perspectives in the Yellowstone to Yukon Conservation Initiative. *Policy Sciences* 44: 103-133.

109. Mattson, D., K. Logan, & L. Sweanor (2011). Factors governing risk of cougar attacks on humans. *Human-Wildlife Interactions* 5(1): 135-158.

108. Clark, S.G., M.B. Rutherford, M.R. Auer, D.N. Cherney, R.L. Wallace, **D.J. Mattson,** D.A. Clark, L. Foote, N. Krogman, P. Wilshusen, & T. Steelman (2011). College and university educational programs as a policy problem (Part 2): Strategies for improvement. *Environmental Management* 47(5): 716-726.

107. Clark, S.G., M.B. Rutherford, M.R. Auer, D.N. Cherney, R.L. Wallace, **D.J. Mattson,** D.A. Clark, L. Foote, N. Krogman, P. Wilshusen, & T. Steelman (2011). College and university educational programs as a policy problem (Part 1): Integrating knowledge, education, and action for a better world? *Environmental Management* 47(5): 701-715.

106. Mattson, D.J., & S.G. Clark (2010). Groups participating in cougar management. Pages 254-259 in M. Hornocker & S. Negri (eds). *Cougar: Ecology and conservation*. University of Chicago Press, Chicago, IL.

105. Mattson, D.J., & S.G. Clark (2010). People, politics, and cougar management. Pages 206-220 in M. Hornocker & S. Negri (eds). *Cougar: Ecology and conservation*. University of Chicago Press, Chicago, IL.

104. Mattson, D. (2010). Workshop report: Opportunities for collaborative mountain lion research on and near the Colorado Plateau. *Wild Felid Monitor* 3(1): 12-13.

103. Jones, A.L., E. Aumack, J. Balsom, P. Beier, J. Belnap, J. Catlin, T.L. Fleischner, E. Grumbine, **D.J. Mattson,** & C. van Riper III (2010). The legacy and future visions of conservation biology on the Colorado Plateau. Pages 1-20 in C. van Riper III, B.F. Wakeling, & T.D. Sisk (eds). *The Colorado Plateau IV: Shaping conservation through science and management*. University of Arizona Press, Tucson, AZ.

102. Peter-Contesse, T.J., S.G. Clark, & **D.J. Mattson** (2010). A workshop on large scale conservation: An exercise in group problem solving and leadership. Pages 127-150 in S. Clark, A. Hohl, C. Picard, & D. Newsome (eds.). *Large scale conservation: Integrating science, management, and policy in the common interest*. Yale School of Forestry & Environmental Studies Bulletin 24, New Haven, CT.

101. Hendee, J.C., & **D.J. Mattson** (2009). Wildlife in wilderness: a North American and international perspective. Pages 308-333 in C.P. Dawson & J.C. Hendee, eds. *Wilderness management: stewardship and protection of resources and values*. 4th Edition. Fulcrum Publishing, Golden, Colorado.

100. Rosen, T., R. Watter, & **D. Mattson** (2009). Introducing the Yale Large Carnivore Group. *Wild*

Felid Monitor 2(1): 16.

99. Bischoff-Mattson, Z., & **D. Mattson** (2009). Effects of simulated mountain lion caching on decomposition of ungulate carcasses. *Western North American Naturalist* 69(3): 343-350.

98. **Mattson, D.J.**, & N. Chambers (2009). Human-provided waters for desert wildlife: What is the problem? *Policy Sciences* 42: 113-135.

97. **Mattson, D.** (2008). Finding common ground with cougars, among ourselves, in cougar management. *Wild Felid Monitor* 1(2): 16-17. **(INVITED)**

96. **Mattson, D.**, & H. Karl (2008). *Values in Natural Resources Policy and Management: A brief introduction*. For MIT-USGS Science Impact Collaborative website. 22 manuscript pp.

95. **Mattson, D.** (2007). The promise of science to serve society. *Northern Rockies Conservation Cooperative News Letter* 20(2): 4. **(INVITED)**

94. **Mattson, D.**, J. Hart, M. Miller & D. Miller (2007). Predation and other behaviors of mountain lions in the Flagstaff Uplands. Pages 31-42 in D. Mattson, editor. *Mountain Lions of the Flagstaff Uplands: 2003-2006 Progress Report*. USGS Open-File Report 2007-1062.

93. **Mattson, D.J.**, & T. Merrill (2007). Policy-oriented conservation design. Pages 70-98 in M.F. Price, editor. *Mountain Area Research and Management: Integrated Approaches*. Earthscan Press, London, UK. **(INVITED)**

92. **Mattson, D.** (2007). Managing for human safety in mountain lion range. Pages 43-56 in D. Mattson, editor. *Mountain Lions of the Flagstaff Uplands: 2003-2006 progress report*. USGS Open-File Report 2007-1062.

91. **Mattson, D.**, editor (2007). *Mountain Lions of the Flagstaff Uplands: 2003-2006 Progress Report*. USGS Open-File Report 2007-1062. <http://pubs.usgs.gov/2007/1062>

90. Hart, J.V., C. van Riper, III, **D.J. Mattson** & T.R. Arundel (2007). Effects of fenced transportation corridors on pronghorn movements at Petrified Forest National Park, Arizona. Pages 161-185 in C. van Riper III & M.K. Sogge, editors. *Colorado Plateau III: Integrating Research and Resources Management for Effective Conservation*. University of Arizona Press, Tucson, AZ.

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86. **Mattson, D.J.**, K.L. Byrd, M.B. Rutherford, S.R. Brown, & T.W. Clark (2006). Finding common ground in large carnivore conservation: Mapping contending perspectives. *Environmental Science and Policy* 9: 392-405.

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81. **Mattson, D.**, J. Hart, & T. Arundel (2005). Cougar predation in the Flagstaff Uplands: Preliminary results from July 2003-May 2005. Pages 158-169 in R. Beausoleil & D. Martorello, editors. *Proceedings of the 8th Mountain Lion Workshop*. Washington Department of Fish & Game, Olympia, WA.
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(19) NOTEWORTHY PUBLICATIONS

- 5. Mattson, D.J.**, K.L. Byrd, M.B. Rutherford, S.R. Brown, & T.W. Clark (2006). Finding common ground in large carnivore conservation: Mapping contending perspectives. *Environmental Science and Policy* 9: 392-405.

This paper is noteworthy for several reasons, first, as emblematic of an emerging direction in the scientist's research, and, second, as a definitive and empirical demonstration of common ground among participants conflicted over management of large carnivores in the Northern U.S. Rocky Mountains. It is one of comparatively few examples of Q-methodology applied to natural resources, which is relevant because of recent widespread interest among social scientists in this analytic approach to clarifying human perspectives. Google Scholar credits this paper with 23 citations.

- 4. Mattson, D.J.**, & T. Merrill (2002). Extirpations of grizzly bears in the contiguous United States, 1850–2000. *Conservation Biology* 16: 1123-1136.

This paper has emerged as a seminal work explaining historic regional extirpations of species. It has been singled out as an instructive paper in academe in addition to being instructive regarding key determinants of persistence for modern-day grizzly bear populations. When published, the paper was featured in a press release by Conservation Biology and has since been included in eForum on Biodiversity & Conservation. Google Scholar credits this paper with 68 citations.

- 3. Pease, C.M. & D.J. Mattson** (1999). Demography of the Yellowstone grizzly bears. *Ecology* 80: 957-975.

This paper is noteworthy as the only which explicitly accounts for behavioral structuring in the demography of a large-mammal population. It also under-girds emerging understanding of demographic drivers for the symbolically and politically important Yellowstone grizzly bear population. When published, the paper was featured in a press release by Ecology and in an article by Science magazine, and is currently credited with 61 citations by Google Scholar.

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

This paper was among the first to conclusively document relations between mortality in a bear population and food availability and behavioral tolerance of humans. For this reason it is considered a seminal work on relations of bear demography to bear behavior and is credited with 127 citations by Google Scholar.

- 1. Mattson, D.J.**, B.M. Blanchard & R.R. Knight (1991). Food habits of Yellowstone grizzly bears, 1977-1987. *Canadian Journal of Zoology* 69: 1619-1629.

This paper was among the first to report a detailed long-term record of grizzly bear diet, including annual and seasonal variation and implications for bias and design of dietary studies. It is considered the seminal paper on bear food habits and is credited with 140 citations by Google Scholar.

April 25, 2018

The Honorable Matt Mead
Governor for the State of Wyoming
Governor's Office
Capitol Building Room 124
200 West 24th Street
Cheyenne WY 82002-0010

Re: Stay Wyoming's unscientific, drastic grizzly bear hunt for an outside peer-review process

Dear Governor Mead:

We, the seventy-three (73) undersigned biologists and scholars, appreciate the opportunity to provide scientific input on Wyoming's planned grizzly bear sport hunt, which is necessarily addressed in context of Wyoming's broader plans for managing grizzly bear mortality in the Greater Yellowstone Ecosystem (GYE). As preamble, we also appreciate Wyoming's efforts during the last 40 plus years to help bring Yellowstone's grizzly bear population back from the brink of extirpation. However, Wyoming's current plans for managing mortality of GYE grizzly bears suffer from numerous deficiencies, both scientifically and in service of precautionary conservation, we therefore ask you to stay the hunt until Wyoming's proposed sport hunt of grizzly bears receives external peer review and subsequent adjudication by independent scientists.

In brief, Wyoming is purposefully planning to reduce bear numbers within the core Demographic Monitoring Area (DMA), as well as functionally extirpate grizzly bears ranging outside that invisible boundary. These objectives are not prudent given rapidly changing environmental conditions within the GYE and foreseeable amplification of these dynamics during future decades. On top of these threats, Wyoming and Idaho have both signaled their readiness to permit dangerously high levels of trophy hunting even in the face of overwhelming public opposition. Reducing and geographically truncating the GYE grizzly bear population would foreclose opportunities for bears in this ecosystem to occupy ample suitable habitat that is contiguous with or nearby the DMA and, with that, debar achievement of population viability and related resilience to rapid environmental change.

The particulars of our concerns are as follow:

- The methods currently used by Wyoming, Montana and Idaho to calculate total and discretionary allowable mortality, which encompass deaths allocated to sport-hunting, are explicitly premised on the goal of reducing grizzly bear numbers within the DMA. This is not prudent or ecologically justified for reasons that we articulate below.
- Plans to severely reduce grizzly bears outside the DMA are egregiously indefensible. Given a likely population of 80-100 bears outside the DMA, but within Wyoming, a sport hunt of 12 bears—in addition to other foreseeable mortality—is likely to be 500-1000% of sustainable levels. This is tantamount to planned extirpation.

- Even without planned reductions, the current GYE population of roughly 700 grizzly bears is far too small to be viable in the face of foreseeable environmental changes and genetic losses. Recent research suggests that viable populations of animals such as grizzly bears need to be 2,000-10,000 animals. Wyoming's current plans would limit connectivity with other grizzly bear populations and colonization of suitable habitats, thereby preventing the achievement of meaningful viability and, in fact, perversely drive population numbers in the opposite direction.
- Several researchers have independently documented ample suitably remote and productive habitat contiguous with or within colonizing distance of current grizzly bear distribution. Wyoming's plan to reduce grizzly bear numbers inside the DMA and essentially extirpate bears outside prevents expansion into suitable habitat and genetic exchange with other populations by targeting vital dispersers, thereby degrading population viability, especially of the currently isolated GYE population.
- Although there is disagreement over whether recent environmental changes (e.g., loss of historically important whitebark pine and cutthroat trout and loss of snow depth for denning cover) have harmed GYE grizzly bears, no disagreement exists that this change has been dramatic and will continue, if not amplify, during coming decades. Under such conditions, it is not defensible to eliminate bears that would otherwise contribute to enhanced population resilience and viability.
- Deliberate perpetration of human-caused mortality is not needed to control the GYE grizzly bear population. Recent research from the GYE, and indeed worldwide, suggests that grizzly bears and other large-bodied carnivores are self-regulating, with self-regulating dynamics strengthening nearer carrying capacity. If so, the grizzly bear population will naturally oscillate around carrying capacity, even as this capacity changes, and without the need for overt human intervention, particularly in the form of sport hunting.
- The methods used by Wyoming to calculate allowable mortality—including the toll allocated to sport hunting—assume that males can be sustainably killed at twice the rate as females even though males and females are born in equal numbers. This assumption is patently illogical and leads to unsustainable killing of males. Further skewing the sex ratio will drive the effective population size (N_e) lower than the census population, which makes genetic isolation and potential future inbreeding depression more of a problem for the GYE population. The consequences of this logical failure are exacerbated by the fact that the male population segment is not annually monitored and is instead accounted for by complex and assumption-ridden estimates of male survival rates using 6-10 years-worth of retrospective data. This methodology is tantamount to relying on an out-of-focus rearview mirror to manage future male mortality.
- Finally, Wyoming has not accounted for the indirect and almost wholly negative effects that will amplify direct numeric consequences of sport hunting and other human-caused mortality. A large body of research has shown that hunting—along with other mortality

biased against adult male bears—leads to increased rates of infanticide and, with that, unanticipated damping of population growth rates. Moreover, adult-biased, human-caused mortality is evolutionarily novel for grizzly bears, and will select for traits that propel the GYE population in unpredictable and probably maladaptive directions.

- To trophy hunt such a vulnerable population is ethically irresponsible, unwarranted, and not in the public's interest. National and state surveys have consistently shown that the majority of respondents do not support trophy hunting. Moreover, wildlife viewers have outnumbered hunters by 6-7-fold for at least the last 15 years, as evidenced by the millions of tourists who come to view GYE grizzly bears and wolves. According to the National Park Service, in 2016, Grand Teton and Yellowstone National Parks generated \$1.5 billion in revenues that benefited local economies, including supporting almost 18,000 jobs related to park visitation. None of these economic benefits derive from providing a handful of hunters the opportunity to kill grizzly bears—an activity guaranteed to be economically inconsequential.

Again, we appreciate this opportunity to provide input on Wyoming's plans for managing the GYE grizzly bear population, including its recent plans for sport hunting. Please contact Dr. David Mattson if you have any questions or would like additional input.

Sincerely,

David Mattson, Ph.D.

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