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S. HRG. 115–424

FROM YELLOWSTONE'S GRIZZLY BEAR TO THE CHESAPEAKE'S DELMARVA FOX SQUIRREL—SUCCESSFUL STATE CONSERVATION, RECOVERY, AND MANAGEMENT OF WILDLIFE

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED FIFTEENTH CONGRESS

SECOND SESSION

OCTOBER 10, 2018

Printed for the use of the Committee on Environment and Public Works

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FROM YELLOWSTONE'S GRIZZLY BEAR TO THE CHESAPEAKE'S DELMARVA FOX SQUIRREL—SUCCESSFUL STATE CONSERVATION, RECOVERY, AND MANAGEMENT OF WILDLIFE

WEDNESDAY, OCTOBER 10, 2018

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The Committee met, pursuant to notice, at 10:05 a.m. in room 406, Dirksen Senate Office Building, Hon. John Barrasso (Chairman of the Committee) presiding.

Present: Senators Barrasso, Carper, Inhofe, Capito, Boozman, Wicker, Fischer, Rounds, Ernst, Cardin, Whitehouse, Gillibrand, and Van Hollen.

OPENING STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM THE STATE OF WYOMING

Senator BARRASSO. Good morning. I call this hearing to order.

Today the Committee is going to examine several of the important roles that States play in successful conservation, recovery, and management of wildlife. Across the Nation, State wildlife and conservation agencies are on the front lines of preventing species from becoming endangered, of recovering threatened and endangered species, and of preventing the spread of invasive species.

States—not Federal agencies—have primacy over wildlife management. States have made significant investments in research and on the ground conservation.

According to the Association of Fish and Wildlife Agencies, States employ over 50,000 wildlife professionals, including more than 11,000 degreed wildlife biologists, 10,000 wildlife law enforcement officers, and 6,000 employees with advanced education degrees. They also leverage the efforts of over 190,000 volunteers.

States contribute and carry out more than $5.6 billion in conservation efforts. These enormous resources supplement over 11,000 Federal employees and $2.35 billion in annual spending by the U.S. Fish and Wildlife Service and the National Marine Fisheries Services.

In Wyoming, we know the importance of responsible environmental stewardship and habitat management. Our wildlife and the habitat that our States provide is diverse and abundant.

The Wyoming Game and Fish Department has done a tremendous job in safeguarding Wyoming's wildlife resources for present

and future generations. Our wildlife biologists partner with others in the region and with Federal agencies to successfully recover numerous threatened and endangered species such as the bald eagle, the peregrine falcon, the gray wolf, and the grizzly bear. They also actively manage thriving populations of other native wildlife: elk, deer, bison, sage-grouse, and antelope.

States work to manage invasive species. One example, cheatgrass, increases the risk of wildfires; it lowers the quality of forage for wildlife and for livestock; it unnecessarily burdens already stressed water supplies; and it poses one of the most significant threats to sage-grouse habitat conservation efforts.

They also manage the zebra and the quagga mussels, which threaten our aquatic ecosystems and cause millions of dollars in damage to dams, municipal water systems, and agricultural irrigation systems. They monitor and manage mule deer and elk after harsh winters. They study and mitigate the risk of brucellosis for elk, and they remain on the cutting edge of research on chronic wasting disease.

Wyoming demonstrates successful conservation, recovery, and management of wildlife every day. It is no easy task, and the State continues to invest countless hours and millions of dollars. At times, these investments have been dismissed by litigious groups and activist judges in Federal court.

A few weeks ago, a District Court judge struck down the delisting of the grizzly bear in the Greater Yellowstone Ecosystem. For the second time in a decade, courts disregarded the biological expertise of both States and Federal agencies.

The ruling is not based on the reality on the ground. In the delisting, the U.S. Fish and Wildlife Service said, "The participating States of Idaho, Montana, and Wyoming, and Federal agencies have adopted the necessary post-listing plans and regulations which adequately ensure that the Greater Yellowstone Ecosystem population of grizzly bears remains recovered."

In 1975 there were as few as 136 grizzly bears in the Greater Yellowstone Ecosystem. Today there are more than 700. And the bears have more than doubled their range to occupy over 22,000 square miles. The range continues to spread.

Without proper management, they are a threat to public safety not only to the people in my State, but to sportsmen and recreationists from across the country who want to experience Wyoming's national parks, our forests, and other public lands.

Tragically, on September 14th of this year, a Wyoming elk hunting guide was killed by a grizzly bear and her cub. This attack happened when the guide, along with his client from Florida, were cleaning an elk, a normal part of any hunt.

While these are serious examples of wildlife-human interactions, State wildlife managers work tirelessly to limit any negative interactions. We have to let Wyoming and other States do their job.

I would now like to turn to Ranking Member Carper for his opening statement.

OPENING STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

Senator CARPER. Thanks very much, Mr. Chairman.

We welcome our witnesses. I understand Ms. Dohner—I was talking to her—she tells us her husband is on the run today, and it has something to do with the big storm, heading for where, Mobile?

Ms. DOHNER. Mobile, yes, sir.

Senator CARPER. OK. Well, best wishes to him and a lot of other people down there, too.

Mr. Chairman, I am delighted to have the opportunity to highlight today one of Delaware's great endangered species success stories. We hear a lot about failures, but I want to share a success story today.

The U.S. Fish and Wildlife Service considered the Delmarva fox squirrel endangered before the current Endangered Species Act was even enacted into law in—I think it was 1973. Overhunting and habitat destruction were the leading causes of the squirrel's decline.

The Service didn't develop the first recovery plan for the squirrel until 1979, and the plan required two sets of revisions, I think one in 1983, and one in 1993.

Over the course of decades, the U.S. Fish and Wildlife Service worked with Delaware, worked with Maryland, and worked with Virginia to introduce and monitor experimental Delmarva fox squirrel populations. These populations grew and traveled onto private lands, creating some unexpected challenges for landowners. It wasn't easy, but the Service, the States, the landowners, and other stakeholder groups worked together to address these challenges while advancing the squirrel's recovery.

As a result of this collaborative conservation approach, the U.S. Fish and Wildlife Service removed the Delmarva fox squirrel from the Endangered Species List 3 years ago, in 2015, nearly 50 years since the date of listing. The delisting was a shared success among the States, the Service, and all parties that participated in recovery actions. Notably, the delisting did not, did not result in any litigation.

So, I want to underscore the importance of the strong Federal role in the recovery of the Delmarva fox squirrel. Without Federal coordination across State lines, the squirrel may not have recovered. While rate efforts have driven many species' conservation success stories, the backstops and incentives provided by the Federal Endangered Species Act are absolutely critical.

I believe the Delmarva fox squirrel story is the rule for species recovery, not the exception. Most species become imperiled over the course of many years. In this case, the fox squirrel population had likely been decreasing for about a century. Therefore, it should come as no surprise that species recovery can take decades, as it did for the Delmarva fox squirrel.

Lengthy recovery times do not mean that the Endangered Species Act isn't working, as some of our colleagues may suggest. When the Endangered Species Act is adequately resourced—adequately resourced—it actually works quite well.

In addition to the Delmarva fox squirrel, the Endangered Species Act has helped recover bald eagles and is currently helping recover the red knot and the piping plover birds in Delaware and up and down the East Coast. Birders come from near and far. They come to observe these species, and when they do, they support our ecotourism industry.

I also hear from some of our colleagues raising concerns about litigation, especially litigation regarding declining species. Sometimes disagreements between wildlife managers and stakeholders result in litigation, particularly around highly charismatic, nationally beloved predatory species. These disagreements are unfortunate, but judicial review remains a necessary part of the Endangered Species Act.

As we will hear from at least one of our witnesses today, litigation can even forge stronger relationships between the States and Federal agencies as they work to improve species conservation outcomes and overcome lawsuits.

I recognize there may be difficulties associated with litigation, but litigation over delisting decisions is quite rare. In fact, I am told that environmental nonprofits, which provide a voice for the public, have sued in only 9 percent of all delistings. The courts have sided with these NGOs on just two species, grizzly bears and wolves.

Mr. Chairman, I believe that both of these species live in your great State, that would be the grizzly bears and the wolves, but I think it is important for us to acknowledge that we are not talking about a systemic issue here. As such, I hope our Committee will focus much of its efforts on addressing the severe funding constraints that are limiting both State and Federal abilities to better conserve species.

When States work collaboratively with Federal agencies and diverse stakeholders, I believe that our environment, our wildlife, and our economy can prosper together. That is certainly our experience in Delaware. I hope the same is true in all of our States.

Let me conclude by saying we look forward to hearing the testimony from each of you today.

And we want to thank you again, Mr. Chairman, for bringing us all together for what I believe will be a valuable conversation.

I have another committee—in fact, we all have committees that are meeting at the same time, and I am going to be coming and going. I don't mean to be rude, but please bear with us, and we will be with you as much as we can. Thank you all for joining us today.

Thank you, Mr. Chairman.

Senator BARRASSO. Thank you, Senator Carper.

We are now going to hear from our three witnesses. We will be hearing shortly from Mr. John Kennedy, the Deputy Director of the Wyoming Game and Fish Department. I will more formally introduce Mr. Kennedy in a minute.

We also have joining us today Mr. Mike McCormick, the President of the Mississippi Farm Bureau Federation; and Ms. Cindy Dohner, who is the former Regional Director of the Southeast Region of the U.S. Fish and Wildlife Service.

I want to remind each of the witnesses that your full written testimony will be made part of the official hearing record, so please

try to keep your statements to 5 minutes so that we will have time for questions.

I would now like to introduce Mr. John Kennedy, who serves as the Deputy Director for Internal Operations at the Wyoming Game and Fish Department. He began his career at the Wyoming Game and Fish Department in 2004 as the Service Division Chief. In that role, his duties included coordinating the agency's management of wildlife habitat, as well as conservation education.

Now, as Deputy Director, Mr. Kennedy is responsible for the agency's oversight of the fish, wildlife services, and the fiscal divisions. He also serves on a number of committees of the Association of Fish and Wildlife Agencies and the Western Association of Fish and Wildlife Agencies. Each of these positions has provided Mr. Kennedy with valuable wildlife conservation, recovery, and management expertise. He also is a proud and distinguished graduate of a program that I have also attended and graduated from, Leadership Wyoming.

Mr. Kennedy, it is a privilege to welcome you today to the Environment and Public Works Committee. Please proceed.

STATEMENT OF JOHN KENNEDY, DEPUTY DIRECTOR, WYOMING GAME AND FISH DEPARTMENT

Mr. KENNEDY. Good morning, Chairman Barrasso, Ranking Member Carper, and members of the Committee. My name is John Kennedy, and I am with the Wyoming Game and Fish Department.

Mr. Chairman, thank you for the reference to the work that is taking place in Wyoming with the Wyoming Game and Fish Department. I appreciate that and will be sure to pass that on to our employees.

I appreciate the opportunity to testify today about wildlife conservation in Wyoming.

Mr. Chairman and members of the Committee, as you know, the 50 States have the primary legal authority and management responsibility for a great deal of the country's wildlife resources. States have specific authority for wildlife management within their borders, including most Federal lands.

In the late 1800s the Nation's wildlife resources were depleted due to unregulated hunting and habitat loss. In order to protect the resource, hunters and anglers advocated for regulations for hunting and measures to protect valuable habitat. These efforts led to the creation of the North American Model Wildlife Conservation, which has two main areas of focus: fish and wildlife belong to all citizens and wildlife management for perpetual sustainability.

To carry out the management charge granted by the Constitution, every State has an agency dedicated to managing wildlife resources within their borders. In spite of limited funding, State agencies have garnered considerable expertise in response to the growing need to address at-risk and imperiled species, and to carry out management responsibilities across the country.

On average, 60 to 90 percent of State wildlife agency budgets are derived by hunters and anglers. Management of wildlife and the habitats that support them is partially funded through excise taxes on hunting and fishing equipment collected under the Federal authority of the Pittman-Robertson and Dingell-Johnson Acts, which

have been a critical source of wildlife conservation funding in the United States for over 80 years. The sale of hunting and fishing licenses significantly contribute to the conservation efforts at the State level. In Wyoming, hunters and anglers fund the Department's work almost entirely.

The collective annual budget of State wildlife agencies is significant: $5.6 billion. Nearly 59 percent—that is $3.3 billion—comes from hunting and fishing related activities either directly through the sale of licenses, tags, and stamps, or indirectly through Federal excise taxes on hunting, fishing, and recreational shooting equipment.

Despite this hunting and fishing specific funding model, State wildlife agencies have a long history of success in restoring many species, both game and non-game. It has been long recognized that the traditional focus of State wildlife agencies has been on the conservation of game species, but more attention and funding has been directed toward the conservation of non-game species. This shift was the impetus for development of State Wildlife Action Plans and the State Wildlife Grants program. Each State has a plan developed that identifies the species of greatest conservation need in the State and provides for the inventory, research, and management actions necessary to conserve those species.

The need for new and broader funding is reflected in one of the recommendations made by the Association of Fish and Wildlife Agencies Blue Ribbon Panel on sustaining America's Diverse Fish and Wildlife Resources. That recommendation is to secure an additional $1.3 billion for the Wildlife Conservation Restoration Program and is the impetus for our current work on the Recovering America's Wildlife Act.

In Wyoming, the responsibilities of the Department are defined in Wyoming's statute and charge the agency to provide an adequate and flexible system for the control, management, protection, and regulation of all Wyoming wildlife. The Department manages over 800 wildlife species. The Department's core priority is to manage wildlife using sound scientific principles, while maintaining stakeholder satisfaction. This includes actively monitoring wildlife populations, adjusting regulations to ensure sustained use, conducting research, enforcing wildlife laws and regulations, conserving and restoring habitat, and maintaining an increasing public access for hunting and fishing.

While there are significant challenges to managing certain species and habitats, State wildlife agencies are the best to address those challenges, just as Wyoming has done with the greater sage-grouse, black footed ferrets, grizzly bears, and wolves. It is also worth noting the dozens of wildlife that faced serious challenges nearly 100 years ago that were brought back through State led collaborative conservation efforts, including mule deer, moose, elk, and pronghorn antelope.

As you can see in my written testimony, there are many examples of successful State conservation, recovery, management of wildlife in Wyoming, including work on threatened and endangered species, non-game and game. This includes successful conservation work on the bald eagle, peregrine falcon, and again, sage-grouse, grizzly bears, gray wolf, and black footed ferrets.

Mr. Chairman, as you referenced in the introduction, there are also examples of successful State management of invasive species. In terms of aquatic invasive species, we have been successful in keeping two species of concern out of our waters, those being quagga and zebra mussels. And although managing cheatgrass has proven to be extremely challenging and costly, we have accomplished successful site specific treatments in certain areas of Wyoming. We are also controlling certain terrestrial invasive species on wildlife habitat areas that we manage throughout the State.

Mr. Chairman and members of the Committee, thank you for the opportunity to testify today and to talk about Wyoming's work to conserve, recover, and manage wildlife. I am happy to answer any questions that you might have.

[The prepared statement of Mr. Kennedy follows:]

John Kennedy
Deputy Director
Wyoming Game and Fish Department

John Kennedy started with the Wyoming Game and Fish Department in 2004 in the position of Services Division Chief. As Services Division Chief, John was responsible for coordinating the agency's management of wildlife habitat and public access areas and administration of the agency's information technology; conservation engineering; land acquisition; conservation education; and wildlife forensics/fish pathology programs.

As deputy director, John oversees most internal programs in the agency, including development and management of the Commission's budget; final approval of all grants, contracts and agreements; coordination with the Commission; and oversight of the fish, wildlife, services and fiscal divisions. John graduated from the inaugural National Conservation Leadership Institute Program and is currently participating in Leadership Wyoming (Class 2017). John continues to serve on numerous committees of the Western Association of Fish and Wildlife Agencies and the Association of Fish and Wildlife Agencies.

John was born and raised in Idaho. He holds a B.S. degree in wildlife management from the University of Idaho and an M.S. degree in wildlife management from South Dakota State University. His M.S. research focused on habitat selection by white-tailed deer in the northern Black Hills of South Dakota and Wyoming. John is an avid outdoorsman and spends his spare time hunting and fishing.

WYOMING GAME AND FISH DEPARTMENT

5400 Bishop Blvd. Cheyenne, WY 82006

Phone: (307) 777-4600 Fax: (307) 777-4699

wgfd.wyo.gov

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TESTIMONY OF JOHN KENNEDY
DEPUTY DIRECTOR
WYOMING GAME AND FISH DEPARTMENT

BEFORE THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
"Wyoming's Work to Conserve, Recover, and Manage Wildlife"

Good morning Chairman Barrasso and members of the Committee. My name is John Kennedy, and I am the Deputy Director of the Wyoming Game and Fish Department. I chair the Association of Fish and Wildlife Agencies' (AFWA) State/Federal Agency Coordination Committee. AFWA represents the perspectives of the 50 state fish and wildlife agencies across the nation. I sincerely appreciate the opportunity to testify today about wildlife conservation in Wyoming.

I would like to begin by describing the jurisdictional authorities for fish and wildlife management and the state and federal relationships between those authorities. The 50 states have the primary legal authority and management responsibility for a great deal of the country's fish and wildlife resources. States have specific authority for conservation and management within their borders, including most federal land. The tenth amendment to the United States Constitution, as well as the Public Trust Doctrine, directs that powers not specifically delegated by the Constitution to the Federal Government be delegated to state authority or to the people, including the responsibility to manage most of the nation's fish and wildlife resources. Furthermore, United States Congress has the sole authority to preempt a state's authority for fish and wildlife management, and then only for certain federal actions. An example of this is the Endangered Species Act, which affirms the federal authority given to the federal agency that exists concurrently with the pre-existing authority of the state agency. Collectively, the 50 state fish and wildlife agencies own, manage, or administer wildlife conservation in excess of 464 million acres of land and 167 million acres of lakes. Of these, nearly 500,000 acres of land and 48,000 acres of lakes are located in Wyoming.

In the late 1800s, the nation's wildlife resources were depleting due to unregulated hunting and habitat loss. In order to protect the resource, hunters and anglers advocated for regulations for hunting and measures to protect valuable habitat. These efforts led to the creation of the North American Model of Wildlife Conservation, which has two main areas of focus: 1) fish and wildlife belong to all citizens; and 2) wildlife management for perpetual sustainability. These focus areas encompass seven tenets of conservation: 1) the Public Trust Doctrine, tasking the government with holding wildlife in trust for all citizens; 2) Democratic Rule of Law, which provides the resource to be allocated for use by all citizens; 3) Opportunity For All, which dictates that all citizens in the United States and Canada should have equal opportunity to participate in activities such as hunting and fishing; 4) Commercial Use, which prohibits a

commercial market for dead animal parts; 5) Legitimate Use, which dictates guidelines for appropriate use of the resource, such as killing for food, fur, self-defense, protection of property, and other legitimate reasons; 6) Science and Wildlife Policy, which dictates that science is used and credited as critical to comprehensive wildlife management; and 7) International Wildlife Migratory Resources, which recognizes that migratory wildlife and fish do not operate under state's boundaries, therefore, regulations on wildlife conservation must be realistic. The use of these principles dictates the successful management of our nation's most valuable resource.

To carry out the management charge granted by the Constitution, every state, territory, and the District of Columbia has an agency dedicated to manage wildlife resources within their borders. These agencies are predominantly governed by boards, commissions, or political appointees charged with policy decisions and agency oversight. In spite of limited funding, state agencies have garnered considerable expertise in response to the growing need to address at-risk and imperiled species and to carry out management and conservation responsibilities across the country.

Since 1937, sportsmen have been the driving force for conservation funding in the country. On average, 60 to 90% of state fish and wildlife agency budgets are derived by sportsmen, in addition to countless hours of volunteer time and dollars to national, regional, and local organizations dedicated to conservation. Conservation and management of game species and the habitats that support them is partially funded through excise taxes on hunting and fishing equipment collected under the federal authority of the Pittman-Robertson and Dingell-Johnson Acts, which have been a critical source of wildlife conservation in the United States for over 80 years. Additionally, sales of hunting and fishing licenses to the public significantly contribute to conservation efforts at the state level. In Wyoming, a 2017 decision of the Legislature removed the Wyoming Game and Fish Department from the state's general fund. Therefore, hunters and anglers fund the Department's work almost entirely.

History of the Wyoming Game and Fish Department

The Wyoming Legislature created the Office of State Game Warden in 1899, followed in 1921 by the creation of the Wyoming Game and Fish Commission. The Wyoming Game and Fish Department was created and placed under the direction and supervision of the Wyoming Game and Fish Commission, established under Wyo. Stat. Ann. § 23-1-401. The responsibilities of the Department are defined in Wyo. Stat. Ann. § 23-1-103. The Department is charged with providing..."an adequate and flexible system for the control, management, protection, and regulation of all Wyoming wildlife."

The Department manages over 800 wildlife species for the benefit of all citizens of Wyoming. The Department's core priority is to manage fish and wildlife using sound scientific principles while maintaining stakeholder satisfaction with the wide array of recreation activities and experiences Wyoming has to offer. Activities to achieve this priority include actively monitoring fish and wildlife populations; adjusting regulations to ensure sustained use; maintaining a dialogue with users, conservationists, and other government managers; conducting research; enforcing laws and regulations; assisting in habitat conservation and restoration efforts; maintaining public access to recreation; promoting hunter and boater safety; providing conservation information and education; building effective partnerships; maintaining sound

business management and accounting processes; and more. Fortunately, Wyoming and states across the country have a dedicated and talented staff of game wardens, biologists, managers, statisticians, technology experts, accounting specialists, clerical staff, administrators, and others to make this conservation charge possible and successful.

SUCCESSFUL STATE CONSERVATION, RECOVERY, AND MANAGEMENT OF WILDLIFE IN WYOMING

Sage-Grouse

Wyoming is proud of its leading role in the conservation and management of greater sage-grouse. There are 43 million acres of occupied sage-grouse range in Wyoming (70% of the state). 90% of historic range in Wyoming is still occupied; compared to 56% range wide. 26% of North America's occupied sage-grouse range is in Wyoming. 37% of the world's population of greater sage-grouse inhabit Wyoming.

Wyoming led the creation and refinement of what is now commonly known as the "core area strategy" aimed at ensuring long-term conservation of the species. This strategy focuses on identifying those habitats that are vital for sage-grouse viability and prescribing focused protections for those areas. The strategy serves to allow normal development on those lands outside of the core area. This mechanism became the model for sage-grouse conservation and was used by other states as a basis for their management plans. Ultimately, the implementation of this strategy culminated with a decision in 2015 by the USFWS not to list sage-grouse under the Endangered Species Act by issuing a finding of "not warranted" in response to the petition to list. Conservationists, sportsmen, energy developers and other interests were well served by this state-based and state-led approach.

In Wyoming and other western states, sage-grouse habitats are expansive and relatively intact outside of towns, rural subdivisions and developed natural gas and oil fields. Habitats for sage-grouse occur across mixed land ownership jurisdictions. Most sage-grouse leks (sage grouse breeding grounds) are found on Bureau of Land Management (BLM) lands. Nesting and early brood rearing habitats are also found predominantly on BLM lands, while many birds move to moist meadow habitat located on private or public/private interfaces during late brood rearing and/or during summer. These moist areas include irrigated hay meadows in stream valleys, desert seeps and springs, or mountain foothill meadows. Fall movements away from these moist areas to sagebrush-dominated uplands on BLM lands occur in late September/early October. As winter progresses, birds concentrate on sagebrush upland habitats, which are also located primarily on BLM lands. Because sage-grouse habitats change throughout the year, state managers must develop strong partnerships and work closely with private landowners, federal land management agencies, and state land managers.

As of the spring of 2018, there were 1,815 known occupied sage-grouse leks in Wyoming. Department personnel, together with personnel from other agencies, volunteers, and consultants, surveyed 88% of these leks at least once. The proportion of leks checked in the previous 10 years averaged 87%. In the spring of 2018, 1,169 leks were confirmed active, 303 confirmed

inactive, and 131 unknown or unchecked. The role of volunteers and a multi-agency, collaborative approach to sage-grouse data collection is significant.

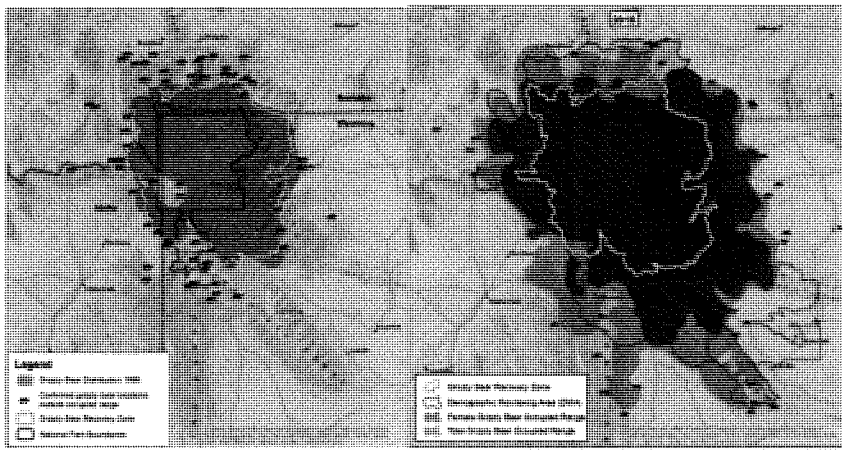
The Wyoming Greater Sage-grouse Conservation Plan (2003) established an objective of a minimum of 1,650 known occupied leks. Monitoring sage-grouse population trends requires knowledge of the location of all or most leks along with the average number of males attending the leks each year. While it is presumed the location of most leks is known, new leks are discovered each year. The numbers of inactive and unoccupied leks has increased due to continued habitat disturbance and fragmentation primarily associated with increasing human infrastructure (subdivisions, roads, power lines, gas wells, compressor stations, etc.) and the associated activity. These impacts continue to be documented and quantified by research in Wyoming and this research informs new decisions on best solutions to mitigate impacts.

The plan also established an objective of an average of 28 male sage-grouse/lek, not to fall below 10 males/lek during cyclical lows. The average number of male sage-grouse observed on leks also indicates population trend if the number of leks is stable. From 1999-2003, the number of known occupied leks increased due to increased monitoring effort. At the same time, the average number of males observed decreased, believed to be in large part due to drought, but also due to increasing disturbance and fragmentation. Monitoring and research suggests sage-grouse populations cycle, similar to rabbits where populations increase and decline regularly over time. While overall numbers vary over time, the trend is positive when comparing information from 1996 to present. The information and analysis that inform Sage-Grouse Management Plan development and implementation is possible because of state led wildlife management.

Collaboration and partnership between states is another benefit of our current model where sage-grouse management is handled by states. Wyoming Game and Fish Department personnel worked with the North Dakota Game and Fish Department, Utah State University researchers, and others to capture and translocate 60 sage-grouse from Wyoming to North Dakota in an effort to prevent extirpation of the North Dakota population. The effort will be repeated in 2018 and researchers will determine not only the success of the translocation, but the effects of translocation on the source population in Wyoming. This study is part of a larger collaborative effort involving translocation projects in Utah, California, and Nevada. As expected, translocated sage-grouse move long distances and suffer high mortality. However, successful reproduction has been documented. Additional translocations are scheduled for 2018.

Grizzly Bears

By many accounts, the biggest conservation success story in North America is the successful recovery of the grizzly bear in the Greater Yellowstone Ecosystem. In 1975, there were as few as 136 bears in this population. Using an ultra-conservative population estimate used by three states and the USFWS, there were over 700 bears in the ecosystem at the end of 2017. More accurate estimates put the population between 1000 and 1200. Today, grizzly bears have expanded to all suitable habitats and have saturated the core habitats in the ecosystem. Grizzly bears have started to occupy less than suitable habitats on the fringes of the ecosystem, further demonstrating their successful recovery.



Grizzly bear occupancy in 1990 Grizzly bear occupancy in 2016

The Wyoming Game and Fish Department has invested enormous fiscal and personnel resources to monitor and manage grizzly bears over a period of decades. Since 1980, the Wyoming Game and Fish Commission has invested over $50 million in grizzly bear recovery—more than any other single entity. Those funds have been used to monitoring the status of the population, conducting radio telemetry and observation flights, monitoring food sources, handling conflicts between humans and bears, enforcing laws and conducting an extensive public information campaign. In recent years, annual costs of the Department's grizzly bear program have approached and exceeded the $2 million mark. These funds are derived primarily from hunting and fishing license sales and federal excise taxes (Pittman-Robertson Act Funds). In 2005, the Department also began implementation of the Wyoming Bear Wise Community Program. Although efforts were focused primarily in the initial demonstration area, the Department also initiated a smaller scale project in the Jackson area to address the increased frequency of black and grizzly bear conflicts. For the past 10 years, the Wyoming Bear Wise Community programs in the Cody and Jackson areas have been effective at educating the public, minimizing human-grizzly bear conflicts, and promoting safe practices for those working, living and recreating in grizzly bear country. Although challenges remain and vary among communities, progress is expected to continue as the Wyoming Bear Wise Community Program effort reaches more people. In an effort to broaden the program, the Department branded this work as the "Bear Wise Wyoming Program" beginning in 2013. This rebranding was in response to increasing distribution of grizzly bears and the realization that interest in Wyoming's grizzly bears has broadened to statewide, national, and even international scales.

Soon after listing of the grizzly bear occurred under the ESA, a team of scientists and bear managers from Montana, Idaho, Wyoming, the USFWS, and the USGS (research arm of the USFWS) formed a team later identified as the Inter-agency Grizzly Bear Study Team (IGBST). This team used science to develop a recovery plan for the Yellowstone Grizzly Bear population

that was modified over time as the team conducted research and learned more about grizzly bear ecology. Today, the grizzly bear is one of the most studied animals in the world. The science developed by this group as well as other scientists was used to finalize the recovery criteria that are in effect today. These include:

- At least 500 individual grizzly bears to ensure genetic diversity
- Reproducing females across the entire ecosystem (at least 16 of 18 bear management units occupied by reproducing females)
- Mortality limits below established limits by age and gender class and at least 600 individual grizzly bears in the demographic monitoring area (DMA)

These recovery criteria have been met or exceeded for over 15 years. Despite the phenomenal success with the bear population, it remains under federal management under the ESA. In 2007, the USFWS delisted grizzly bears in the Greater Yellowstone Ecosystem. A federal judge reinstated protections in 2009 after finding that the USFWS did not adequately consider the impacts of the decline of whitebark pine nuts– a grizzly bear food source. In 2013, the IGBST determined that the reduction in whitebark pine nuts did not significantly affect grizzly bears and again recommended delisting. In 2017, the USFWS published a rule delisting grizzly bears in the Greater Yellowstone Ecosystem. States gave additional assurances regarding long-term viability. Wyoming, Idaho and Montana adopted Grizzly Bear Management Plans and entered into a memorandum of agreement regarding the allocation of discretionary mortality. Wyoming also conducted significant public outreach regarding public desires for state-led management. In May of 2018, the Wyoming Game and Fish Commission and the Idaho Fish and Game Commission approved conservative and tightly regulated hunting seasons to begin in the fall of 2018.

Since the early 20th century, regulated hunting has played an instrumental role in the recovery and health of wildlife populations. Regulated hunting is not only a pragmatic and cost effective tool for managing populations at desired levels, it also generates public support, ownership of the resource, and funding for conservation as well as greater tolerance for some species such as large predators that may cause safety concerns and come in conflict with certain human uses. Hunting has been used in Montana, Idaho and Wyoming, as well as many other states, to effectively manage other large carnivores like gray wolves, black bears and mountain lions. Today, populations of these large carnivores are thriving by all scientific and qualitative measures.

On September 24, 2018, a Federal District Court Judge in Montana vacated the 2017 rule promulgated by the USFWS that ended ESA protections for grizzly bears in the Greater Yellowstone Ecosystem. Effective immediately grizzly bears are again listed as threatened under the ESA. Accordingly, the grizzly bear hunting season in Wyoming authorized for this fall is not able to go forward. The court listed the grounds for reversal of the delisting decision as follows:

I. The Service did not fulfill its duties under the ESA because it failed to analyze the threat posed by the Final Rules outside of the Greater Yellowstone ecosystem.

...

A. In the Final Rule, the Service designated the Greater Yellowstone grizzly as a distinct population segment consistent with its long-standing policy.

...

B. The Service violated the ESA under the standards set forth in the APA by delisting to the Greater Yellowstone segment without analyzing the impact of delisting on other continental grizzly populations.

...

II. The Service's failure to require a recalibration provision in the Conservation Strategy is arbitrary and capricious.

...

A. The Service did not act arbitrarily and capriciously in relying on the states' commitment to manage mortality.

...

B. The Service acted arbitrarily and capriciously by determining that the final Conservation Strategy need not provide for a recalibration mechanism.

...

III. The Service's determination that it need not provide for either natural connectivity or translocation is contrary to the best available science.

Crow Indian Tribe et al v. United States of America et al., CV 17-89-M-DLC (D. Mont. Sep. 24, 2018).

Wyoming citizens are extremely frustrated by this decision and the resulting transfer of management authority back to the federal government. This decision is proof positive that the Endangered Species Act is in need of reform.

Black-Footed Ferrets

For over three decades, the Wyoming Game and Fish Department has worked in collaboration with the U.S. Fish and Wildlife Service, state and federal agencies, and private landowners to ensure that populations of black-footed ferrets continue to succeed in the wild, both in Wyoming and throughout the historical distribution of the species. The Department and the State of Wyoming remain committed to the recovery and conservation of the ferret, and efforts continue today within the state toward the ultimate goal of recovering this native species.

The ferret was first listed as endangered under the Endangered Species Preservation Act in 1967, and recovery of the species is under the jurisdiction of the USFWS in collaboration with the 12 western and midwestern states within the historical distribution of the species (Arizona, Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming).

The recovery and conservation of the black-footed ferret shares a unique history with Wyoming, as the state represents the home of both the rediscovery of the species, thought to be extinct as recently as 1981, and the first and longest surviving reintroduction site.

In 1981, a fortuitous event occurred that irrefutably saved the ferret from extinction and initiated one of the most successful wildlife conservation stories in history. On September 26, 1981, a rancher's cattle dog brought the carcass of a weasel-like animal to the doorstep. A local taxidermist identified the species as a ferret, and soon thereafter biologists discovered a population of ferrets in the surrounding area. On the Lazy BV Ranch, 20 miles west of Meeteetse, Wyoming, the family of John and Lucille Hogg soon learned that their lands supported the last remaining population of ferrets in the world. This discovery forever linked the conservation and recovery of this rare species to Wyoming. As word of this remarkable find spread, biologists from multiple wildlife agencies and organizations convened in Meeteetse to study the newly discovered population. Efforts were led primarily by the Department and the USFWS. In 1982, population estimates suggested that at least 61 ferrets were distributed on the Lazy BV and neighboring ranches, including the Pitchfork and 91 Ranches. By 1984, the population reached 129 individuals. In May 1985, the Department and the USFWS decided to capture a subset of the population to place into a captive breeding program to propagate the species. Six individuals were captured and placed into captivity at that time.

Before the first ferrets were released in 1991, the Department and the USFWS established what is known as a "10(j) rule" throughout the proposed Shirley Basin Reintroduction Area. This rule — a designation under the Endangered Species Act — allows a listed species to be considered a nonessential experimental population within a specific area. This special designation removes the penalties associated with accidental take such as harming or killing of ferrets while conducting an otherwise legal activity. The assurances of the 10(j) rule were critical to the ferret reintroduction effort; they not only helped pave the way for landowners to voluntarily accept an endangered species onto their property, but they also allowed landowners to play a leading role in species recovery efforts without fear of violating the ESA or disrupting their ranching operations. Because of the need to establish more reintroduction sites throughout North America, the Department started to consider additional release sites in the state. Given the assurances granted to private landowners by the 10(j) rule, Wyoming proactively asked USFWS to expand the 10(j) designation to the entire state. The Department and other state and federal agencies engaged interested stakeholders in developing a public outreach strategy to establish support for the expanded designation. As we hoped, many landowners came forward and asked to have ferret populations established on their land, including the Lazy BV and Pitchfork Ranches. When the USFWS approved the expansion of the rule in late 2015, the path opened up to releasing the previously extinct ferrets on the lands where they were rediscovered.

Following the reintroduction in July 2016, the Department returned to Meeteetse that fall to conduct post-release monitoring. To determine how many ferrets survived their first months in the wild, we followed the same protocol—multiple sets of three consecutive nights of spotlight surveys—that had been used for over two decades to monitor ferrets at the Shirley Basin Reintroduction Area and other reintroduction sites across the West. In total, the monitoring team, consisting of state and federal agency personnel and volunteers, conducted 224 survey hours over 8,600 acres of prairie dog colonies, including areas outside of the originally mapped

reintroduction area. Out of the 35 ferrets released, we located 19 (54%). All the released animals had embedded microchips (for radio telemetry work), and we were able to determine that they moved 1.5 kilometers on average and a maximum 5 kilometers. Given these rather large distances and the fact that spotlight surveys inherently do not detect 100% of a population, we are confident that more ferrets likely survived on the Meeteetse landscape than were documented. In fact, these results are quite remarkable and suggest that the Meeteetse ferrets are off to a strong start and on their way to becoming an established population. The post-release survival rates of this group are among the highest reported for all reintroduction sites, which are typically less than 50%.

As of 2017, two populations of ferrets have been re-established in Wyoming: the Shirley Basin/Medicine Bow Reintroduction Site and the Meeteetse Reintroduction Site. Both of these populations contribute toward the recommendations and state-specific population targets for Wyoming set forth by the USFWS in the 2013 Recovery Plan. In addition, site-specific management plans have been created outlining the Department's strategies and goals specific to each reintroduction site.

By all accounts, black-footed ferret conservation efforts have been a resounding success. From 18 ferrets, representing eight genetic founders, approximately 300 individuals now live in the wild, with breeding facilities across the United States providing 150 to 220 more kits annually for reintroduction efforts. However, there is still work to be done. With continued landowner support and participation, the Department plans to release captive-bred ferrets in the Meeteetse area to supplement the established wild-born population. Monitoring efforts will also continue for both ferrets and the prairie dog populations on which they rely. While not surprising, recent confirmation that prairie dogs in the Meeteetse area are challenged with sylvatic plague means that additional disease management strategies will be needed, including dusting the area with insecticide, deploying newly emerging vaccine treatments, or both. In fact, sylvatic plague and a lack of suitable reintroduction sites remain the biggest hurdles to ferret recovery nationwide. With the collaborative framework among state and federal agencies and private landowners and a statewide 10(j) regulation in place in Wyoming, the Department is well prepared to tackle these challenges. Numerous partners have helped provide funding and personnel for continued plague control efforts at Meeteetse, and the multi-agency Wyoming Black-Footed Ferret Working Group is currently developing a statewide management plan for ferrets that will provide recovery objectives, management strategies, and a framework to evaluate additional reintroduction sites in the state. Certainly, black-footed ferrets in Meeteetse have had a long road to recovery. Although the work is far from done, it is reassuring to know that ferrets have finally returned to their last known native home and are fulfilling the role on the landscape that has been vacant for the last 30 years.

Northern Rocky Mountain Gray Wolf

The Endangered Species Act was signed into law in 1973 and the Northern Rocky Mountain gray wolf subspecies was immediately added to the list as an endangered species. In 1978, the USFWS listed all wolves in the lower 48 states under the ESA. Recovery planning in the northern Rocky Mountains began as early as the mid-1970s and by the 1980s several drafts of recovery plans were circulated for public comment. In the early 1990s, an Environmental Impact Statement was prepared for gray wolf releases in Yellowstone National Park and central Idaho.

Gray wolves were reintroduced in Wyoming in 1995 and 1996 in Yellowstone National Park. The Gray Wolf Recovery Plan identified clear and measurable recovery criteria that called for 30 breeding pairs and 300 wolves between the three states of Idaho, Montana, and Wyoming (with 10 breeding pairs and 100 wolves in each state) and genetic interchange between the sub-populations in all three states. Those criteria were met in 2002 and in 2003. The USFWS began to prepare for delisting by issuing a notice of intent to delist. This was followed by years of litigation and disagreements between the states and the USFWS with challenges over state management plans and the establishment of Distinct Population Segments (DPS). Following a 2008 court decision that dismissed a challenge to Wyoming's Wolf Management Plan, the USFWS determined gray wolves no longer needed the protections of the ESA and delisted the Northern Rocky Mountain population.

Environmental litigants immediately challenged the delisting rule and were successful in convincing a district court judge to enjoin the rule, effectively stopping state management. The court ruled that the USFWS failed to show evidence of genetic interchange and that it relied on Wyoming's flawed wolf management plan. The court concluded that Wyoming's wolf plan failed to commit to managing for at least 15 breeding pairs, despite the fact that the recovery plan required only 10. Additionally, the court found Wyoming's plan to manage wolves with dual legal status to be problematic.

In 2009, the USFWS published a new rule establishing the Northern Rocky Mountain DPS and delisting that DPS with the exception of Wyoming. The USFWS stated that Wyoming's plan was not sufficient to ensure a recovered population. In 2010, a federal judge vacated the 2009 rule on the basis that the USFWS could not delist only a portion of a DPS. The court also disagreed with the USFWS assertion that Wyoming's dual status plan was insufficient.

In 2011, Congress intervened by initiating the USFWS 2009 delisting rule which reinstated state management of wolves in Montana and Idaho. This was challenged by environmental litigants, but held as constitutional by the courts. Wyoming entered into discussions with the USFWS which culminated in an agreed upon path forward for delisting in Wyoming. The agreement established 10 breeding pairs and 100 wolves as the minimum threshold Wyoming would manage for outside of Yellowstone National Park and the Wind River Reservation. The state also agreed to provide a "flex" zone where management would encourage wolf movement to other sub-populations to help facilitate genetic interchange. Wyoming agreed to manage for a buffer above this threshold through an addendum to their wolf management plan. In September of 2012, the USFWS issued a final delisting rule and Wyoming took over management of its wolf population for the second time. At this time, the wolf population in Wyoming includes at least 328 wolves with 27 breeding pairs.

All three states manage wolves well above the minimum recovery criteria. The state fish and wildlife agencies conduct biological monitoring to track population trends, assess genetic interchange and ensure that the populations remain far above minimum recovery levels. Additionally, all three states initiated well-regulated hunting and manage wolves that cause damage to private property. Following 2 years of state management in Wyoming, the wolf population continued to thrive and remain far above recovery criteria. At the end of 2013, Wyoming's population included at least 306 wolves in 43 packs with 23 documented breeding

pairs. Wolves were legally harvested in areas defined by both legal statuses and populations continued to thrive.

In 2012, following delisting in Wyoming, environmental litigants filed suit again challenging the USFWS decision. On September 23, 2014 (seven days prior to the opening of the annual hunting season), a Washington D.C. Federal District Court Judge vacated the USFWS rule delisting wolves in Wyoming. The court found no fault in the Wyoming's dual status management scheme or their genetic connectivity analysis. The court concluded the population was recovered, but that Wyoming's "nonbinding and unenforceable representations" to manage for a population above 100 wolves and 10 breeding pairs was not adequate. This conclusion by the court regarding the enforceability of a commitment to manage above recovery criteria was the basis of the court's decision to vacate.

The USFWS appealed this decision to the Washington, D.C. Circuit in 2015. In March of 2017, the appellant court overturned the District Court decision, which effectively returned state management to the state of Wyoming. The Wyoming Game and Fish Department has now reinitiated wolf management activities for the third time and the Wyoming Game and Fish Commission continues to consider new regulations.

Wyoming has contributed in spades to the recovery of this species and has managed gray wolves using sound scientific principles at those times when the state had authority to do so. The state has made significant commitments to maintaining a healthy, viable, and sustainable population of gray wolves into the future, both through its actions and the adoption of effective and responsible regulatory mechanisms. Wyoming citizens have been extremely patient while the USFWS and the courts have wrestled with the status of a recovered population of wildlife within Wyoming's borders for over 15 years. Their patience is waning quickly and the citizens of the state are ready for predictability and commitments that ensure state management into the future.

The state has demonstrated skill and competence in managing gray wolves in an adaptive manner over the two years the state has had management authority. During the period of October of 2012 to September 2014, Wyoming's wolf population thrived and remained far above recovery criteria. In fact, wolf populations and the number of breeding pairs occupying suitable habitats remained over 70% above the minimum requirements of the ESA recovery plan criteria of 100 wolves and 10 breeding pairs. Management included biological monitoring, regulated hunting, and livestock damage control actions.

Wyoming citizens invested in wolf recovery then and now by compensating livestock producers who experienced significant losses to wolf depredation. This compensation program existed while wolves were listed and will continue into the foreseeable future. In 2017, Wyoming livestock producers were compensated $390,000 (increase of $80,000 from previous year) for cattle and sheep losses attributed to wolves. In 2018, livestock producers have been compensated $399,271. Wyoming is home to a diversity of wildlife species including many that cause damage to private property such as elk, mule deer, Canada geese, mountain lions, black bears, grizzly bears and antelope. Gray wolves caused 37% of all damage compensation in the state in 2017. Gray wolves have caused 34% of all damage in 2018.

During periods of time when the state had management authority, a primary management goal was directed at reducing human conflicts and the number wolves that were required to be removed through agency action. During the two years when Wyoming managed the population, there was an average of 35 wolves removed by the agency consequential to livestock damage. Last year federal managers removed at least 113 wolves through control actions in response to livestock depredation.

At the end of 2017, the gray wolf population in Wyoming remained above minimum delisting criteria; making 2017 the 16th consecutive year Wyoming has exceeded the numerical, distributional, and temporal delisting criteria established by the USFWS. At least 347 wolves in ≥53 packs (including ≥23 breeding pairs) inhabited Wyoming on December 31, 2017. Of the total, there were ≥97 wolves and ≥11 packs (including ≥3 breeding pairs) in Yellowstone National Park, ≥12 wolves and ≥2 packs (≥1 breeding pair) in the Wind River Reservation, and ≥238 wolves and ≥40 packs (including ≥19 breeding pairs) in Wyoming outside Yellowstone National Park and the Wind River Reservation.

Due to successful recovery and delisting, new opportunity arose in Wyoming to hunt wolves. In 2017, the Department instituted a wolf hunting season with the biological objective to reduce the wolf population by approximately 24% in the Wolf Trophy Game Management Area. A mortality quota of 44 wolves was divided between 12 hunt areas in Wyoming. A total of 43 wolves were legally harvested during the hunting season.

Wolves were confirmed to have killed 194 head of livestock (113 cattle and 81 sheep) and one dog statewide in Wyoming in 2017. An additional five cattle were injured by wolves but survived. Of the 29 packs involved in at least 1 depredation statewide, 21 packs were involved in at least 2 depredations and 19 packs were involved in at least 3 depredations. Control efforts lethally removed 62 depredating wolves statewide in an effort to reduce livestock losses due to wolves. A combined minimum of $528,328 was spent on wolf damage management in Wyoming by Wildlife Services ($216,714) and livestock depredation compensation by the State of Wyoming ($311,614) in 2017. The State continues to work with livestock owners to prevent damage and compensate for losses by wolves.

Invasive Species

Aquatic Invasive Species (AIS)

The Wyoming AIS program is funded through Game and Fish license sales and from monies generated from the sale of the mandatory AIS decal required of all watercraft before launch. Decal revenues are used to offset the amount of money from license fees. The total AIS program budget for fiscal year 2018 was $1.3 million. In 2017, 45,070 decals were sold resulting in receipt of $707,650. Of the resident motorized decals sold, 7,431 ($222,930) were three-year decals. Sales of resident and nonresident, nonmotorized decals increased from 2016. From 2016 to 2017, the number of decals sold increased by 1,792, resulting in an increase in sales of $41,170. Personnel in 2018 include one permanent coordinator, five 12-month contract Regional AIS Specialists, three 9-month contract Regional AIS Specialists, and 45 seasonal technicians (38 funded through the state's general fund; three funded by the Forest Service funded; and four funded by the USFWS).

In 2017, watercraft check stations were operated from April 29 through September 17 at fourteen permanent check stations at port of entries, rest areas, and other border locations to intercept watercraft entering the state. Roving crews also conducted inspections at waters on a rotating basis. 46,164 watercraft inspections were conducted over 212 days, resulting in 28,438 individual boaters being contacted at all check stations. 3,659 high-risk inspections were conducted and 706 watercraft required decontamination. The majority of decontaminations (75%) were performed on watercraft with standing water in the motor. Nine watercraft were intercepted with suspected zebra or quagga mussels attached and were completely decontaminated; on all watercraft the suspect AIS were determined to be dead and not viable. Suspect mussel infested watercraft originated from Lake Michigan, WI (2 watercraft); Lake Winnebago, WI (1); Lake St. Clair, MI (1); Lake Minnetonka, MN (1); Lake Powell, UT (1); Milford Lake, KS (1); and unnamed positive waters in Illinois (1) and Wisconsin (1).

No zebra or quagga mussels were detected by plankton tow monitoring or shoreline surveys in 2017. Current AIS populations in Wyoming include New Zealand mudsnails, Asian clam, rusty crayfish, and curly pondweed. New populations of Asian clam were found in Keyhole Reservoir in 2017.

Annual sampling of existing populations of invasive species in Wyoming is conducted to monitor known populations and determine whether populations have spread. Asian clams were first detected in the Laramie River in 2011. Asian clams were found at Tunnel Road, Monolith and Jelm access points to the river. In 2013, surveys found the highest concentration of Asian clam at Monolith, as far away from the access as one-half mile upstream. Additionally, Asian clams were observed at the Tunnel Road Bridge. Asian clams were also detected in the main stem of the North Platte River in 2013, downstream from Guernsey Reservoir. Asian clam shells were found near Optimist Park access point, however, no live clams were found there and the shells were sparsely distributed. In 2017, Asian clam were found in Keyhole Reservoir and Guernsey Reservoir just upstream of the dam. Brook stickleback are currently widespread throughout Wyoming's warmer water streams.

Curly Pondweed was first found in Wyoming in 2011 in Lake DeSmet. It was subsequently found in additional waters including Keyhole and Boysen Reservoirs. Curly pondweed was also detected in the North Platte River between Kortez Reservoir and Pathfinder Reservoir, a section of river called the Miracle Mile, and at New Fork Lake at the constriction between upper and lower New Fork Lake. Curly pondweed was detected in the Shoshone River for the first time in 2014. New Zealand mudsnails were first found in the Snake River in 1999. This population persists, and populations have since been found in Polecat Creek, Bighorn River, Shoshone River, and Lake Cameahwait. Rusty crayfish were first found in Wagonhound Creek, a North Platte River tributary, in 2006. Several eradication efforts have been conducted since that time. The North Platte River was sampled for crayfish above and below the confluence with Wagonhound Creek in 2014 and no crayfish were detected. Sampling in 2016 near the North Platte River confluence did not find any evidence of rusty crayfish.

Cheatgrass

Cheatgrass has become more prevalent throughout the arid West, and nearly all of Wyoming's diverse habitat types have been impacted to some degree, excluding some high elevation habitats

(alpine, sub-alpine). The invasion by this annual grass has far-reaching impacts for management of wildlife habitat, agricultural lands, and the wildland/urban interface. Forage quality and quantity is negatively impacted (nutritional content, nesting, hiding and fawning/calving cover), and potential wildfire frequencies are increased. Animal performance can be negatively impacted due to injury (eyes, mouth, nose, ears, and feet) caused by seed awns as well. The presence of cheatgrass ties the hands of habitat managers, as it can severely restrict tools available for habitat improvement, most importantly prescribed or managed wildfire which have historically been one of the most cost-effective methods to rejuvenate mixed mountain shrub communities, and create mixed age classes of timber and shrubs that fulfill nutritional and cover requirements of big game species. Managing cheatgrass has proven to be a costly endeavor. Collectively, managers of rangelands and croplands have tried numerous methods to date, with very mixed results. Ruggedness of terrain and remoteness of infested sites further complicates implementation, increases expenses, and can limit control techniques that may be implemented. In many cases, a single treatment does not appear to be sufficient to provide long-term control of cheatgrass.

Wildlife Habitat Management

Strategic Habitat Plan

Habitat management remains a high priority for the Wyoming Game and Fish Department. The Strategic Habitat Plan (SHP), which was first approved by the Wyoming Game and Fish Commission in 2001, is testimony to the importance of habitat management. The SHP defines how the Department will strive to meet its mission of Conserving Wildlife and Serving People by working together with external partners to conserve and improve habitats. The SHP is updated in five year increments and has remained the cornerstone of habitat management in the state. In 2017, our SHP helped direct restoration, monitoring, and enhancement activities in Wyoming aimed at improving 124 stream miles and over 700,000 acres of terrestrial habitats including planting nearly 37,000 native trees and shrubs.

Aquatic Habitat Program

The Aquatic Habitat Program works to protect, restore and enhance Wyoming's water, watersheds, and waterways. During 2017, the aquatic habitat section was involved in 37 projects involving funding from the Game and Fish Trust Fund, the Department's fish passage budget, the Wyoming Wildlife Natural Resource Trust (WWNRT), USFWS, Wyoming Landscape Conservation Initiative, and other sources. These partners provided over $1.27 million toward aquatic habitat projects. Department aquatic habitat dollars spent on contracts or grants in 2017 totaled over $510,000. The number of on-going aquatic habitat projects involving significant funding (37) has been similar the last five years with project numbers ranging from 37 to 42. This level of project management and engagement likely represents a maximum effective level given the number of full-time permanent aquatic habitat biologists engaged in project management.

Terrestrial Habitat

During 2017, Terrestrial Habitat Program was heavily involved with on-the-ground implementation and oversight of 52 projects using Department trust funds and funds granted to

the Department from sources such as the WWNRT, various conservation organizations, local, county, state and federal agencies, conservation districts, weed and pest districts, private landowners, and others. These sources provided approximately $2,687,400 for implementation of on-the-ground terrestrial habitat projects.

In 2017, Terrestrial Habitat personnel continued to refine and implement a new inventory and assessment methodology for the Department. "Rapid Habitat Assessments" are a landscape level assessment that will be used to help inform mule deer objective reviews as well as provide baseline data for habitat conditions statewide.

Wyoming Landscape Conservation Initiative

The Wyoming Landscape Conservation Initiative (WLCI) is a long-term, science-based effort to assess and enhance aquatic and terrestrial habitats at a landscape scale in southwest Wyoming, while facilitating responsible development through local collaboration and partnerships.

The WLCI had a successful year working with partners. The WLCI found itself operating on a reduced budget; however, the initiative was able to fund many projects through unobligated funds from other BLM sources. In 2017, WLCI allocated $623,000 to 23 projects and estimated WLCI partner contributions were about $5,250,000. In other words, for every dollar WLCI contributed, project proponents had $8.42 in matching funds. These projects and associated activities were accomplished through numerous coordination meetings, field trips, and work sessions. WLCI members met with NGOs, permittees, private landowners, other agencies, and other entities to coordinate WLCI activities. The 23 projects encompassed all but one of WLCI's focus communities: aspen, mountain shrub, riparian and sagebrush. Eight projects addressed control of invasive species. Six projects involved erecting wildlife friendly fencing to reduce barriers along pronghorn and mule deer migration corridors or involved steel jack fence to protect riparian vegetation. Three projects in riparian communities included stream enhancements, riparian tree and shrub plantings, and improving fish passage by replacing a push-up diversion and installing a new irrigation diversion structure. Three other projects enhanced the sagebrush ecosystem through juniper removal. WLCI funded two projects within aspen communities. Both projects removed conifers through mechanical means. This was the final year for the Sibert Ecosystem Services Project, which was a "pay for performance" type project. The landowner reduced stocking rates, left portions of hay meadows uncut, planted riparian vegetation, and applied herbicide to improve habitat primarily for mule deer and sage-grouse.

The Mule Deer Initiative

Following several decades of declining statewide mule deer numbers, the Department in 2007 implemented the Wyoming Mule Deer Initiative (MDI) in two key deer herds. The MDI focuses on collaborative public involvement processes to develop local management plans to address site-specific population and habitat issues. Based on the success of the initial public outreach efforts, the Department expanded the MDI to eight additional priority deer herds in 2015 across Wyoming. Increased resources and focus have been invested by the Department, Commission and the public to develop future management recommendations for these high priority deer herds. Public participation efforts have ranged from local working groups to strategically place-based collaborative workshops.

In July 2015, the Commission unanimously voted to make a significant investment in projects intended to benefit local mule deer populations. Regional working groups were formed to develop projects that enhance mule deer populations and the habitat that support them. The Commission approved funding of up to $2.5 million dollars over a five-year period to support projects derived from this effort. The intent of this investment is to serve as seed money for local mule deer projects identified through the MDI process.

In 2016 and 2017, seventeen projects were approved, targeting over 29,000 acres for on-the-ground mule deer habitat projects. The Commission investment of nearly $1 million to date was matched with approximately $7.6 million from project partners. Matching project dollars ranged from 5 to 8 dollars for every dollar invested by the Commission. Projects have ranged from cheatgrass and juniper control, aspen rejuvenation and sagebrush thinning treatments to mule deer collaring studies evaluating migration corridors and habitat use.

Ungulate Migration Corridor Strategy

The advancement in Global Positioning System (GPS) technology has enabled the Department to utilize radio-telemetry data collected from collared big game to more precisely document animal movements across the landscape. Over the past several years, the Department has utilized GPS technology to aid in quantifying length and width of big game movement corridors as well as identify important habitats within these corridors. Following GPS data analysis and designation of migration corridors, wildlife managers develop migration corridor assessments to evaluate risks, existing land use prescriptions, appropriate management actions and additional data needs. The overarching goal of the assessments is to collaboratively engage with stakeholders to ensure activities planned in and around designated corridors occur in a manner that maintain habitat function and result in no significant declines in animal distribution or abundance.

The first corridor designation and associated assessment was completed in 2017 for the Sublette mule deer herd in western Wyoming. This corridor is the longest ungulate migration (+150 miles) ever recorded in the lower 48 states. Numerous other big game GPS radio-telemetry studies are underway or recently completed and further migration corridor designations and assessments will be forthcoming throughout Wyoming to aid the Department in proactive management actions for big game populations in the state.

The Future of Wildlife Management

The North American Model of Wildlife Conservation has facilitated the form, function, and successes of wildlife conservation and management in Wyoming. Wildlife management decisions are best made by those who live, work, and recreate closest to the resource. These decisions are best implemented by state wildlife managers who spend lifetimes studying wildlife and building relationships with the citizens who own those wildlife resources. While there are significant challenges to managing certain species and habitats, state wildlife management agencies are the best to address those challenges, just as Wyoming has done with the Greater Sage-Grouse (and their habitats), Black-footed Ferrets, Grizzly Bears and Gray Wolves. It is also worth noting the dozens of wildlife that faced challenges nearly 100 years ago that were brought back to strong populations thanks to citizen conservationists, thoughtful political leaders,

and the state wildlife management agencies. These species include mule deer, moose, elk, pronghorn antelope, and many more.

The 50 state wildlife agencies own, manage, or administer wildlife conservation on more than 464 million acres of land and 167 million acres of lakes, reservoirs, wetlands, and riparian areas. State wildlife agencies employ nearly 50,000 employees and leverage the efforts of 190,000 volunteers. Collectively, state agencies have 11,000 degreed wildlife biologists, 10,100 law enforcement officers, and nearly 6,000 employees with advanced degrees. Annually, state wildlife agencies contribute more than $5.6 billion to conservation through their collective annual budgets. The contribution of the 50 state fish and wildlife agencies is enormous and integral to wildlife conservation in North America.

State fish and wildlife agencies have a long history of success in restoring many species, both game and non-game. It has long been recognized that the traditional focus of state fish and wildlife agencies has been on the conservation of game species, and that more attention and funding should be directed towards the conservation of non-game species. This need has been the impetus for the development of "State Wildlife Action Plans" (SWAPs) and the State Wildlife Grants (SWG) program. The SWAPs are comprehensive strategies designed to maintain the health and diversity of wildlife within a state including preventing the need for the listing of new species under the Endangered Species Act. Wyoming's first SWAP was completed in 2005. This plan was revised and approved by the Wyoming Game and Fish Commission in January 2010 and later approved by the USFWS in July 2011. Developing a SWAP is required in order to receive funding through the federal SWG program. The intent of the SWAP is to not only direct the Wyoming Game and Fish Department's activities, but also to serve as a guide for the combined efforts of government agencies, conservation organizations, academia, tribes, and individuals in conserving Wyoming's Species of Greatest Conservation Need (SGCN). The 2017 SGCN list identifies 229 SGCN. This includes 80 birds, 51 mammals, 28 fish, 9 amphibians, 24 reptiles, 8 crustaceans, and 29 mollusks. In the 2010 SWAP, 180 species received the SGCN designation. The 2010 SWAP list included 56 birds, 46 mammals, 30 fish, 8 amphibians, 21 reptiles, 5 crustaceans, and 14 mollusks.

The SWAPs are comprehensive strategies designed to maintain the health and diversity of sensitive wildlife. This work is critical to recover listed species and to prevent the need for the listing of new species under the Endangered Species Act. While the Endangered Species Act has contributed to the recovery and prevention from extinction for many species, it has become a major disincentive for many state-led efforts. Many re-listing decisions are made by judges and not based on science and whether or not a species has been recovered, but rather on technicalities in federal rule making. Until states are given some type of grace period to prove their capability to maintain recovery of delisted species without fear of an immediate re-listing by a federal judge, the incentive for states to invest in recovery will likely decline. Citizen support for the ESA is declining and many are frustrated by a process that appears to need overhauling.

To continue their important contribution to conservation, state agencies will need to shore up the logistical and financial underpinnings of the state conservation model. The need for new and broader funding is reflected in both recent recommendations made by the Association of Fish and Wildlife Agencies' Blue Ribbon Panel on Sustaining America's Diverse Fish and Wildlife Resources. The first recommendation is to secure an additional $1.3 billion for the Wildlife

Conservation Restoration Program with existing revenue from the development of energy and mineral resources on federal lands. The second is to establish a forum that would examine the impact of societal changes on the relevance of fish and wildlife conservation and make recommendations on how to transform agencies to engage and serve broader constituencies. The first recommendation broadens participation in wildlife conservation funding. The second aims to attract a broader audience outside of our traditional customers.

States could use these funds to effectively implement their State Wildlife Action Plans (focus on species of greatest conservation need). States could also use these funds on wildlife conservation education and to help recover federally listed species under the Endangered Species Act. States could use these funds to manage, control and prevent invasive species and nuisance species as well as other threats to state species of greatest conservation need. Clearly, this additional funding would allow state wildlife agencies to do the proactive, incentive-based wildlife conservation work that we have a proven track record of success in doing.

Thank you for the opportunity to testify today and to share Wyoming's work to conserve, recover, and manage wildlife and to serve people. I am happy to answer any questions.

Senate Committee on Environment and Public Works
Hearing entitled, *"From Yellowstone's Grizzly Bear to the Chesapeake's Delmarva Fox Squirrel -- Successful State Conservation, Recovery, and Management of Wildlife"*
October 10, 2018

Questions for the Record for John Kennedy

Chairman Barrasso:

1. Deputy Director Kennedy, on September 24th, a U.S. district court judge in Montana vacated the Final Rule delisting the grizzly bear in the Greater Yellowstone Ecosystem. As I mentioned in my opening statement, the U.S. Fish and Wildlife Service delisted the grizzly bear in June 2017, noting at that time that Wyoming and other pertinent states had already adopted necessary measures to ensure that the population remains recovered. What is your opinion of the Service's 2017 assessment?

   The U.S. Fish and Wildlife Service's assessment was accurate and justified biologically. The states of Montana, Idaho and Wyoming worked extensively with the Service over a period of 6 years to identify regulatory mechanisms that were more than sufficient to ensure the long term recovered status of the GYE grizzly bear population. In fact, those measures were overly conservative and went far beyond the standards that have been established for other sensitive species. All regulatory mechanisms were backed by layers of second and third stop gaps to ensure that if one measure failed, there were others that would compensate and fill the gap.

2. Deputy Director Kennedy, the Association of Fish and Wildlife Agencies, or "AFWA", released a report in 2017 that detailed the results of a 50-state survey assessing their collective contributions to conservation. Aptly titled "The State Conservation Machine", the report concluded - "the contribution of the 50 state fish and wildlife agencies is enormous and integral to wildlife conservation in North America." Can you provide specific examples of the Wyoming Game and Fish Department having success conserving, recovering, or managing wildlife?

   The Wyoming Game and Fish Department manages approximately 800 wildlife species in Wyoming. The Department's core priority is to manage wildlife using sound scientific principles while maintaining stakeholder satisfaction with the wide array of recreation activities and experiences Wyoming has to offer. In addition to wildlife management on federal lands (about 50% of the state), the Department manages nearly 500,000 acres of land and 48,000 acres of lakes in Wyoming that provide crucial wildlife habitat and public access for hunting, fishing, and other wildlife-related recreational activities. Based on recent, extensive public survey work, the agency's stakeholders are very satisfied with the Department's work to conserve, recover, and manage wildlife. Among residents, 95% rated the agency credible, with 79% rating it very credible. Hunters, anglers, and wildlife viewers gave similarly high ratings of credibility.

Satisfaction is high with the agency: 90% of residents are satisfied, including 62% who are very satisfied. These survey results are testimony that the Department is having success conserving, recovering, and management wildlife in Wyoming.

Specific examples of successful conservation, recovery, and management in Wyoming include the recovery of several sensitive species, including the bald eagle, peregrine falcon, Canada lynx, black-footed ferret, grizzly bear, gray wolf, and sage-grouse.

Wyoming is proud of its leading role in the conservation and management of the greater sage-grouse. There are 43 million acres of occupied sage-grouse range in Wyoming (70% of the state). Approximately 90% of the historic range in Wyoming is still occupied; compared to 56% range wide. About 26% of North America's occupied sage-grouse range is in Wyoming. About 37% of the world's populations of great sage-grouse inhabit Wyoming.

By many accounts, the biggest conservation success story in Wyoming is the successful recovery of the grizzly bear. In 1975, there were as few as 136 bears in the Greater Yellowstone Ecosystem; there were over 700 bears in the ecosystem at the end of 2017. Today, grizzly bears have expanded to all suitable habitats and have saturated the core habitats in the ecosystem. Grizzly bears have started to occupy less than suitable habitats on the fringes of the ecosystem, further demonstrating their successful recovery.

Black-footed ferret conservation efforts have been a resounding success; from 18 ferrets in the early 1980s to approximately 300 in the wild today. As of 2017, two populations of ferrets have been re-established in Wyoming. Both of these populations contribute toward the state-specific population targets for Wyoming in accordance with the 2013 Recovery Plan.

In terms of gray wolves, at the end of 2017, the population in Wyoming remained above the minimum delisting criteria; making 2017 the 16th consecutive year that Wyoming has exceeded the numerical, distributional, and temporal delisting criteria established by the U.S. Fish and Wildlife Service. Wolf populations and the number of breeding pairs occupying suitable habitats remained over 70% above the minimum requirements of the ESA recovery plan criteria of 100 wolves and 10 breeding pairs. At least 347 wolves in at least 53 packs were in Wyoming at the end of December 2017.

Other examples of successful conservation and management include the Department's work on big game populations, including mule deer, elk, pronghorn antelope, moose, and bighorn sheep. Healthy populations of these species are important to hunters, conservationists, wildlife watchers, and the state's economy. Wyoming has the fourth highest percentage of active hunters; the fourth highest percentage of active anglers; and the third highest percentage of active wildlife viewers. While the rest of the country is moving away from values that support hunting, Wyoming is seeing an increase in that value. Hunting, fishing, and wildlife viewing contribute approximately $1 billion dollars each year to Wyoming's economy.

3. Deputy Director Kennedy, in 2016, the Obama Administration recognized that the grizzly bear in the Greater Yellowstone Ecosystem was fully recovered when it proposed to delist the species. It based this on scientific fact that since the 1970s the grizzly's population had increased by more than 415 percent; its range had more than doubled; its population had been stable for more than a decade; and the ecosystem was at or near its carrying capacity. Dan Ashe, the U.S. Fish and Wildlife Director at the time, called the recovery of the grizzly bear "a historic success." A little over two weeks ago, a U.S. district court judge in Montana ignored all of the scientific evidence and expert conclusions when he arbitrarily and indefensibly re-listed the grizzly. This was the second time in about 10 years that an activist judge upended a final determination by the U.S. Fish and Wildlife Service that the grizzly was fully recovered. What does this development mean for Wyoming's ability to effectively manage the grizzly population, and for the incentive states and other stakeholders have to invest in wildlife conservation activities in the future?

   Judge Christiansen's decision sets back years of advances in cooperative state/federal wildlife conservation efforts. This decision exacerbates an already frustrated citizenry and Wyoming's wildlife managers. The State of Wyoming invested more in grizzly recovery than any other single entity and the result of their efforts is a grizzly population that exceeds all scientifically based recovery criteria. While the population is thriving by all measures, the people who invested in the recovery of the population have no authority to manage in accordance with the proven tenants of the North American Model of Wildlife Conservation. Wyoming sportsmen's patience and incentive to invest more is waning to say the least.

Ranking Member Carper:

4. A 2016 report from the University of Wyoming, commissioned by Governor Mead, outlined the ways in which Wyoming's economy would be impacted by an Endangered Species Act listing of the greater sage-grouse. The report concluded that "the economic impact associated with a listing of the sage-grouse would have been acutely felt in Wyoming," as more than two-thirds of the state is covered by the species' range. The report estimated that a listing could range from $1.5 billion-$5.4 billion in total economic impact, which could be up to $4.4 billion higher than the current sage-grouse plans. In addition to this Wyoming-specific data, the report acknowledges that sage-grouse habitat spans 11 Western states and that conservation efforts were undertaken not only by states, but also by Federal agencies and countless public and private partners.

   Given these dynamics and considering that listing decisions depend on threats across a species' range, do you believe one state can prevent an Endangered Species Act listing for greater sage-grouse on its own? If the proposed amendments to the federal conservation plans significantly weakened conservation protections in other critical states across the range, do you believe those changes could lead to an Endangered Species Act listing, which could have a disproportionate impact on Wyoming? Does the federal government play an important role in convening states to address conservation for species that span several states, as is the case for the greater sage-grouse?

The Greater sage-grouse is a state-managed wildlife species that is dependent on sagebrush steppe habitats. While Wyoming supports over one-third of all sage-grouse in the western United States, inhabiting 43 million acres in the state, the extensive distribution of the species across 11 states ranging from North Dakota to Washington requires broad-scale habitat conservation and management with a multitude of stakeholders. No single state can ensure adequate conservation actions would prevent an ESA listing of Greater sage-grouse.

A 2016 report from the University of Wyoming outlined the ways in which Wyoming's economy would be impacted by an Endangered Species Act listing of the Greater sage-grouse. The report concluded that the economic impact associated with a listing of the sage-grouse would have been acutely felt in Wyoming, as more than two-thirds of the state is covered by the species' range. The report estimated that a listing could range from $1.5 billion to $5.4 billion in total economic impact, which could be up to $4.4 billion higher than the current sage-grouse plans.

The sage-grouse is considered a sagebrush obligate species; they depend almost exclusively on healthy, productive sagebrush habitats to survive. Given the broad-scale distribution of the species and their habitat across 11 Western states, federal land managers are important partners in successful conservation planning to prevent ESA listing. In Wyoming, the BLM manages 18.7 million of the 43 million acres of occupied sagebrush habitat. The BLM's management actions play a direct and significant role in landscape-scale habitat management, directly supporting sage-grouse populations. In addition to the BLM, other federal land management agencies support key sage-grouse conservation actions. In 2010, the Natural Resources Conservation Service invested $296.5 million dollars to implement a major sage-grouse initiative, establishing key partnerships with private landowners and other stakeholders to improve sage-grouse habitats throughout the state. In 2015, an additional $211 million dollars was added to the initiative to provide additional assistance to ranchers and other private landowners to continue conservation efforts aimed at enhancing private lands that support sage-grouse habitats across the Western U.S.

5. I was surprised to hear that Wyoming's Legislature removed the Wyoming Game and Fish Department from the state's general fund, at a time when Wyoming is seeking an expanded role in managing shared wildlife resources. Your testimony goes on to state that hunters and anglers now fund your Department's work almost entirely. However, millions of people visit Yellowstone National Park each year, and when they do, they support restaurants, hotels and businesses in Wyoming. Further, a 2016 National Park Service study showed that the vast majority of visitors to the Park found wildlife, including bears, to be an important resource to them.

   Despite the Legislature's decision to remove Wyoming Game and Fish from the state's general fund, do you think ecotourism revenues should still be strongly considered when you're making wildlife management decisions. If yes, how so?

This is a question we are grappling with continually, given our agency manages more than 800 wildlife species. The opportunity to see elk, mule deer, bald eagles, pronghorn, or beavers and otters attract millions of visitors to this state every year. So, we do consider tourism in all of our work and in our request to augment funding to our state. One example of how we have considered this happened this year when the Wyoming Game and Fish Department created regulations for grizzly bear hunting, we closed a portion of a hunt area near Grand Teton National Park, not because of a management or scientific need, but because of public comments that visitors to the National Park who wanted to view bears did not want to overlap with those who use wildlife in a different matter. So, we consider ecotourism in Wyoming, but we do not receive any funding directly from those wildlife users.

Our legislature is also very aware of this matter and just this year passed a resolution that asked the National Park Service and Department of Interior to consider collecting wildlife conservation fees from visitors to Yellowstone and Grand Teton National Parks. This diversification of funding could help our agency and the Park Service with wildlife conservation.

6. Your testimony states that your Department manages over 800 wildlife species in Wyoming, only a small number of which are game species. Given your Legislature's 2017 decision to remove your Department from the state's general fund, do you believe you have the resources to continue to effectively managing those 800 species?

   From the period 2005 to 2017, the Department received general fund support for certain programs that benefit more than hunters and anglers, such as sensitive species (including work to keep species from being listed under the Endangered Species Act); wildlife diseases; aquatic invasive species; and recovering certain ESA-listed species, such as the sage-grouse and gray wolf. The Department continues to implement these programs with funding provided by the Wyoming Game and Fish Commission (about $6 million/year). Therefore, hunters and anglers fund the Department's work almost entirely. To continue and expand our conservation work, the Department needs additional permanent and dedicated funding.

   We do not have the resources to effectively manage 800 species of wildlife. The Wyoming Game and Fish Department's current budget is approximately $82 million (almost entirely supported by hunters and anglers). Of that total, approximately $25 million dollars is available to move around to changing priorities. Based on current priorities, we have about $6 million dollars to allocate to proactive wildlife conservation work.

   What might the Wyoming Game and Fish Department be able to do to improve species conservation outcomes with additional financial resources?

   With additional financial resources, preferably permanent and dedicated funding that is not tied to hunting and fishing, the Wyoming Game and Fish Department could allocate additional funding to nongame species, including sensitive species that are identified in our State Wildlife Action Plan (to keep species off the Endangered Species Act list). In

Wyoming, additional financial resources would also be used to help recover species that are already listed under the ESA.

In addition to work on sensitive species, additional financial resources would all us to do more for aquatic invasive species; terrestrial invasive species; wildlife law enforcement; wildlife diseases (e.g., CWD; brucellosis); landscape-level habitat projects (e.g., big game migration corridors); access for hunting and fishing; and shooting ranges.

Senator BARRASSO. Well, thank you for your testimony. We are grateful to have you and your testimony here today. Thank you.

Mr. McCormick.

STATEMENT OF MIKE MCCORMICK, PRESIDENT, MISSISSIPPI FARM BUREAU FEDERATION

Mr. MCCORMICK. Chairman Barrasso, Ranking Member Carper, and members of the Committee, my name is Mike McCormick. I am the President of the Mississippi Farm Bureau Federation, and I am pleased to be here today to offer my testimony on several issues of importance to farmers and ranchers across the country.

On behalf of the nearly 6 million Farm Bureau member families across the United States, I commend you for your leadership in providing oversight of successful State work to conserve, recover, and manage wildlife.

I would like to devote my time today to primarily discuss several examples of species which have witnessed positive conservation goals and recovery largely due to the effective partnerships between private landowners and State wildlife agencies.

A great example of local and State partnerships is a stewardship program that Mississippi Farm Bureau Federation and the Mississippi Department of Agriculture developed to protect and manage pollinators. The Mississippi Bee Stewardship Program is the result of a series of collected discussions held among stakeholder groups to discuss ways of fostering better working dialogue among the State's row crop farmers and beekeepers, all in the spirit of conservation, coexisting, and cooperation to protect pollinators through voluntary efforts.

Three pillars of the Bee Stewardship Program include communication, cooperative standards, and habitat restoration. With these efforts primarily tailored to the relationships between the farmers and beekeepers, we feel the standards they develop will be beneficial to native pollinators as well.

This program was used as a model nationally and was adopted by several other States and included in the President's Pollinator Partnership Action Plan. Much of the success can be attributed to the fact that the Environmental Protection Agency and other Federal agencies supported the effort but allowed local partnerships to develop and implement the plans.

Additionally, the Mississippi Department of Wildlife Fisheries and Parks has done a tremendous job with the preservation and recovery of numerous other species. To restore Mississippi's wild alligator population after it was placed on the Endangered Species List, the Mississippi Game and Fish Commission relocated nearly 4,000 alligators to the State. The Mississippi Game and Fish Commission's relocation efforts, combined with Federal regulations of protecting alligators, have allowed the alligator population in Mississippi to rebound.

After 24 years of dedicated recovery efforts by private landowners, farmers, and State Federal agencies, the Louisiana black bear was removed from the List of Endangered and Threatened Wildlife in 2016.

During the 1800 to 1850 time period the white-tailed deer population in the State disappeared from much of their range, mostly

east of the Mississippi River. Due to strict protection of antlerless deer and partnerships among private landowners, farmers, and State agencies, the Mississippi white-tailed deer herds have grown rapidly, and today Mississippi deer herds rank among the most abundant in the United States.

Another very successful program in Florida is the Landowner Assistance Program. The Landowner Assistance Program, housed at the Florida Fish and Wildlife Conservation Commission, has a history of cooperative working relationships with private landowners and managers. The program assists with measures to conserve wildlife habitat, while keeping land productive for many agricultural and recreational uses. Specifically, this program works with landowners to preserve habitat and protect species such as white-tailed deer, black bear, wild turkey, bobcat, panther, gopher tortoise, kite, and caracara.

The final example of landowners working hand in hand with Federal and State partners is in the State of Kentucky. Black vulture depredation was recognized as an issue in Kentucky around 2004, when cattlemen began noticing a new type of behavior by vultures. This bird was having a devastating impact on cattle farms when newborn calves were birthed and these vultures would attack the calf and would typically result in the loss of the newborn.

After numerous conversations with stakeholder groups and State agencies, the USFWS encouraged the Kentucky Farm Bureau to submit an application for depredation permits. In 2013 the Kentucky Farm Bureau was allowed to issue depredation permits with close oversight by the USFWS. Today, the Farm Bureau is issuing permits with close support by the Kentucky Fish and Wildlife Service.

One key ingredient that has been vital to the success in the examples I have just highlighted is the positive working relationship that exists between stakeholder groups and all Federal and State agencies in those respective States. Additionally, the success of many of these programs would not be possible without the support of our land grant universities, which provide a vital service to agriculture in our State.

I am joined here today by my staff, as well as a representative from the Department of Agriculture and Commerce that has extensive background in wildlife management. Their presence here today is another reflection of the strong working relationship that we have with our State and agency partners. I believe they also have a letter of support that has been introduced in the record.

In closing, the American Farm Bureau Federation appreciates the Committee's commitment to promoting successful examples of conservation and wildlife recovery achieved through partnerships with private landowners and State and Federal agencies. The continued commitment to stewardship and conservation by American farmers and ranchers cannot be overstated. We look forward to continuing to work with you in advancing the shared conservation goals which I have highlighted today, and I look forward to your questioning. Thank you.

[The prepared statement of Mr. McCormick follows:]

Mike McCormick
President
Mississippi Farm Bureau Federation

Mike McCormick was elected President of the Mississippi Farm Bureau Federation on December 8, 2014. He is a cow/calf and timber farmer from Union Church in Jefferson County, Mississippi. He operates one of the oldest farms in Mississippi which has been in his family since the 1820s.

Prior to becoming Mississippi Farm Bureau Federation's 10th president, Mike was a member of the Mississippi Farm Bureau Federation Board of Directors and was actively involved with the Jefferson County Farm Bureau Board of Directors for 20 years where he served as County President. He also served on the Jefferson County Farm Service Agency Committee for 12 years as vice-chair.

Mike has served on numerous committees and councils including the National Cattlemen's Beef Promotion and Research Board, the Mississippi Beef Council, the Mississippi Farm Bureau Federation and American Farm Bureau Federation advisory committees on beef and forestry, and the Jefferson County Economic Development Board of Directors. Mike also serves on many local and county service committees.

He is a founding member of the Farm Families of Mississippi Ag Image Promotion Campaign where he served as the committee's vice-chair.

Mike is a graduate of the University of Southern Mississippi with a Bachelor of Science degree in Business Administration. He and his wife, Suezan, have been married for 28 years and are active members of the Union Church Presbyterian Church.

Statement of the American Farm Bureau Federation

To the United States Senate Committee on Environment and Public Works

Hearing on:

"Consider the testimony of state officials and other stakeholders regarding successful state work to conserve, recover, and manage wildlife, in partnership with federal agencies, landowners and stakeholders."

October 10, 2018

Presented By:
Mike McCormick, President
Mississippi Farm Bureau Federation
On behalf of the American Farm Bureau Federation

Chairman Barrasso, Ranking Member Carper, and Members of the Committee, my name is Mike McCormick and I am the President of the Mississippi Farm Bureau Federation. I am pleased to be here today to offer testimony on several issues of importance to farmers and ranchers across the country.

On behalf of the nearly six million Farm Bureau member families across the United States, I commend you for your leadership in providing oversight of successful state work to conserve, recover and manage wildlife in partnership with federal agencies, landowners and stakeholders. We appreciate the committee's desire to understand how farmers and ranchers partner with the state and federal governments to promote stewardship and wildlife conservation on private agricultural lands. Such a review is timely and, in our judgment, will permit policymakers to gain a greater appreciation for the conservation ethic of our members and how agricultural producers seek to identify solutions in addition to their efforts to produce food, feed, fiber and fuel.

I would like to devote my time today to discussing several examples of species recovery and positive conservation goals due to effective partnerships between private landowners and state wildlife agencies.

Longleaf Pine

Longleaf pine forest once encompassed more than 90 million acres across the Southeast. Over the past two centuries longleaf pine habitat has been reduced to less 5 percent of its original range due to conversion to other forest types and development. There are more than 30 species, including the red-cockaded woodpecker, gopher tortoise, dusky gopher frog and black pine snake, listed by the U.S. Fish and Wildlife Service as threatened or endangered that depend on longleaf pine for their habitat. In 2005, America's Longleaf Restoration Initiative (ALRI) was formed to support restoration efforts across public and private lands.[1] ALRI estimates that approximately 80 percent of the restoration efforts will have to occur on private lands within 17 Significant Geographic Areas (SGA). SGAs are large tracts of existing longleaf pine that are anchored by public lands such as military installations, national forest, state forest or heritage reserves.

As a member of ALRI, the Natural Resources Conservation Service (NRCS) works with agricultural producers and conservation partners to restore longleaf forest through its Longleaf Pine Initiative (LLPI), launched in 2010. The LLPI operates in nine states (Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Texas and Virginia) providing technical and financial assistance to restore or improve existing longleaf habitat. Financial assistance comes from a variety of Farm Bill programs including the Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), and Regional

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1 https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/initiatives/?cid=nrcsdev11_023913

Conservation Partnership Program (RCPP). NRCS' goal is to restore or protect 400,000 acres by the end of fiscal 2018. Both NRCS and the landowner invest in the implementation of conservation and restoration practices that seek to maximize a balance between environmental benefit and economic return.

The Mississippi Bee Stewardship Program

A great example of local and state communities coming together to address an issue, as opposed to imposing broad federal regulations, is a stewardship program that the Mississippi Farm Bureau® Federation and the Mississippi Department of Agriculture & Commerce developed to protect managed pollinators. The Mississippi Bee Stewardship Program is the result of a series of collective discussions held among stakeholder groups in the state to discuss ways of fostering a better working dialogue among the state's row crop farmers and beekeepers, all in the spirit of conservation, coexistence and cooperation to protect pollinators through voluntary efforts. Farm Bureau brought all local stakeholders to the table in early conversations. Deliberations ultimately led to the development of a set of standards or general operating suggestions targeting the state's beekeepers, farmers and other pesticide applicators. The founding partners in this effort are the Mississippi Farm Bureau Federation, the Mississippi Department of Agriculture and Commerce, the Mississippi State University Extension Service, the Mississippi Beekeepers Association, the Mississippi Agricultural Aviation Association, the Mississippi Agricultural Consultants Association and the Mississippi Agricultural Industry Council. While these efforts are primarily tailored to the relationship between farmers and beekeepers, we feel the standards they developed will benefit native pollinators as well.

The Mississippi Honey Bee Stewardship Program includes three pillars:

1. Communication: "Know Your Farmer: Know Your Beekeeper" encourages farmers and beekeepers to foster a strong and open line of communication. Knowing when and where bees will be placed on the farm and knowing when and where pesticide applications will be made is vital to the cooperative coexistence of commercial agriculture and bees. A key component of the communication strategy is the development and utilization of the "bee aware" flag system. The "bee aware" flag is a nonverbal communication tool placed in the vicinity of beehives in a location visible for pesticide applicators, reminding them to use extreme caution in the area.

2. Cooperative Standards: Extension service apiculturists, Extension entomologists, row crop producers and members of the beekeeping community developed a set of cooperative standards for farmer-beekeeper partners. These standards include, but are not limited to, hive identification, hive locations, orientation of hives in relation to the field, placement of the "bee aware" flag, timing of pesticide applications, wind speed and direction of pesticide applications, and notification protocols of pesticide application.

3. Habitat Restoration: The establishment and restoration of bee habitat is another major priority for the program. Extension specialists developed appropriate seed mixtures that will provide bee forage for extended periods. The cooperative partners have worked diligently with the USDA-NRCS to promote bee habitat restoration priorities within their set of programs, such as CSP. CSP incentivizes land owners to plant and maintain pollinator habitat and restoration on their property.

This process was such a success that it was adopted by several other states and is included in the President's Pollinator Partnership Action Plan. Much of the success can be attributed to the fact that the Environmental Protection Agency supported the effort but allowed local partnerships to develop and implement the plans.

Florida Landowner Assistance Program

One very successful program in Florida is the Landowner Assistance Program (LAP). Housed within the Office of Conservation Planning Services at the Florida Fish and Wildlife Conservation Commission (FFWCC), the LAP has a history of cooperative working partnerships with private landowners and managers. The program assists with measures to conserve wildlife and habitat, while keeping land productive for many agricultural and recreational uses. Specifically, this program works with landowners to preserve habitat to protect such species as white-tailed deer, black bear, wild turkey, bobcat, panther, gopher tortoise, kite and caracara. The FFWCC[2] also works closely with NRCS to get funding assistance for landowners who participate in the program.

The Lee family has 103 acres in Columbia County, Florida, and has worked with FFWCC on their property with great success in conserving for wildlife, specifically black bear, wild turkey and bobcat. The Register family also shares a strong land stewardship ethic. They have a 1,200-acre ranch owned by the Genevieve Family Trust and Troy Register in Suwannee County, Florida. Cooperation with FFWCC in the LAP and the Florida Forest Service's developing prescribed burning and rotational mowing of pine stands have helped preserve and protect such species as wild turkey, white-tailed deer, gopher tortoise, Sherman's fox squirrel and common species like cottontail rabbit and numerous songbirds.

Lykes Bros. Inc., [3] owns and operates 575,000 acres in Florida and Texas for cattle farming, forestry, hunting and land and water resources. They have partnered with the South Florida Water Management in their dispersed water management program to provide storage and water quality treatment on approximately 20,000 acres of their farming operation in south Florida before water is released into Lake Okeechobee. These facilities provide habitat for various wetland-wading birds such as the lemkin, great blue heron and white pelicans. Habitat around

[2] http://myfwc.com/conservation/special-initiatives/lap/

[3] http://www.lykes.com

these areas provides home to the burrowing owl, panther, gopher tortoise, black bear, white-tailed deer, caracara and the migratory swallow-tail kite.

Kentucky - Black Vulture Depredation

Another great example of landowners working hand-in-hand with federal and state partners is in the state of Kentucky. Black vulture depredation was recognized as an issue in Kentucky around 2004 when cattlemen began noticing a new type of vulture that many referred to as a Mexican crow because it was smaller than the turkey vulture. This bird was having a devastating impact on cattle farms. When newborn calves were birthed, these vultures would attack the calf and would typically result in a death loss.

The Kentucky Farm Bureau adopted policy years later and began working with the Kentucky Department of Fish and Wildlife to see what could be done. It was determined that Kentucky Fish and Wildlife had no jurisdiction because black vultures were federally protected under the Migratory Bird Treaty Act, dating to the early 1900s. This gave jurisdiction to the U.S. Fish and Wildlife Service (USFWS). When Farm Bureau began working with USFWS, initial conversations did not result in major relief. But once Kentucky stakeholders had direct engagement with the former Director of USFWS to share information from multiple states and allow the director to see the issue first-hand, agency officials understood the extent of the damage and hardships the vultures were having on cattle farmers.

In early discussions with USFWS, the agency suggested that Farm Bureau run a campaign to educate producers on calving techniques to reduce the possibility of depredation (calving indoors or near inhabited areas, removing afterbirth from birthing areas on a regular basis, using sound cannons to discourage roosting near calving areas and trapping and relocating vultures). Most of these practices and recommendations were uncommon and very difficult to achieve.

Eventually, USFWS encouraged the Kentucky Farm Bureau to submit an application for a depredation permit. At the time, producers were losing $250,000-$300,000 in baby calves (annual livestock losses continued in that range and included more mature cattle being lost along with hogs, sheep, lambs and even poultry) across Kentucky, according to losses reported to the University of Kentucky Extension Service.

All state and federal agencies supported the Farm Bureau application with a Form 37 report to USFWS, and Kentucky Farm Bureau was awarded its first depredation permit that would allow issuance of Livestock Protection Permits to livestock producers who were experiencing depredation. The permits only could apply to livestock producers, even though there were additional problems with damage to buildings, vehicles and boats in various areas of Kentucky. Farm Bureau agreed to open the permits to all producers rather than limit them to Kentucky Farm Bureau members.

In 2013, the Kentucky Farm Bureau quickly issued its allotment of allocations and had to apply for an amended permit, with the support of USDA Wildlife Services. Today, Farm Bureau is

issuing up to 1,300 takes, with sub-permits issued in 88 of Kentucky's 120 counties. Kentucky Fish and Wildlife also supports the Farm Bureau effort and routinely recommends the program to producers who contact them about trying to reduce black vulture problems. Farm Bureau works with the University of Kentucky Extension Service on non-lethal measures such as artificial effigies to dissuade black vultures from congregating in areas. Farm Bureau routinely refers non-livestock property owners to USDA Wildlife Services for assistance and has experienced great cooperation between multiple agencies.

While the program has achieved successes, it would be much easier if there was a nationwide depredation order issued by USFWS and the state wildlife agencies were allowed more flexibility in regard to federal jurisdiction in situations like these. There should also be a process to allow producers to protect property (livestock, buildings, equipment, etc.) when they witness depredation occurring without first having to take the time to apply, and wait, to receive a depredation permit.

Federal, State, & Local Cooperation

One key ingredient that has been vital to the success in the examples I just highlighted is the positive, working relationships that exist between stakeholder groups and all federal and state agencies in those respective states. One thing possibly unique about the Southeast region is how all stakeholder groups and government agencies work together toward common goals. Additionally, the success of many of these programs would not be possible without the support of land-grant universities, which provide a vital service to the agriculture communities and landowners in their respective states.

American Alligator

Mississippi also has additional success stories in several species that I'd like to feature next.

The American alligator has existed in the Southeast for thousands of years, according to fossil records. However, due to over-harvest and lack of conservation regulations, alligators became endangered in the early- to mid-1900s. In 1967, USFWS placed the American alligator on the Endangered Species List throughout its entire southeastern U.S. range. Following its listing, stiff penalties curtailed illegal alligator harvest, and populations recovered more quickly than anticipated. In 1987, the status of the American alligator was changed to threatened due to similarity of appearance, which allows wildlife officials to identify alligator parts from other endangered crocodilians entering commercial trade. Shortly thereafter, people in alligator markets began experimenting with alligator farming, and commercial alligator farms were successfully created in Louisiana and Florida, with state and federal regulatory oversight. Today, after years of research and regulated monitoring, alligators are commercially raised from an egg to marketable sizes. Alligator farming in Louisiana has a multi-million=dollar economic impact annually.

To restore Mississippi's wild alligator population after it was placed on the Endangered Species List, the Mississippi Game and Fish Commission relied heavily upon the Louisiana Department of Wildlife and Fisheries. During 1970 – 1978, approximately 4,000 alligators were captured from Louisiana and transported to Mississippi. The Mississippi Game and Fish Commission's relocation efforts, combined with federal regulations protecting alligators, allowed the alligator population in Mississippi to rebound. In some cases, alligators rebounded beyond expectations into areas where they were not common prior to being listed as endangered. Because of this conservation success, alligator populations are abundant across the Southeast, and alligator hunting is allowed in many states. In 2018, Mississippi completed its 14th alligator hunting season. [4]

Louisiana Black Bear

The Louisiana black bear was listed as a threatened subspecies in January 1992 primarily because of modification and reduction of its habitat, reduced quality of remaining habitat due to fragmentation, and threat of future habitat conversion and human-related mortality. However, after 24 years of dedicated recovery efforts by private landowners, farmers, state and federal agencies, universities and non-governmental organizations, the Louisiana black bear was removed from the Lists of Endangered and Threatened Wildlife in 2016. Additionally, voluntary landowner-incentive-based habitat restoration programs and environmental regulations not only stopped the net loss of forested lands in the Lower Mississippi River Alluvial Valley, they have resulted in significant habitat gains. The conservation success story of the Louisiana black bear would not have been possible if it were not for private landowners and farmers. Louisiana farmers worked voluntarily with U.S. Departments of Agriculture and the Interior to restore more than 485,000 acres of bottomland hardwood forests in priority areas for conservation. [5] [6] [7]

White-tailed Deer

The white-tailed deer is arguably the most important game species in North America. However, during 1800 – 1850, white-tailed deer were extirpated from much of their range, including many states east of the Mississippi River. Market hunting and unregulated harvest that caused this species' great decline were not effectively stopped until after 1900. Pittman-Robertson Act funds allowed restoration efforts led by state wildlife agencies in the mid-1900s. For example, much of Mississippi was restocked with white-tailed deer from 1950 to 1970. Most source deer came from remaining pockets of deer throughout the state. Due to strict protection of antlerless deer

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[4] *Alligatars in Mississippi: Then and Now www.mdwfp.com/alligator*

[5] *U.S. Department of the Interior Press Release (March 2016): The Teddy Bear is Back*

[6] *U.S. Fish and Wildlife Service Delists Louisiana Black Bear Due to Recovery*

[7] *U.S. Fish and Wildlife Service Questions and Answers: Louisiana Black Bear Removal from the Lists of Threatened and Endangered Species Due To Recovery*

and partnerships among private landowners, farmers, state agencies and federal agencies, Mississippi's new white-tailed deer herds grew rapidly. By the 1990s, deer were abundant and an antlerless harvest was needed to control deer herds across the state.

Today, Mississippi has one of the most abundant deer populations in the U.S. Landowners, farmers and ranchers across the Southeast work voluntarily with their respective state wildlife agencies annually to collect biological data and ensure this important wildlife species continues to thrive. [8] [9]

Wild Turkey

Long heralded as one of conservation's greatest successes, the wild turkey was saved from extinction by the dedicated efforts of state wildlife agencies, conservation groups, landowners and hunters. During the early 1900s, due to neglect for conservation, turkeys were hunted into near-extinction. Lack of game laws left turkey populations exposed to year-round hunting both by locals and market hunters. To make matters worse, many forests were in poor condition because of early over-harvest and misuse of timber resources. During the first five decades of the 20th century, many forests were void of wild turkeys.

To solve this problem in Mississippi, the Mississippi Game and Fish Commission trapped wild turkeys from the few locations in which they remained and relocated them across the state into suitable habitat. By the 1980s, Mississippi had one of the largest turkey flocks in the nation and was regarded as a top turkey hunting destination. Today, the return of the wild turkey to Mississippi and much of the rest of the southeastern U.S. is considered one of wildlife conservation's greatest success stories. This success would not have been possible without state government and stakeholder actions. [10] [11]

Conclusion

The American Farm Bureau Federation appreciates the committee's commitment to promoting successful examples of conservation and wildlife recovery achieved through partnerships with private landowners and state and federal agencies. The continued commitment to stewardship and conservation by American farmers and ranchers cannot be overstated. We look forward to continuing to work with you in advancing the shared conservation goals that I have highlighted today.

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[8] *Mississippi Outdoors: Mississippi's Changing Deer Herd (September 2017, www.mdwfp.com).*

[9] *Ecalogy and Management of Large Mammals. Demarais and Krausman. 2000.*

[10] *Mississippi's Comprehensive Wild Turkey Management Plan*

[11] *www.mdwfp.com/turkey*

Senate Committee on Environment and Public Works

Hearing entitled, "From Yellowstone's Grizzly Bear to the Chesapeake's Delmarva Fox Squirrel -- Successful State Conservation, Recovery, and Management of Wildlife" October 10, 2018

Questions for the Record for Mike McCormick

Chairman Barrasso:

1. Mr. McCormick, when it comes to conservation, state and local government agencies are on the ground working with area landowners on a daily basis. How would you characterize the relationship between state and local agencies and landowners in Mississippi and the Southeastern United States when it comes to the conservation and recovery of species, and the fight to address invasives?

Thank you Mr. Chairman for addressing this topic. State and local governments play an important role in providing technical assistance and helping landowners with resources to address resource concerns and conservation goals. This goes hand-in-hand with the importance of managing invasive species. In Mississippi and the Southeast, the majority of species of concern prefer open-forest canopy, such as longleaf pine habitat. Conservation includes management of these forests for invasive species such as cogongrass, Chinese tallow tree, and privet hedge. These understory vegetation present significant challenges to proper forest management and must be controlled. USDA NRCS, the Forestry Commission, and university landgrant extension research are all important to providing landowners the information and resources necessary to address these concerns and balancing forest management objectives. In terms of balancing, we must consider that Chinese Tallow and privet, while not beneficial to creating habitat for threatened and endangered (T &E) species, are a primary food source for pollinators in the region.

2. Mr. McCormick, the Southeastern United States has a significant amount of private land ownership compared to western states. In Mississippi, how do state agencies encourage your members to become engaged in wildlife conservation efforts on their own lands?

In my experience, private landowners do not necessarily need "encouraging" to become engaged in wildlife conservation but rather seek information and technical assistance to become better stewards of their land. Private landowners are very proud of their land and are willing to make improvements that are beneficial to wildlife. State agencies help by assisting landowners recognize where improvements can be made and making sure Best Management Practices (BMP's) are being followed. Cost share assistance through Farm Bill programs, such as the Conservation Reserve Program (CRP), Wetland Reserve Program (WRP), Conservation Stewardship Program (CSP) and Environmental Quality Incentive Program (EQIP) are vital to helping landowners achieve conservation goals.

Ranking Member Carper:

3. Thank you for sharing inspiring conservation success stories with us. Between your testimony and Ms. Dohner's, it sounds like the Southeast region is creating collaborative conservation models to which other regions can aspire. For several of the species you mentioned, including the American alligator and the Louisiana black bear, the U.S. Fish and Wildlife Service was heavily involved.

   Would you agree that the Service also played an important role in those recovery efforts?Do you believe the states would have been as motivated to recover these species without Endangered Species Act regulations?

Thank you Senator Carper, and I would agree that Fish and Wildlife Services (FWS) play an important role in understanding the biology and providing technical assistance to the recovery efforts of species. However, I do believe we could be making much more progress without the threat of liability (real or perceived) involved with the presence of T &E species. In other words, the gains we have made in conservation are made in spite of the ESA, not necessarily because of it. I agree with Ms. Dohner's statements regarding the collaboration that exist in the southeast between landowners and agencies; however I disagree with her assertion that the ESA was necessary to "force" landowners to the table. I believe without the threat of excessive fines or imprisonment, or the prospect of losing some economic benefit of their property, landowners would be more than willing to help address species concerns.

As an example, I would mention the Longleaf Pine Initiative administered through the USDA NRCS. Longleaf pine is an important habitat for many species of concern. In trying to convince landowners to enroll and convert their land to longleaf habitat the primary concern is that it will become attractive to T &E species. In order to alleviate those fears FWS has agreed to enter into "Safe Harbor Agreements." I believe longleaf pine restoration would be occurring at a much greater pace if not for the accompanying liabilities of the ESA.

Senator BARRASSO. Thanks so very much for your testimony. We appreciate you being here and joining us today.

Now we look forward to what you have to say. Thanks, Ms. Dohner, for attending.

STATEMENT OF CINDY DOHNER, CINDY K. DOHNER, LLC AND FORMER REGIONAL DIRECTOR, U.S. FISH AND WILDLIFE SERVICE

Ms. DOHNER. Good morning, Chairman Barrasso, Ranking Member Carper, and members of the Committee. I am Cindy Dohner, and I work in the environmental field since I retired from the Service last year. I served as the Southeast Regional Director and provided leadership and oversight for the Service's species conservation work across 10 States, Puerto Rico, and the U.S. Virgin Islands.

Since leaving the Service, I continue to find new ways to advance species conservation, and I am helping lead a conservation effort called Conservation Without Conflict, that started last year. This new effort is both an approach and a coalition. Members have diverse goals and values, including economic profit, hunting, fishing, conservation, and national security. They all come together around common conservation interests and a sense of good land stewardship, and we are making a difference.

Mr. Chairman, I appreciate the opportunity to add my perspective on the conservation, recovery, and management of wildlife. As the Regional Director in the Southeast, I worked hard to balance the conservation of natural resources with the needs of the public on the landscape.

This Nation values land and the well-being it provides family, the recreational opportunity it affords, and the wildlife it sustains. I was also committed to making the ESA works for the American people.

I believe the Act provides a critical catalyst and has inherent flexibilities, although not always used, that allows those in the landscape to work together in an effort to conserve species. Not only do I believe it, but I have seen the successes in the South.

The States and the Service conservation efforts in the South have resulted in more than what we call 185 wildlife wins. That includes species not needing the Act's protection or those that have been recovered, down listed, or delisted. Today I would like to give you a few examples.

We work closely with the State fish and wildlife agencies throughout the Southeast Association of Fish and Wildlife Agencies. That includes 15 southeastern States, and that is 5 more than my region had. We had a common sense approach to species conservation. We forged a unique relationship between the Service and our State partners, sometimes referred to as ensuring there is no daylight between us. This didn't mean that we agreed all the time, because the missions varied, but that we agreed on as many things we could, and we didn't surprise each other.

Since the South is rich in biodiversity, it isn't surprising to find at least five States in the South have the highest Federal listings, with Alabama being one of the States with the most aquatic diversity in the Nation, having 127 federally protected species. However,

you don't hear much controversy in this region because we work hard to advance conservation without a lot of conflict. This type of working relationship was forged almost 20 years ago, when both the Service and the State of Florida, the Florida Conservation Commission, were sued over manatee recovery issues. We realized at the time, if we worked together we were stronger, and we were able to provide more conservation for the species, and both the State and the Service played important roles.

But agencies have limited resources to conserve species under the Act, and sometimes difficult choices need to be made. Because of the two lawsuits, the State and the Service came together to share resources to address high priority actions available under their oversight and their laws. The manatee is now one of the species that has been down listed, but it took the collective recovery efforts of both agencies, many stakeholders, and others to make a difference. The species has now been down listed.

One thing the Service and the State agreed on is the desire to reduce the regulatory burdens on landowners. As RD, we explored many processes available to streamline the regulatory process by using tools like safe harbor agreements for private landowners.

In some cases, we developed new innovative tools to reduce regulatory burdens. A unique example is the Section 6 agreement we have with the State of Florida, the Service has. This agreement streamlined the permitting process by giving the Commission the ability to issue Endangered Species Act permits for the Service, resulting in the elimination of duplicate permitting for the same action. The State of Florida, though, had to change its laws to ensure they could meet the Act's requirements.

Another major challenge I dealt with as the RD came with the Service's multi-district litigation settlement in 2011 and numerous ESA petitions. As a result of these actions, the Southeast was required to determine the status of more than 450 species. There were concerns that if all the species were listed, it could have resulted in more than doubling the number of species listed, which would have significantly increased the regulatory burden on the landowners.

As RD, I knew this was a challenge that would require a collaborative effort to get durable outcomes, so I approached the State directors in the Southeast Association to discuss the issue. Needless to say, they were surprised, concerned, and a bit worried over the sheer number of species needed to be evaluated. They were not too happy that I was also changing their priorities, and to be honest with you, I didn't blame them. However, because of our dialogue and deliberations, in 2011 we embarked on the At-Risk Species Conservation Strategy.

With sound science as our guide, we, along with Federal agencies, private landowners, industries, and NGOs, began the process of proactively conserving as many species as possible. Through these efforts, the Service has determined that Federal listing is not warranted for 171 species. I am proud of the many actions taken by the Service across the South to conserve at-risk species during my time as RD, especially the partnerships we formed with the States, private landowners, industry, and other Federal agencies.

Private lands comprise about 90 percent of the landscape in the South, and these lands provide habitat for about 80 percent of our Nation's imperiled species. But other Federal agencies, industries, and NGOs all play a role.

In closing, Mr. Chairman, I would like to emphasize the importance of both the Service and the States' roles to conserve species. The Act has provided a critical framework that has catalyzed an approach and created successful partnerships to conserve species. When the law is implemented more effectively and collaboratively, and with a common sense approach, you get benefits for species and landowners.

Both the States and the Service rely upon having a science driven and transparent decisionmaking process where people and businesses in affected communities can participate easily and effectively. I know the Service and the States are committed to conserving fish and wildlife by relying upon strong partnerships and creative, voluntary solutions to achieve conservation, minimize the regulatory burden, and keep working lands working. Their commitments have been demonstrated by the conservation successes in the South.

I believe the Act is already inherently flexible and allows us to recover and conserve species, but these flexibilities are not always used today. I am also aware various bills have been proposed to amend the law. We have learned much since the law was originally passed.

If ESA amendments are considered, I think it is important to think strategically about what works and what is really needed to improve the effectiveness of the Act. What we really need are new, innovative tools, adequate resources to implement the law, more people that use a common sense approach to implement it, and time.

Thank you for your interest in recovering and conserving species, and the implementation of the Act. I appreciate the opportunity to testify and have submitted a written testimony with more detail.

[The prepared statement of Ms. Dohner follows:]

Cynthia K. Dohner
Environmental Contractor
Cindy K. Dohner, LLC

Cynthia K. Dohner (Cindy) currently works as an independent environmental contractor. Previously, she served as the Regional Director of the U.S. Fish and Wildlife Service Southeast Region. In this position, she provides oversight for Service activities in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee, the Commonwealth of Puerto Rico, and the U.S. Virgin Islands.

Cindy previously served as the Deputy Regional Director for five years overseeing daily Service operations. She was also responsible for the supervision of five Assistant Regional Directors, the Chief of Refuges, and a Special Assistant for the Councils and Commissions. These supervisors are responsible for carrying out the work of the Service's major programs throughout the Southeast. There are more than 1500 employees in the Southeast Region.

Before moving to the Deputy position, Cindy was the Assistant Regional Director (ARD) for Ecological Services (ES) in the Southeast. In this position, she managed the Region's 16 ecological services field offices. The ES program is responsible for implementing numerous programs, such as the Endangered Species Act, Coastal and Partners for Fish and Wildlife programs, federal water resource development activities, National Wetlands Inventory, and the Environmental Contaminants program. As ARD, she managed Service activities at the ES field offices throughout the Southeast Region.

Before coming to the Southeast Region, Cindy worked with the Fish and Wildlife Service in the Division of Fish Hatcheries in the Washington, D.C. office. She moved to the Endangered Species Program, where she first served as the national coordinator for the development of the Habitat Conservation Planning Program. She coordinated national issues for the Endangered Species Program, such as recovery, section 7 program, Habitat Conservation Plans, and private lands initiatives.

Cindy has worked a variety of environmental jobs within the private sector and environmental groups, as well as with a few States and other federal agencies. She has propagated fish, conducted field surveys and water quality analysis, and drafted and finalized federal regulations, policies and guidelines. She earned her B.S. in Marine Biology from Millersville University in 1982, and a M.S. in Fisheries and Aquaculture from the University of Rhode Island in 1984. She is married and has two boys, Zachary and Jacob.

TESTIMONY OF CYNTHIA K. DOHNER, PRESIDENT, CINDY K. DOHNER, LLC BEFORE THE U. S. SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS ON "FROM YELLOWSTONE'S GRIZZLY BEARS TO THE CHESAPEAKE BAY'S DELMARVA FOX SQUIRREL -- SUCCESSFUL STATE CONSERVATION, RECOVERY AND MANAGEMENT OF WILDLIFE"

OCTOBER 10, 2018

Good morning Chairman Barrasso, Ranking Member Carper, and Members of the Committee. I am Cindy Dohner and I currently work in the environmental field as an independent environmental contractor since my retirement last year from the U.S. Fish and Wildlife Service (Service) within the Department of Interior (DOI). I served as the Southeast Regional Director for the Service and provided leadership and oversight for the Service's species conservation work across 10 southeastern states, Puerto Rico, and the U.S. Virgin Islands. I also served as Department of the Interior's Authorized Official for the Deepwater Horizon Oil Spill Natural Resource Damage Assessment and Restoration, the lead for DOI on the Resources and Ecosystems Sustainability, Tourism Opportunities and Revived Economy of the Gulf Coast (RESTORE) Act Council, and oversaw the activities related to the National Fish and Wildlife Foundation's Gulf Environmental Benefit Fund, which is part of the restoration effort in the Gulf of Mexico.

I have extensive experience in comprehensive natural resource conservation, where I provide support to Federal Agencies, State Fish and Wildlife Agencies, private landowners, tribes, Nonprofit Organizations, and industry. I also have experience in landscape and watershed conservation, building partnerships, at-risk species conservation, and assisting private landowners solve large scale conservation issues. Additional I worked for three State Agencies, other Federal agencies (i.e., National Marine Fisheries Service), and in the private sector where I was the regulated community.

Since leaving the Service, I continue to find new ways to advance species conservation and am helping lead a conservation effort referred to as Conservation without Conflict that started last year. This new effort is both an approach and a coalition. Members have diverse goals and values, including economic profit and sustainability, hunting, fishing and other outdoor recreation, conservation, national security, and public service, but all come together around common conservation interests and a sense of good land stewardship. This effort intends to demonstrate to policy-makers, funders, conservation groups, the public that investments in collaborative conservation protect land and the values we ascribe to it. It also allows working lands to work and conserve species at the same time and demonstrates that if we work together we can make a difference in conservation.

Mr. Chairman, I appreciate the opportunity to add my perspective to today's discussion on the conservation, recovery and management of wildlife that I was involved with during my career with the Service, and the proactive work done by federal and state agencies, private landowners, industry and environmental groups, and the work I continue today.

My role as the Service's Southeast Regional Director

As the Regional Director in the Southeast, I worked hard to balance the conservation of fish and wildlife resources with the needs of the public on the landscape. This nation values land for the wellbeing it provides families, the recreational experiences it affords, the support for our outdoor ways of life, the economics it affords the communities, the ecological benefits it delivers to those same communities, and the wildlife it sustains. Land and wild life unite us and enhance our quality of life; but there is only one landscape that we work in, and there are many competing uses. I know there is a desire to pass these tremendous benefits and the natural outdoor heritage on to successive generations, however, the nation has diverse goals and values that sometimes conflict with that desire. These include ensuring economic profit and sustainability, hunting, fishing and other outdoor recreation, conservation, national security, and public service to name a few. I believe, however, that we can address these challenges and the conflicts if we all work together collaboratively around these common interests and goals and strive to find solutions to ensure good land stewardship and the conservation of fish and wildlife. The work in the Southeast among the various stakeholders, States, private landowners, tribes, industry, nongovernmental organizations (NGOs) and the Service has proven that collaborative conservation is successful.

I love the Service's mission and worked hard to ensure it was met but I also have a variety of experiences that includes working for other federal agencies, state agencies, and industry, where I was the regulated public, which I think provides a unique perspective when addressing challenges. My intent is to do the best that I can for fish and wildlife resources. While growing up, some of the rivers in Pennsylvania caught on fire and DDT was found to be the cause for some of the bird declines. My desire in choosing an environmental field in which to work was to help in any way I could so that my two sons can enjoy the things I so enjoyed growing up, such as playing in the outdoors, scuba diving, hunting and fishing.

I was also committed to making the Endangered Species Act (ESA) work for the American people to accomplish its purpose of conserving at-risk, threatened and endangered species and protecting the ecosystems upon which they depend. I am still committed to that practice today and continue the work and believe the ESA has enough flexibility to conserve and recover species if everyone on the landscape works together in a collaborative effort. Not only do I believe it, but I know it works because of the successes from the Southeast's At Risk Species Conservation effort led by the States and Service: there are more than 185 "wildlife wins," which includes species recovered, down listed, delisted or listed as a threatened species with a 4(d) rule because of the conservation efforts.

In passing the ESA in 1973, Congress acknowledged we were facing a crisis. Since that time, the ESA has conserved hundreds of at-risk species, prevented the extinction of species and promoted the recovery of many, including the Delmarva fox squirrel, brown pelican, bald eagle, American alligator and Louisiana black bear to name a few. This great conservation work has helped achieve Congress's call to preserve the nation's natural resource heritage, and it has happened alongside sustained economic development. The ESA gets activated when conservation measures fail, which is unfortunate. Sometimes it is because of a long term downward trend in habitat destruction over many decades, and other times it may because of a

catastrophic event. Either way the species needs to be afforded the protection of the ESA to ensure its long term survivability. Depending on the situation, it may take as many decades to recovery the species.

As you know, species don't recognize boundaries and to recover a species you need to address the threats across the range of the species as needed. Often, the range of the species goes across numerous state lines or may go across international borders. The Service fulfills that important role under the ESA by ensuring the entire range of the species is considered regardless of the administrative boundaries (e.g., State lines and other countries) within the range of the species, and they help stitch together the conservation actions needed to recover the species. This is particularly important in wide ranging species like recovered bald eagle found throughout the nation and multi-jurisdictional species like the Red Knot that overwinters in the South America.

It is more important now than ever to have an effective, collaborative approach to conserving imperiled species to continue this country's commitment to wild places and wild life. Congress also clearly defined roles for both the federal agencies and the state agencies in the law; and when implemented effectively and collaboratively, there are success for both species already listed under the ESA, or those species at-risk of needing the ESA's protection. The law provides the Secretary of the Interior with flexibility to involve the states in imperiled species conservation and recovery. For example, Section 4(f)(2) of the ESA allows for states to be involved in recovery planning activities as deemed appropriate and is not be subject to the Federal Advisory Committee Act. The states were very involved in conserving and recovering species in the Southeast, including recovery planning, although I think it would be beneficial for the Service to work closely with all States to further define the state's roles under the ESA to reflect the intent of Section 6 of the ESA.

I, and the Service's staff in the Southeast worked closely, and the Service still does, with the State fish and wildlife agencies through the Southeast Association of Fish and Wildlife Agencies (SEAFWA), which includes 15 southeastern states – 5 more than the states that comprised the Service's Southeast Region. I worked hard to remain as neutral as possible in fish and wildlife conservation and brought a common-sense approach to that work. This approach to working helped forge a unique relationship between the Service and its state partners in the Southeast. We worked as closely as possible on issues, always trying to ensure there was "no daylight" between our positions. This didn't mean we agreed all the time because the missions varied, but that we agreed on as many things as we could within the bounds of our respective laws. This working relationship was first forged almost 20 years ago when both the Service and the State of Florida (Florida Fish and Wildlife Conservation Commission – FL FWCC) were sued over manatee recovery issues. We realized at the time that if we worked together on the issues, we were stronger, and we were able to provide more conservation for the species – AND both the State and the Service played very important roles in the ESA challenge. This also ensured we used the best scientific and commercial science to guide our management decisions.

Both the States and the Service have limited resources to recover all the species listed under the ESA, and difficult choices need to be made. For the manatee actions that resulted from the 2 lawsuits, the State and the Service shared resources (e.g., staff and funding) to address the high-priority actions needing to be taken. The FL FWCC acted on those measures (e.g., establishing local boating speed zones) available under their oversight and the state laws; and the Service

acted on measures (e.g., designating manatee sanctuaries) available under their oversight and the federal laws. The manatee was listed in 1967, but it took decades for the species to become imperiled. With some species it takes long to recover them and includes a lot of hard work to stabilize the species population. The manatee is now one of the species that has been downlisted under the ESA, but it took the collective recovery efforts of the State, the Service, the U.S. Army Corps of Engineers (USACE), industry and private landowners to make a difference.

One thing the Service and the states in the southeast agree on is the desire to minimize and reduce the regulatory burdens on landowners. As Regional Director, I was committed to using the flexibilities in the ESA to help landowners work their lands while also conserving imperiled species. This was also a request from the elected officials. We explored as many processes available to streamline the regulatory process, including the use of programmatic agreements, section 7(a)(1) agreements with other federal agencies, and the various incentive tools (e.g., Safe Harbor Agreements, Candidate Conservation Agreements with Assurances, etc.) established under the ESA for private landowners. In some cases, we developed new innovative tools to reduce regulatory burdens. The distinct ESA Section 6 Agreement that was developed between the FL FWCC and the Service is an example of such innovation. When used properly, this agreement streamlined the permitting process by allowing the FL FWCC to issue ESA permits for the Service, resulting in the elimination of duplicate permitting for the same issue. This was a new tool under the ESA and the State of Florida had to change its laws regarding the destruction of habitat to ensure they could meet the ESA requirement of protecting the habitat upon which the species depends.

A Change in Species Conservation and Recovery Efforts

One of the most controversial and challenges issues I dealt with as the Regional Director was the result of the Service's Multi-District Litigation settlement in 2011 and numerous petitions received under the ESA, including a mega-petition for listing 404 species under the ESA. As a result of these actions, the Southeast Region was required to determine the status of more than 450 species under the ESA. There were concerns that if all these species were listed, it could have resulted in more than doubling the number of species listed under the ESA in the southeast and would add significant new regulatory burdens on private landowners. The petitions also reflected serious threats to important ecosystems that we needed to address. As the Regional Director, I knew this was a challenge that would require collaborative conservation to get less burdensome outcomes, so I approached the Southeast Association of Fish and Wildlife Agencies (SEAFWA) Directors to discuss the pending challenge. Needless to say, they were surprised and expressed concern over the number of species that needed to be evaluated and the challenges we faced. However, as a result of our dialogue and deliberations, in 2011 the Service's Southeast Region and the states embarked on the At Risk Species Conservation Strategy.

With sound science as our guide, the Service and the states along with other Federal agencies through the Southeast Natural Resources Group, universities, private landowners, and industry to begin the process of proactively conserving as many species as possible through voluntary actions so that ESA protection was not needed. This included raising awareness, educating people on the challenges and opportunities, increasing surveys and research needed for clarifying the status and needs of the species, and developing new processes and tools to be used in the

effort – all of which is still ongoing. This effort resulted in a lasting change in the way the states and the Service, as well as other entities, are working to conserve fish and wildlife that are not currently federally listed. The effort demonstrates that the ESA can provide an important framework and catalyst for how states and the Service can work to effectively conserve species.

Leadership for this effort has also been shared between the States and the Service, and each has its distinct role. Because of limited staff and funding resources, the State is addressing high-priority actions within their oversight that need to be taken, such as species field surveys by using their Section 6 funding and funds from the State Wildlife Grant Program; and the Service is addressing high-priority actions within their purview, such as Species Status Assessments and ESA rules as needed. Although one or the other of the agencies leads the work at any given point, it is done in a seamless fashion.

If together we can address the need to protect additional plants and animals without listing, landowners and the species benefit. The Service also encourages State, Federal and Private landowners to use voluntary conservation tools that protect private land interests and provide incentives and regulatory certainty for landowners to manage lands and waters in ways that benefit at-risk species. From the landowner perspective, proactive conservation is voluntary and flexible and easier to manage. Fish, wildlife and plants benefit when we focus limited resources where they are most needed. This helps species on a larger, landscape scale. Another benefit is counted in savings to the American taxpayer. In general, it costs less money to protect a species that is beginning to face threats than it does to recover critically endangered species.

The goal of this effort is to ensure, in working with partners, that sufficient conservation measures are in place such that these species would not warrant listing under the ESA. That means we are addressing real threats to the landscape people rely on but in a manner that was developed together. With the States and the Service leading the way and sound science as our guide, the Service and the States, along with other Federal agencies, universities, industries, and private landowners—are prioritizing species and coordinating our resources. Partners are acquiring the best science, documenting conservation activities already taking place, and using voluntary, non-regulatory conservation programs to proactively conserve as many of these species as possible so that listing will not be necessary. The Service also is encouraging State, Federal, and private landowners to use voluntary conservation tools that protect private land interests and provide incentives and regulatory certainty for landowners to manage lands and waters in ways that benefit at-risk species.

The Service and the 15 southeastern States that are part of the SEAFWA are currently working to complete the actions identified in the Service's 7-year listing workplan that was solidified in the Multi-District Litigation settlement agreement. The workplan was developed jointly with the States and is publicly available at www.fws.gov/endangered/improving_esa/listing_workplan_FY13-18.html. The Service's Northeast Region and those States are also committed to the same process.

Another part of the Service's at-risk conservation effort includes working closely with the Southeast Association of Fish and Wildlife Agencies' Wildlife Diversity Committee and moving aggressively to share expertise, available science and monitoring data that I believe is crucial to our efforts to evaluate the status of fish, wildlife and plants that are included in our listing

workload. The SEAFWA Diversity Committee now leads this effort with the Service. An exceptional example of how the ESA works through a collaborative effort and is successful. I believe this expanded partnership is helping the Service and the States to efficiently speed progress in their collective effort to achieve the conservation needed to render unnecessary the listing of as a many species as possible. Using the ESA proactively, it is possible to manage species' needs and secure conservation as well as to keep working lands working.

During this time, we also worked with closely states, industry, federal agencies, and large private landowners to employ creative, innovative, and voluntary strategies in the implementation of the ESA. These efforts are producing positive results for conservation and recovery and the local economies. The results of this Service and state-led collaboration has proven to be very promising so far. Through these collaborative efforts, the Service has determined that federal listing is not needed for approximately 171 species, and they are working with partners to put in place conservation tools that provide landowners with stability and clear expectations.

I am proud of the many collaborative actions taken by the Service and its partners across the Southeast to conserve at-risk species during my time as Regional Director. One such collaboration is the Unpaved Roads Program in Arkansas. The Service is part of a coalition of a dozen organizations and associations led by the Arkansas Farm Bureau, the Arkansas Game and Fish Commission, the Association of Arkansas Counties, and The Nature Conservancy to work collaboratively to develop simple best management practices to make it easier for the counties to maintain and repair rural, unpaved roads while reducing costs and improving water quality. This is important because, at the time, about 85 percent of Arkansas county roads were unpaved. These roads are critically important to local economies and these actions may minimize erosion and improve the health of lakes and rivers. Reducing sedimentation, thereby improving water quality, from unpaved roads is key to conserving many of the aquatic species that need to be evaluated under the ESA. The Service supports the use of voluntary conservation programs like those offered by the Natural Resources Conservation Service (NRCS) and the Service's PFW Program, to conserve and enhance fish and wildlife habitat, which are essential for helping to preclude the need to list at-risk species in Arkansas.

This proactive approach to conservation is starting to pay dividends, and many at-risk species no longer need the ESA's protection. Some of this work includes the discovery of new information, some is because of these voluntary conservation agreements and the associated actions, and some species' populations were found to already be secure. These collaborative partnerships efforts are continuing to grow.

In the Service's Southeast and Northeast Regions, our objective was, and continues to be, to conserve species in a way that comports with the ESA, protects our natural way of life, continues to allow working lands to work, and ensures the enduring tradition of outdoor recreation that is so important to many of our citizens. There are also small pockets around the country that working in a similar fashion. That work was recently highlighted in a paper entitled "Improving Implementation of the Endangered Species Act: Finding Common Ground through Common Sense" written by Paul Henson, Rollie White, and Steve P. Thompson. This paper clearly states "The ESA is a resounding success story. It stops extinctions and recovers species..." It also concludes that "...Although the ESA enjoys broad support among the American public, over the

years, its implementation has alienated key segments of that public. The act is a flexible statute, and it can be implemented with more common sense to find common ground..."

Private Landowners' ESA Recovery and Conservation

Private lands are predominant in the Southeast and comprise about 90 percent of the landscape under the purview of the Service's Regional Director. As such, private landowners are key to any conservation effort. As the Regional Director, I worked hard to ensure staff used a common-sense approach to fish and wildlife conservation, working with everyone on the landscape to balance the various interests, whether there were, or were not, conflicts. Many times, while working with private landowners, the Service and the State had to ensure there was "no daylight" between our positions on an issue so that we spoke with one voice to the regulated community. Oftentimes, there is confusion over roles of the State fish and wildlife agencies and the Service because the missions are similar. To be effective in species conservation, I believe it's important that all parties respect the different values essential to a landowner's way of life and what they as individuals require from their lands, whether it's farming, timber, energy, economic profit, hunting and fishing, national defense preparedness or any number of other uses. I know from experience that working collaboratively towards conservation goals allows us to conserve wildlife species and support the shared values and ownership objectives on private lands.

It is estimated that private lands provide habitat for 90 percent of our nation's imperiled species. Since the Southeast is rich in biodiversity, it isn't surprising that the region has the largest percentage of listed species in the nation. In fact, eight of the top ten states/territories with the most federal listings are in the South, with Alabama being one of the states with the most aquatic diversity in the south, and perhaps across the nation, having 127 federally protected species in total as of July 2016. However, you don't hear as much controversy in this region compared to others. In my former job, I tried to move conservation forward without a lot of conflict. Those that were before me did as well. This is the balance I am referring to.

But, private landowners needed to engage for this At Risk Species Conservation Strategy to be successful. Together, the Service and the States are addressing the need to protect additional plants and animals without listing and working to provide incentives and assurances for private landowners to get engagement in these efforts. A large majority of the land in the United States is privately owned and the privately-owned land is often the most agriculturally productive as well as critically important to wildlife and fisheries. Also, well known, is that the vast majority of landscapes in the United States are described as "working landscapes" where at least parts of the landscape are utilized for economic activity such as production of food and fiber and/or energy production. Even most of our public lands can be described as working landscapes and a large percentage are utilized to some degree by the private sector. Common to almost all these working landscapes is the importance of private interests, including in most cases private landowners, and the decisions they make in their operations.

Private landowners also working hard to try and find creative solution to the species conflicts with working lands. Partners for Conservation (PFC), established in 2008, embodies a grassroots movement of private landowners working with agencies, non-profit organizations, and policymakers to collaborate on conservation projects to sustain working landscapes for present

and future generations. PFC represents the voices of 21st century conservation and the collective effort to support working landscapes through voluntary, incentive-based public and private programs.

Landowners care very deeply about the lands they steward for a number of social, historic, economic, and altruistic reasons. Landowners also care very deeply about their rural communities that are also dependent upon the condition of the natural resources that exist on the land. It has become more evident in recent years, that landowners believe that conserving their land and sustaining their communities requires collaboration that goes beyond the fence line. PFC seeks to help facilitate the process of coming together to ensure functional landscapes and viable rural communities are found across the country, by working to improve communication among landowners and landscapes as well as between public agencies and stakeholders.

Leveraging Other Federal Agencies' ESA Conservation and Recovery

Under the ESA, Federal agencies have a special obligation to conserve imperiled species and their habitats. Under Section 7(a)(1) of the ESA, Federal agencies are required to "...utilize their authorities in furtherance of the purposes of the Act by carrying our programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act." Under Section 7(a)(2), Federal agencies are required to consult with the Service to ensure that their actions do not jeopardize the continued existence of a listed species or adversely modify its critical habitat that the species needs to recover. The Service works with Federal agencies through the consultation process to avoid or minimize impacts to a species and critical habitat by developing appropriate conservation measures that can be incorporated into the project or, if needed, a biological opinion. I believe these sections of the ESA could be used even more effectively than is currently done to meet the ESA's goals. The Service's Federal partners like the Department of Defense (DoD) and the U.S. Army Corps (USACE) proactively conserve species through voluntary actions developed under Section 7(a)(1) that help streamline Section 7(a)(2) consultations.

Conservation plans developed by Federal agencies under the 7(a)(1) authority offer another example of the flexibility within the ESA. For example, in 2013 the Service conducted a consultation under Section 7(a)(2) with the USACE's Mississippi Valley Division on the Conservation Plan for the Interior Least Tern, Pallid Sturgeon, and Fat Pocketbook Mussel in the Lower Mississippi River Channel Improvement Program Conservation Plan, which outlines a process to conserve the three endangered species within the footprint of the Program in the Lower Mississippi River (LMR). Over the course of the consultation, individuals realized that that the most significantly impacts to the endangered species and their river habitats could be important and effective tools to maintain and enhance its ecological functions were needed. This resulted in the identification of conservation opportunities that could be effectively incorporated into existing channel improvement or maintenance projects, with little to no additional program costs, and with no negative impact to the USACE's primary flood management and navigation safety missions. It also resulted in significantly improved habitat and population baselines for all three endangered species within the LMR portion of their ranges. The consultation demonstrates that numerous benefits for the species, the ecosystem, and the agencies can be derived under Section 7(a)(1). Largely because of this work, the Service recommended in a five-year status

review that the Interior least tern should be delisted. Section 7(a)(1) agreements can provide greater predictability and efficiency to federal agencies and puts in place a transparent and continuous process of effective interagency communication, review, and feedback at all levels of management. This ensures a strong adaptive management component of cost-effective conservation program execution that helps streamline the 7(a)(2) consultation process.

Additionally, Congress acknowledged DoD's important mission of military readiness and reflected it in Section 7(j) of the ESA. From my experience in the Southeast, DoD takes conservation seriously, and it is evident by the fact that DoD has never invoked Section 7(j) even when invited to do so. DoD continues to work proactively with the Service to actively conserve at-risk and listed species even with this exemption in the law. DoD sees integration of on- and off-installation conservation activities as one potential tool that provides extra flexibility in implementing the ESA that addresses the dynamics of future training requirements that are uncertain yet for which the ability to respond must be preserved. I have seen firsthand DoD's active pursuit of innovative and creative approaches to addressing conflicts between species and training.

I worked with my counterparts at DoD to develop a prelisting agreement for at-risk species. The "*Gopher Tortoise Conservation and Crediting Strategy*" ensures the military has the regulatory predictability it needs to carry out critical missions and training while at the same time providing conservation benefits for the gopher tortoise, which is at-risk of needing federal protection in the eastern portion of its range. This type of solution-oriented partnership offers flexibility for the military, private landowners, public agencies and others that keeps working lands working, contributes to our nation's military readiness, and provides hunting, fishing and recreational opportunities.

Another DoD example of collaborative conservation the Red-Cockaded Woodpecker (RCW) Recovery and Sustainment Program (RASP) partnership on Marine Corps Base Camp Lejeune, in North Carolina. The goal of this partnership is to manage the RCW and its habitat while allowing the Marine Corps to enhance its operational and training opportunities. DoD along with the North Carolina Wildlife Resources Commission (NCWRC), which leads the management effort, the Service, and the National Fish and Wildlife Foundation are all working together to protect the endangered woodpecker. Through this partnership, DoD has funded a perpetual endowment to cover the costs of RCW management on the State-owned game lands. The NCWRC will conduct short and long-term management activities to establish and conserve longleaf pine forest habitat essential for RCW recovery.

DoD is one of the federal agencies leading the effort with the Service and the states to conserve species and ensure military training is not impacted but NRCS is also helping to lead the way in meeting its mission and conserving species. Through the Working Lands for Wildlife Program, NRCS uses a win-win approach to systematically target conservation efforts to improve agricultural and forest productivity which enhance wildlife habitat on working landscapes. Specific target species (e.g., gopher tortoise) are used as barometers for success because their habitat needs are representative of healthy, functioning ecosystems where conservation efforts benefit a much broader suite of species. Through the Farm Bill, NRCS provides technical and financial assistance to participants who voluntarily make improvements to their working lands while the Service provides participants with regulatory predictability for certain species under

the ESA. This innovative approach empowers landowners with a means to make on-the-ground improvements and provides peace of mind that no matter the legal status of a species, they can keep their working lands working. This model has proven extremely popular with private landowners across the nation. To date, WLFW has helped producers conserve millions of acres of wildlife habitat and have helped many species such as the New England cottontail in the Northeast. For the cottontail — in large part because of voluntary conservation efforts on private lands — the Service determined listing under ESA was not warranted. Beginning in 2017, NRCS expanded this model and now includes 19 landscapes covering 48 States.

NGOs Conservation and Recovery Efforts

Wildlife Mississippi has recognized that mitigation is a great way to protect, restore and enhance significant wetlands, rivers and streams in Mississippi, and benefit listed species. It also recognizes that if it provides reasonably-priced mitigation credits to economic developers who must compensate for unavoidable impacts to wetlands and streams, it could help foster sustainable economic development and help expand and recruit business and industry, thereby increasing jobs in Mississippi. With this concept in mind, Wildlife Mississippi created the Mississippi Strategic Wetland Acquisition and Management Program, or Mississippi SWAMP for short. Today, Wildlife Mississippi owns and manages approximately 20,000 acres of mitigation lands, making it one of the largest owners of mitigation banks in the nation. These mitigation banks are in areas that not only help meet a significant ecological need but provide the greatest service to future economic development and some of the lowest cost mitigation credits in the United States. This allows Mississippi to have a competitive edge in competing for businesses and industries, putting more of its citizens to work. As an example, they have purchased over 8,000 acres and 34 miles of the Buttahatchie River in Northeast Mississippi. This river harbors six federally listed mussel species. They have developed most of these lands into mitigation banks, significantly benefitting economic development and improving water quality and habitat for these species and demonstrating how mitigation can be used to conduct landscape level conservation. Another example – they have purchased approximately 20 miles of Bayou Pierre, the only home known of the threatened bayou darter. They recently helped bring Continental Tire to Mississippi, adding over 3,000 new jobs, but using the mitigation Continental needed for the tire plant to purchase and restore another 1,000 acres along this critically important river. I believe healthy landscapes and healthy economies go hand in hand

To help support the efforts in recovering grizzly bears, the National Wildlife Federation works with ranchers grazing on public lands to eliminate livestock/grizzly conflicts in areas of high bear activity; the Greater Yellowstone Coalition has led efforts to bear-proof public campgrounds all around Yellowstone National Park; and rancher associations like the Madison Valley Ranch Lands Group and the Centennial Valley Association hired range riders to monitor and protect the livestock herds of their members. Similarly, collaborative efforts by state and federal officials in Delaware and Maryland, partnering with private forest landowner and the forest products industry, helped restore critical fox squirrel habitat across the Delmarva Peninsula. All to conserve species and allow working lands to work.

Industry ESA Conservation and Recovery Efforts

During my time as Regional Director, I also partnered with industry to implement landscape-scale restoration that meets both conservation and economic needs. One of the greatest areas of risk for large privately owned working forests is having forest management or harvest activities modified or restricted by decisions made under the auspices of the ESA.

The Service and states work with member companies of the National Alliance of Forest Owners (NAFO) are proactively collaborating to conserve at-risk and declining species – specifically, to provide young forest, open canopy, and riparian and aquatic habitats in actively managed working forests to help conserve at-risk and other rare species. Commercial forest management activities can be planned for as long as 10, 20, or 50 years into the future, and this at-risk species effort will position actively managed forests as contributing to the conservation of species, particularly species that need young forest, open canopy or riparian and aquatic habitats. The effort is based on mutual trust and the desire of all entities to build a lasting partnership that transcends administrations, personnel changes, and time. While it is still a developing partnership, progress towards affecting species conservation and lasting change is already being demonstrated, and NAFO is actively continuing the effort.

I also worked with Resource Management Service, LLC (RMS), an industrial timberland management and acquisitions firm, on the Coastal Headwaters Forest project. RMS invested in the Coastal Headwaters Forest project, which is unprecedented and could revolutionize the relationship between Southern timber, conservation and rural communities. Coastal Headwaters would also underscore the collaborative effort by the Service to conserve southern lands, create green corridors for protected and at-risk species and protect prime hunting and fishing areas. The Southeast Conservation Adaptation Strategy (SECAS), which is supported by the Service and more than two dozen Southeast state wildlife agencies, conservation groups and others, seeks to knit together large tracts of public and private land by 2060 to develop wildlife corridors and help protect areas that are high priority for wildlife and are shared goals for all. RMS Coastal Headwaters project is an important tract of land in this effort. This is one more example of industry working together with the Service, States and other partners to conserve species and the land they depend upon.

In 2014, the Service announced that Georgia aster does not require federal protection under the ESA, a decision reflecting years of conservation work by myriad partners including Georgia Power, a Southern Company energy provider. Georgia aster is a wide-ranging, but rare, purple-flowering plant found in the upper Piedmont and lower mountain regions of Alabama, Georgia, North Carolina and South Carolina. The plant has been a candidate for the federal endangered species list since 1999. Georgia Power and the Georgia Department of Transportation, two partners to the agreement, committed to measures that will conserve the species like agreeing to avoid broadcast spraying of herbicides near Georgia aster populations and marking populations to avoid damaging the plants during right-of-way maintenance. Southern Company is also working to conserve the robust redhorse, which was believed to be extinct for 122 years. Georgia Department of Natural Resources (DNR) biologists discovered several robust redhorse in the Oconee River near Toomsboro, Georgia. The Service and Georgia Power, along with many other partners, developed a Candidate Conservation Agreement with Assurances for

the robust redhorse in the Ocmulgee River, Georgia. The agreement involves the commitment of specified research and management actions in exchange for assurances to non-federal participants that further regulatory actions will not be undertaken if the legal status of the species were to change.

Conservation without Conflict

In meeting the responsibility to ensure the future of wildlife, Federal and state governments often use regulations to protect and manage species. Regulations have an important role in the history of conserving the abundance and diversity of the nation's fish and wildlife resources and ensuring access and opportunity to enjoy them, thus safeguarding our rich natural heritage for current and future generations. Nevertheless, regulatory actions don't always promote the collaboration that is necessary to achieve the level of conservation required to ensure the future of wildlife. Indeed, regulatory inflexibility can create a counterproductive and adversarial tension as landowners try to balance their individual priority needs with public expectations for conserving fish and wildlife. Across the country, and especially in the eastern United States, the future of fish and wildlife depends heavily on private landowners.

A collaborative approach, along with appropriate and effective incentives that recognize the benefits landowners provide to America's fish and wildlife, can help landowners keep working lands working. This approach realizes the economic and cultural benefits of working landscapes, allows recreational opportunities, and contributes to the enhancement of important habitats. Collaboration that promotes this essential balance of mutual gain among partners is more successful in providing conservation at the scales needed and will be more sustainable than a relationship relying on regulatory approaches alone or at all. This is the essence of Conservation without Conflict

Conservation without Conflict is both an approach and a coalition of numerous organizations. Members have diverse goals and values, including economic profit and sustainability, hunting, fishing and other outdoor recreation, conservation, national security, and public service that come together around common interests and in a sense of good land stewardship. The goal is to demonstrate that investments in collaborative conservation protects lands and the values we ascribe to them and ensures working lands work while conserving species. A Conservation without Conflict Summit will be held in March 2019 in Washington, DC as a follow-up to the initial meeting last year in Atlanta, Georgia.

A lot has been accomplished over the past year but there is more to do. There is a commitment to working cooperatively to conserve at-risk and listed species while both respecting and supporting the needs of landowners, industry, states and other Federal agencies. New organizations have joined in the collaborative approach to conservation. The Service has expanded its engagement and has support from leadership to continue to pursue the goals of operationalizing the principles of Conservation without Conflict across the nation.

This coalition is working to keep forests, farms, ranches and defense installations working for people and wildlife. The goal is to use sound science and proactive, collaborative conservation to recover listed species and conserve as many species of fish, wildlife and plants as possible, minimizing the need for the ESA's protections. If federal protection is required, creative use of

the ESA's flexibilities to apply existing tools, or develop new collaborative incentives as needed, to provide regulatory predictability and assurances for landowners' conservation efforts. With demonstrated success across the Northeast and the Southeast, and within limited areas across the country creating regulatory flexibility and incentives around at-risk and listed species, the hope is that this approach can be broaden to areas of the country that have challenges and obstacles blocking the conservation effort.

ESA Implementation and Resource Needs

Based on data from the Service, the ESA has saved species from extinction and conserved many more from needing the protection of the ESA – both need to be recognized. In a recent report by U.S. Geological Survey they reported that the State/Territorial Wildlife Action Plans identified 12,263 species, not including plants as Species of Greatest Conservation Need (SGCN). The list of SGCNs includes aquatic and terrestrial species that are at-risk or are declining, as well as many other species whose populations are of concern within a State's jurisdiction USGS compiled a comprehensive SGCN database: https://www1.usgs.gov/csas/swap/national_list.html that lists these species.

It is widely acknowledged that precluding the need to list a species under the ESA saves money. The cost associated with an ESA listing builds up quickly when you consider the cost of a proposed and final rule to list a species, a proposed and final rule for critical habitat, a possible 4(d) rule under the ESA, which allows for management flexibility, if a species is listed as threatened, and all of the actions (e.g., section 7(a)(2) consultations) after a listing occurs, including staff time and then the impacts to landowners from increase regulations. The cost only increases when a listing occurs. The Service and the States, along with appropriate stakeholders need to ensure every bit of flexibility under the ESA is explored, and new and innovative approaches for providing incentives and assurances to landowners are developed.

I believe that funding is one of the limiting factors in implementing the ESA and realizing successes. A common sense approach to conservation will help but even for that approach to work, more resources are needed. Staff is needed to develop agreements (e.g., Safe Harbor Agreements) that identify voluntary actions to be taken by those working on the landscape to conserve species that will also provide assurances or regulatory certainty. Species surveys and species status assessments need to be done but all these actions require funding, and unfortunately, both the Service and the States are limited by the resources available for conservation actions.

I know the effectiveness of ESA would increase if more funding was dedicated to the Services and the states. For the ESA to work as was intended, the agencies charged with overseeing and implementing it need to have the resources (e.g., staff and funding) necessary to conduct the work needed (e.g., developing agreements with assurances or section 7(a)(1) consultations) for those landowners regulated by the ESA.

It is important for Congress to hear from individuals and organizations involved in these collaborative efforts and to know that their colleagues in the House Appropriation Committee are leading an effort to improve the implementation of the ESA by using the flexibilities already inherent in the ESA. In FY 2018, the House Appropriation Committee added the following

language "...Based on feedback provided by the States, the Service is commended for its efforts in the Southeast to work with States and others to preclude the need to list many of the hundreds of species recently petitioned for listing. The effort demonstrated that the ESA can work when the Federal government treats States as equal partners and makes full use of flexibilities already inherent in the ESA to minimize regulatory burdens. The Service is expected to expand this model." And, then in FY 2019, the House Appropriation Committee added supportive language in the draft house bill that directs the increase in Candidate Conservation to the Service's Regions that "...have adopted the Southeast model of true collaboration with the States." This funding allows for voluntary, proactive work with partners and is not tied to the regulatory requirements of the ESA like listing and critical habitat designations. Conservation and recovery activities for species will be more successful if funding were available for the Service's recovery activities, their work to develop innovative agreements with assurances; the State activities that include proactive species conservation, recovery planning and implementation, and the work of State Wildlife Action Plans; and to develop agreements with private landowners that will provide assurances and an incentive for them to engage in conservation.

There have been numerous successful efforts to improve the efficiency and effectiveness of the ESA through administrative actions that has provided more flexibility over the years, all the while staying committed to the purposes and goals of the law itself. During my time as Regional Director, I demonstrated that the ESA has inherent flexibilities and, if implemented in a common sense approach, can work. Several improvements in the administrative processes (e.g., Habitat Conservation Plans, Candidate Conservation Agreements, etc.) over the years have made the ESA work better for both the species and for landowners. The Services continue these constructive and innovative improvements today, and I know the Service is willing to work with others to develop new tools under the ESA.

I am aware of the various bills proposed to amend the ESA. However, the ESA already has quite a bit of flexibility that allows us to recover those species federally listed, and conserve at-risk species so they do not need the protection of the ESA, but these flexibilities are not always used today. If ESA amendments are considered, I think it is important to think strategically about what works and what is really needed to improve the ESA. More process will slow the effectiveness of the ESA down and new terms that may be introduced could result in ambiguity. It is important to minimize the opportunities that allow the courts to get involved with ESA implementation because of the introduction of new terms or requirements that may not be defined or could be interpreted differently. I have demonstrated that some practitioners are already using the flexibilities already inherent in the ESA to conserve species while ensuring working lands work. What we really need is more time, new innovative tools, adequate resources to implement the ESA, and more people that use a common sense approach to implementation.

Invasive Species

An invasive species is one that is not native to an ecosystem and which causes, or is likely to cause, economic or environmental harm or harm to human health. In addition to the many invasive species from outside the U.S., there are many species from within the nation that are invasive in other parts of the country.

The Service is the only agency of the U.S. Government whose primary responsibility is the conservation of the nation's fish, wildlife, and plants. Because of these responsibilities, I know that the Service is very concerned about the impacts that invasive species are having across the Nation. Invasive plants and animals have many impacts on fish and wildlife resources. Invasive species degrade, change or displace native habitats and compete with our native wildlife and are thus harmful to our fish, wildlife and plant resources.

The Service has many programs addressing invasive species issues like the Aquatic Nuisance Species (ANS) Program with various programs on prevention such as "Stop Aquatic Hitchhikers" and the "Habitattitude" public awareness campaigns; staff that conduct activities related to the listing of organisms as injurious wildlife and staff that address invasive species issues through its work in integrated pest management and to promote the use of native plants as part of its efforts to protect pollinators and biocontrol

In addition to this work, the Service ensures it addresses invasive species issues on the National Wildlife Refuges, encompassing approximately about 96 million acres of wildlife habitat; impacts to at-risk, threatened and endangered species and the ecosystems on which they depend; and by using wildlife inspectors at the major U.S. airports, ocean ports, and border crossings to prevent the introduction of injurious wildlife through its wildlife inspection program. The Southeast was an area with quite a bit of invasive species challenges.

Conclusion

In closing, Mr. Chairman, I'd like to emphasize the importance of both the Service and the state's roles to conserve and recover imperiled species. These roles were clearly defined by Congress and provide for a role for both the federal agencies and the state agencies in the ESA. When the ESA is implemented more effectively and collaboratively, and with a common sense approach, you get benefits for those species already listed under the law and those species at-risk of needing the ESA protection, as well as for landowners.

Both the states and the Service rely upon having a science-driven, transparent decision-making process in which people and businesses in affected communities can participate easily and effectively. I know the Service and the states, especially those in the Southeast, are committed to conserving America's fish and wildlife by relying upon strong partnerships and creative, voluntary solutions to achieve conservation, minimize the regulatory burden and keep working lands working. Their commitment is demonstrated by the conservation successes they have seen. I believe what we really need is more time, new innovative tools, adequate resources to implement the ESA, and more people that use a common sense approach to implementation.

Thank you for your interest in recovering and conserving species and in the ESA implementation more generally. I appreciate the opportunity to testify here today. I would be pleased to answer to any questions you and other members of the Committee might have.

Links to documents for the testimony of Cynthia K. Dohner before the U.S. Senate Committee of Environment and Public Works on October 10, 2018.

"Improving Implementation of the Endangered Species Act: Finding Common Ground through Common Sense" Paul Henson, Rollie White, and Steve P. Thompson *BioScience*, biy093, https://doi.org/10.1093/biosci/biy093: Published: 29 August 2018

Section 6 Agreement between the U.S. Fish and Wildlife Service and Florida Fish and Wildlife Conservation Commission. Found at https://www.fws.gov/northflorida/Guidance-Docs/FWC_Section_6/20120514_ca_2012_FWS-FWC_Section%206_Coop_Agreement.htm.

The Department of Defense's "Gopher Tortoise Conservation and Crediting Strategy." Found at https://www.fws.gov/southeast/news/2017/03/fws-dod-adopt-credit-strategy-for-southeast-installations-benefiting-gopher-tortoise-and-other-species/

Compiled National List of Species of Greatest Conservation Need. Found at https://www1.usgs.gov/csas/swap/national_list.html

National Listing Workplan for the U.S. Fish and Wildlife Service. Found at www.fws.gov/endangered/improving_esa/listing_workplan_FY13-18.html.

Senator BARRASSO. And that will be included as part of the permanent record.

Ms. DOHNER. Thank you, sir.

Senator BARRASSO. Thanks for being here.

Senator Inhofe.

Senator INHOFE. Thank you, Mr. Chairman, for taking me out of turn. We have a conflict in the Armed Services Committee, but this is so significant to me that I wanted to be sure to get on record, as we have many times before, back at the time when I used to be chairing this Committee.

Our Oklahoma Department of Wildlife Conservation has been doing a great job conserving species in my State of Oklahoma. The Oklahoma Paddlefish Management Program was responsible for the fact that it is now thriving in Oklahoma, and yet other States are on the decline. The same thing is true—in fact, it has been taken off the listing of our swift fox, our mountain plover, which is a bird, have been withdrawn from the petition, so good things are happening there.

I would mention, though, that the lesser prairie-chicken was not one of our successes. I would say to Mr. Kennedy, we partnered, about 4 years ago, with New Mexico, Kansas, Texas, and Colorado, so the five of us, our States partnered together, put together a program for the lesser prairie-chicken, and it is one that was very, very successful. We increased the population. We had some buy in of various stakeholders to prevent threatening and listing, and yet the U.S. Fish and Wildlife—you have to keep in mind when you are dealing with a bureaucracy, there is this idea that they do a better job than we do at the State level.

Mr. Kennedy, I think some of the listings actually have a negative effect on the conservation efforts. Don't States have more flexibility when it comes to conservation efforts over the ESA? What is your experience?

Mr. KENNEDY. Chairman Barrasso, members of the Committee, Senator, I think that you explained it quite well. There is some frustration, and that frustration comes into play when you get passt the science and the good work that is taking place on the ground. There is some bureaucracy that can come and get in the way, certainly. I would agree with that.

These listings take a lot of time, and we have limited staff resources to deal with these, and certainly the U.S. Fish and Wildlife Service has limitations. If you look at the number of listings nationwide that takes place and the work that is required, there is no wonder why these things take a lot of time. It also diverts a lot of time and expertise away from the States and their current priorities that they are working on to work on these recovery goals and listing decisions.

So, in my opinion, the Endangered Species Act, I think I agree with all the comments that have been made and the testimonies that have been provided, but it has become a regulatory tool for litigants to direct Federal land management activities and/or State wildlife management goals, as opposed to a conservation measure.

Senator INHOFE. I appreciate that.

Mr. McCormick, I know the Farm Bureau has been very active in activating people, this concept that they care more about their

land than any bureaucrat in Washington does. As a matter of fact, we had Dan Ashe, who is the head of the Fish and Wildlife of the last Administration, and he actually learned himself. During his confirmation, I got a commitment for him to make two trips out to Oklahoma to talk to our landowners, and he came back with the idea that, in fact, that is a better way of doing it.

What has been your experience?

Mr. MCCORMICK. Mr. Chairman, I appreciate the opportunity to be here.

Senator Inhofe, I think you are exactly right. Farmers have but one goal, and that is to pass our land, our farms along to the next generation better than we found it today, and we certainly want to have wildlife there for our children and grandchildren.

Senator INHOFE. And you are aware of the Partnership Program? The Partnership Program is one that brings the landowners in with Fish and Wildlife, and that was what was expanded dramatically during that time, when the Administration actually was initially opposed to it.

So, is that working in Mississippi?

Mr. MCCORMICK. I am not aware of that, Senator, but I am sure our staff is.

Senator INHOFE. It is working well. Tell your staff they are doing a good job.

Thank you, Mr. Chairman.

Senator BARRASSO. Senator Carper.

Senator CARPER. Let me just wait. I can stay now. If others would like to go ahead. I am going to be here until the very end.

Senator BARRASSO. Senator Cardin.

Senator CARDIN. Well, thank you.

First, let me thank our witnesses.

Mr. Chairman, I have been to Yellowstone several times. I have been able to, at one time, observe a wolf. I think the wolf knew I was a member of the Senate because it took off right away, out of fear.

Senator BARRASSO. Professional courtesy?

Senator CARDIN. I think so. And I have observed bears at Yellowstone at safe distances, and safe distances is having someone smaller than you in front of where I was. I did that also.

I have never seen a grizzly. Have no desire to see a grizzly out in the wild, but I am glad to see that recovery is taking place.

I do take pride in Delmarva fox squirrel being delisted. I was in the Maryland part of Delmarva with the Secretary of Interior when we announced the delisting at Blackwater National Wildlife Refuge, which is one of the areas that expanded its capacity to have the habitat necessary for the Delmarva fox squirrel to be able to recover.

I have also been to Florida and seen many times manatees in the wild. It is an incredible sight to see and know the challenges at work there.

So, I am a strong supporter of the Endangered Species Act, recognizing that at times it does cause conflict. But in the way that it has worked over its years, it has been a cooperative effort. As Senator Carper mentioned in his opening statement, in most cases the listing and delistings occur in a cooperative way, not in litiga-

tion, although at times litigation is necessary. And as Ms. Dohner pointed out, litigation has brought some good results, and I appreciate that very much.

Ms. Dohner, I want to get to the point that you raised. I thought it was a very telling point. And that was that it is not just the listed species that benefits from the recovery work, but other species benefit as well. That has certainly been true in the Chesapeake Bay Watershed. What is happening at Blackwater is not just affecting the Delmarva fox squirrel, but you can look at bald eagles, you can look at so many other species that are flourishing as a result.

Could you just comment briefly that the Endangered Species Act and the recoveries that have taken place under that, the impact it has on the general environment, not just those listed species?

Ms. DOHNER. Yes, sir. Thank you for that, and thank you for your work in the Chesapeake Bay, because I grew up in that area, and I got to enjoy it all the time.

I believe that the Endangered Species Act is a very important law and one that serves as a catalyst to bring people together. I think that you have heard from some of the work that the other witnesses talked about, that the conservation efforts, when you bring people together, you can actually get a lot of work done, and the fear of regulation is one thing that brings people to the table.

Private landowners on the land want to work their lands. Military bases want to ensure that they can train. Timber companies want to ensure that they can cut their timber. And when you look at additional regulation, that could impact all of those sources and those aspects of the use of the land, so one of the things, when we got that large petition, is it brought everybody together. Everybody came together. It coalesced the interests so that we could work real hard to minimize the regulation that would go onto the landscape.

By doing that, we were able to find ways to conserve species. I said there was 171 that were conserved so far that don't need the Act's protection, which in itself is a success story. And you are able to go forward with all the lands that are continuing to work.

Senator CARDIN. Thank you for that.

I just want to mention one other area that has me concerned, and that is the challenges we are seeing on climate change and whether the Endangered Species Act is even strong enough to deal with some of these new challenges.

In Florida, red tide, we don't know exactly what has caused it, but it is unprecedented, the range and length of this red tide episode. They believe weather conditions have added to those concerns.

Do we need to look at our environmental laws, including the Endangered Species Act, as to whether it is adequate to deal with the challenges that we are facing as a result of climate change?

Ms. DOHNER. Sir, thank you for that question. I think the Endangered Species Act, the way it is currently written, requires the Service to work closely with the States and to evaluate the status of the species, and that includes anything as far as changes to the status of the species, so impacts from climate, impacts from habitat degradation, and those types of things. The judicial reviews that happen as part of the Endangered Species Act and the things similar to what the manatee was, they are challenging, they are frus-

trating, and it is hard work, but that process also brought everybody to the table and brought the Endangered Species Act evaluation open, it opened it up, and it was more public, and we were able——

Senator CARDIN. We will see how your successor deals with red tide. To me, that is going to be an incredible impact on species preservation in that region.

Ms. DOHNER. Right. That is all the way over to where I live in Destin, sir, so I understand that concern. And I do think that the Acts are going to be able to address those impacts in the future.

Senator CARDIN. Mr. Chairman, I ask unanimous consent to enter into the record a letter signed by 73 scientists expressing concerns regarding grizzly bear hunting in the Greater Yellowstone Ecosystem.

Senator BARRASSO. Without objection.

[The referenced information follows:]

Attachment 1. Letter to Matt Mead, Governor of Wyoming, dated April 25, 2018, signed by 73 scientists.

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.
USGS Research Wildlife Biologist and Research Station Leader (retired)
Lecturer and Senior Visiting Scientist, Yale School of Forestry & Environmental Studies (retired)
Livingston, MT

Kyle Artelle, Ph.D.
Postdoctoral Fellow and Biologist
University of Victoria and Raincoast Conservation Foundation
Bella Bella, British Columbia

Jonathan Balcombe, Ph.D.
Biologist and author
Boynton Beach, FL

Valerie S. Banschbach, Ph.D.
Professor and Chair,
Environmental Studies
Roanoke College
Salem, VA

Robert L. Beschta Ph.D.
Emeritus Professor
Forest Ecosystems and Society
Oregon State University
Corvallis, OR

Bradley Bergstrom, Ph.D.
Professor, Biology Department
Valdosta State University
Valdosta, GA

Goran E. D. Blomberg, Ph.D.
Wildlife Ecology,
Michigan State University (Retired)
Lansing, MI

Gail Blundell, Ph.D.
Retired, Division of Wildlife Conservation
Alaska Department of Fish and Game
Juneau, Alaska

Barbara Brower, Ph.D.
Professor, Department of Geography
Portland State university
Portland, Oregon

Heather Bryan, Ph.D.
Raincoast - MITACS Postdoctoral Scholar
Applied Conservation Science Lab
Department of Geography, University of Victoria
&
Biologist
Raincoast Conservation Foundation
Sidney, British Columbia

F. Stuart Chapin III, Ph.D.
Professor Emeritus of Ecology
Institute of Arctic Biology
University of Alaska Fairbanks
Fairbanks, AK

Guillaume Chapron, Ph.D.
Associate Professor, Department of Ecology
Swedish University of Agricultural Sciences
Riddarhyttan, Sweden

Peter Chesson, Ph.D.
Professor, Department of Ecology and Evolutionary Biology
University of Arizona
Tucson, Arizona

Susan G. Clark, Ph.D.
Joseph F. Cullman 3rd Adjunct Professor of Wildlife Ecology and Policy Sciences
School of Forestry & Environmental Studies, and
Fellow, Institution for Social & Policy Studies
Yale University - Kroon Hall
New Haven, CT

Scott Creel, Ph.D.
Professor, Department of Ecology
Montana State University
Bozeman, MT

Irene Crowe, Ph.D.
President
Pettus Crowe Foundation
Washington, DC

Brooke Crowley, Ph.D.
Associate Professor, Departments of Geology and Anthropology
University of Cincinnati
Cincinnati, OH

Chris Darimont, Ph.D.
Raincoast Chair and Associate Professor
University of Victoria
&
Director of Science
Raincoast Conservation Foundation

Megan Draheim, Ph.D.
Faculty, Center for Leadership in Global Sustainability
Virginia Tech
Arlington, VA

Lawrence K. Duffy, Ph.D.
Director, Resilience and Adaptation Program
University of Alaska Fairbanks
Fairbanks, AK

John G. Duman, Ph.D.
Gillen Professor of Biological Sciences
University of Notre Dame
Notre Dame, IN

Jorge Echegaray, M.S.
Environmental Sciences
Researcher at GADEN
Vitoria-Gasteiz, Alava, Spain

William J. Etges, Ph.D.
Professor
Program in Ecology and Evolutionary Biology
Department of Biological Sciences
University of Arkansas
Fayetteville, AR

Robert A. Evans, M.S.
Supervisory Wildlife Biologist
USDA Forest Service (retired)
Iron River, MI

Tracy S. Feldman, Ph.D.
Assistant Professor
Department of Natural and Life Sciences
St. Andrews University
Laurinburg, NC

Daniel C. Fisher, Ph.D.
Professor, Department of Earth & Environmental Sciences
Professor, Department of Ecology & Evolutionary Biology
University of Michigan
Ann Arbor, MI

Jed Fuhrman, Ph.D.
McCulloch-Crosby Chair of Marine Biology
Department of Biological Sciences
University of Southern California
Los Angeles, CA

Barrie K. Gilbert, Ph.D.
Senior Scientist (retired)
Department of Wildlife Resources
Utah State University
Logan, UT

Bob Gillespie, Ph.D.
Coordinator Agriculture and Natural Resource Program
Agriculture and Natural Resource Program
Wenatchee Valley College
Wenatchee, WA

Anthony J. Giordano, Ph.D.
Founder & Chief Conservation Scientist
S.P.E.C.I.E.S.
Ventura, CA

John Grandy, Ph.D.
Executive Director
The Pegasus Foundation
&
Representative
The Pettus Crowe Foundation
Washington, D.C.

Donna Hart, Ph.D.
Department of Anthropology (retired)
University of Missouri
St. Louis, Missouri

Rick Hopkins, Ph.D.
Senior Conservation Biologist
Live Oak Associates, Inc.
San Jose, CA

Malorri Hughes, M.S.
Ph.D. Candidate, Biology Department
Portland State University
Portland, Oregon

Marian Kaehler, Ph.D.
Professor
Department of Biology
Luther College
Decorahm, IA

Ken Keefover-Ring, Ph.D.
Assistant Professor, Departments of Botany and Geography
University of Wisconsin-Madison
Madison, WI

Knut Kielland, Ph.D.
Associate Professor
Dept. of Biology & Wildlife
Institute of Arctic Biology
Fairbanks, AK

Alex Krevitz, M.A.
Biologist
Coarsegold, CA

Jennifer Leonard, Ph.D.
Principal Investigator, Conservation and Evolutionary Genetics Group
Estacion Biologica de Doñana (CSIC)
Seville, Spain

John Laundre, Ph.D.
Assistant Professor, Department of Biology
Western Oregon University
Monmouth, Oregon

Jesse A. Logan, Ph.D.
Project Leader (retired)
Rocky Mountain Research Station
USDA Forest Service

Wayne P. McCrory, B.Sc. (Hon. Zool. UBC), RPBio.
President, McCrory Wildlife Services Ltd.
New Denver, B.C. Canada

Andrew Martin, Ph.D.
Professor
Department of Ecology and Evolutionary Biology
University of Colorado
Boulder, CO

John Miles, Ph.D.
Professor Emeritus
Huxley College of Environmental Studies
Western Washington University
Arroyo Seco, NM

Susan Morgan, Ph.D.
Board Chair
The Rewilding Institute
Arroyo Seco, NM

Michael Paul Nelson, Ph.D.
Professor, Department of Forest Ecosystems and Society
Oregon State University
Corvallis, OR

Ronald M. Nowak, Ph.D.
Staff Mammalogist (retired)
Office of Endangered Species
U.S. Fish and Wildlife Service
Falls Church, VA

Paul C. Paquet, Ph.D.
Professor, Geography Department
University of Victoria, Victoria, BC
&
Senior Scientist, Raincoast Conservation Foundation
Sidney, BC

Debra Patla, M.S.
Research Associate
Greater Yellowstone Ecosystem Amphibian and Wetland Monitoring Project
Northern Rockies Conservation Cooperative
Moran, WY

Rebecca Parmenter, M.S.
Region II, NEPA Biologist (Retired)
U.S. Forest Service
Broomfield, CO

Kathleen Perillo, M.S.
Professor
Earth and Environmental Science
Clark College
Vancouver, WA

Mike Phillips, M.S.
Executive Director
Turner Endangered Species Fund
Bozeman, MT
&
State Senator, District 31,
Bozeman, MT

Eric R. Pianka, Ph.D.
Professor, Integrative Biology
University of Texas
Austin, TX

Rich Reading, Ph.D.
Associate Research Professor
Department of Biology
University of Denver
Denver, CO
&
Director of Research and Conservation
Butterfly Pavilion
Westminster, CO

Ian J. Renne, Ph.D.
Associate Professor, Department of Biological Sciences
Youngstown State University
Youngstown, OH

William J. Ripple, Ph.D.
Distinguished Professor of Ecology
Oregon State University
Corvallis, OR

Andrew Rowan, Ph.D.
Chief Scientific Officer
The Humane Society of the United States
Washington, DC

Paula Schiffman, Ph.D.
Professor
Department of Biology
California State University
Northridge, CA

Heidi H. Schmidt, M.S.
Curatorial Assistant
Missouri Botanical Garden
Saint Louis, MO

Richard C. Schultz, Ph.D.
Professor
Natural Resource Ecology and Management
Iowa State University
Ames, Iowa

Thomas C. Shirley, Ph.D.
Professor Emeritus
College of Fisheries & Ocean Sciences
University of Alaska Fairbanks
Fairbanks, AK
&
Professor Emeritus
Department of Biological Sciences
Texas A&M Univ.-Corpus Christi
Corpus Christi, TX

Steven R. Sheffield, Ph.D.
Professor of Biology
Department of Natural Sciences
Bowie State University
Bowie, MD

Winston P. Smith, Ph.D.
Principal Research Scientist
Institute of Arctic Biology
University of Alaska
Fairbanks, Alaska

Stephen F. Stringham, Ph.D.
President WildWatch
Director - Bear Viewing Association
Soldotna, Alaska

Teresa Telecky, Ph.D.
Vice President, Wildlife Department
Humane Society International
Washington, DC

Margaret K. Thayer, Ph.D.
Curator Emeritus, Field Museum, Life Sciences
Lecturer, Committee on Evolutionary Biology
University of Chicago
Chicago, IL

Blaire Van Valkenburgh, Ph.D.
Professor
Department of Ecology and Evolutionary Biology
University of California
Los Angeles, CA

Vic Van Ballenberghe, Ph.D.
Research Wildlife Biologist (retired)
U.S. Forest Service, Pacific Northwest Experiment Station
Anchorage, Alaska

Sacha Vignieri, Ph.D.
Senior Editor, *Science*
Seattle, WA

Samuel K Wasser, Ph.D.
Endowed Chair in Conservation Biology
Director, Center for Conservation Biology
Research Professor, Department of Biology
University of Washington
Seattle, WA

Jonathan G. Way, Ph.D.
Founder, Eastern Coyote/Coywolf Research
Osterville, MA

Matthew Weirauch, Ph.D.
Associate Professor, Department of Pediatrics
University of Cincinnati
Cincinnati, Ohio

Robert Wielgus, Ph.D.
Professor and
Director Large Carnivore Conservation Laboratory
Washington State University
Pullman, Washington

cc:
U.S. Senator John John Barrasso
U.S. Senator Mike Enzi
U.S. Congresswoman Liz Cheney
Diane Shober, Wyoming Office of Tourism
Scott Talbott, Director, Wyoming Game and Fish Department
Mark Anselmi, President, Wyoming Game and Fish Commission

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

October 8, 2018

The Honorable John Barrasso
Chairman, Committee on Environment and Public Works
United States Senate
410 Dirksen Senate Office Building
Washington, DC 20510

The Honorable Thomas Carper
Ranking Member, Committee on Environment and Public Works
United States Senate
456 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Barrasso and Ranking Member Carper:

Thank you for the opportunity to provide a written statement for the Committee's October 10, 2018 hearing entitled, "From Yellowstone's Grizzly Bear to the Chesapeake's Delmarva Fox Squirrel—Successful State Conservation, Recovery, and Management of Wildlife". Please accept these comments for the hearing's official record.

My Background and Expertise

For the record, my name is David J. Mattson, a scientist and recently 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, D.C.) 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).

My Expert Opinion in Brief

The grizzly bear sport hunt and other lethal management planned by Wyoming, Montana, and Idaho upon divestiture of federal management will likely cause irreparable harm to Greater Yellowstone's grizzly bears. This irreparable harm will occur not only immediately upon implementation of this management regime, 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, with each point building on the ones before to clarify how implementation of foreseeable changes under auspices of state management 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.

Yellowstone's Grizzly Bear Are Unlike Any Others

The grizzly bears killed during purposeful population reductions and related lethal management 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.

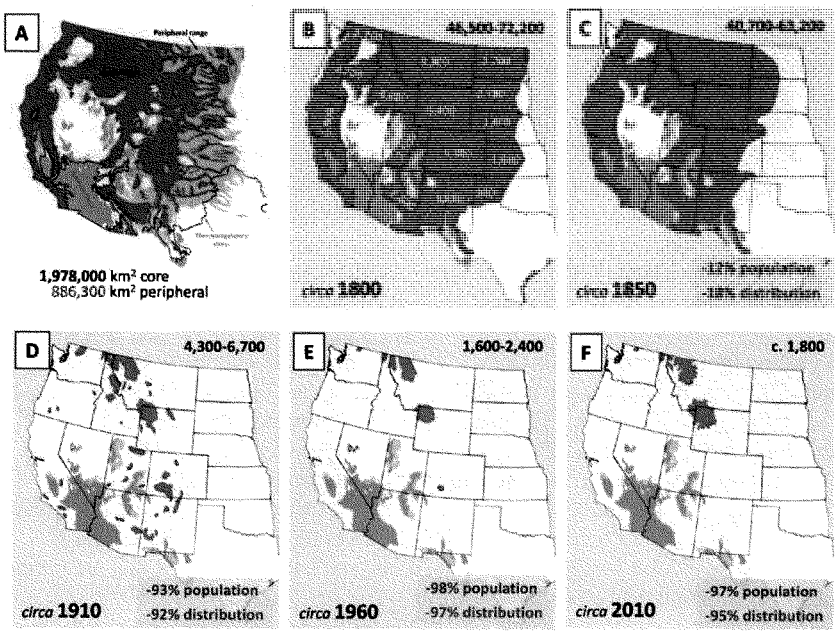


Figure 1. Losses of grizzly bear numbers and distributions in the western contiguous United States between 1800 and 1960 (Panels B, C, D, and E) along with the extent of gains since roughly 1970 (Panel F), largely under ESA protection. The extent of grizzly bear distributions at each time step are shown 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 important. 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 1-2% 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 4[1]) of brown bears that was one of three clades and 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 that resulted 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 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 auxliaris*), whitebark pine seeds (*Pinus albicaulis*), elk (*Cervus elaphus*), bison (*Bison bison*), and, prior to 2000, 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 in this more northern region obtain most of their meat from livestock and deer rather than elk and bison (Aune and Kasworm 1989), very few seeds anymore

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

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 unique whether reckoned ecologically, evolutionarily, or historically.

Grizzly Bears Are Vulnerable Because Of Their Life History

Greater Yellowstone grizzly bears are acutely vulnerable to any human-caused mortality 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 their need for quality forage in spring and fall, their low triennial productivity, and

the strong philopatry[2] of female offspring to maternal home ranges."

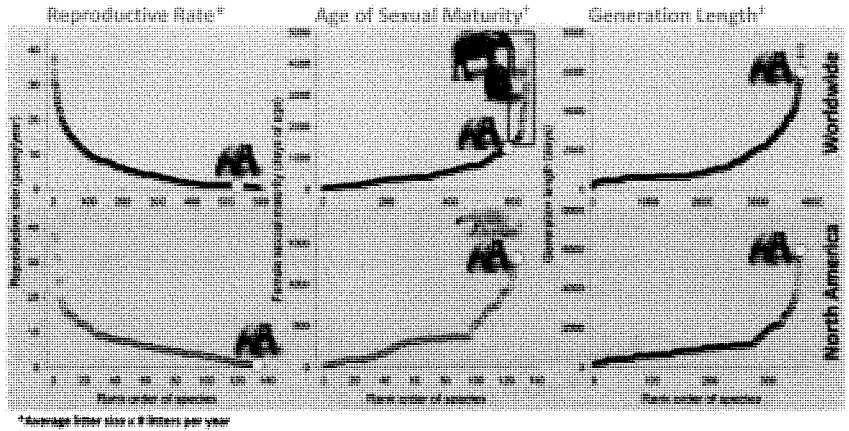


Figure 2. Signifiers of population productivity for grizzly bears (large yellow dots) relative to all other terrestrial mammals, worldwide (top) and in North America (bottom). Sources: Ernest, S. K. (2003). Life history characteristics of placental nonvolant mammals. Ecology, 84(12), 3402-3402. https://doi.org/10.6084/m9.figshare.c.3297992.v1; 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

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 (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 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 (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

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

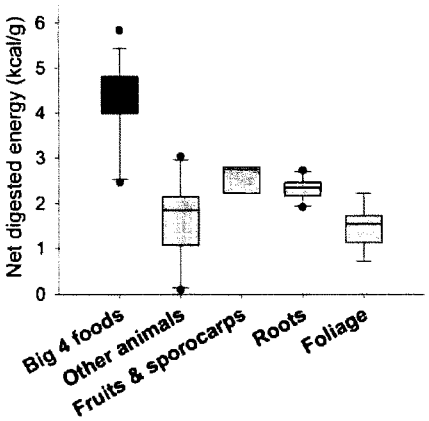


Figure 3. Median net digested energy available from the "Big 4" bears foods (whitebark pine seeds, army cutworm moths, meat from bison and elk, and cutthroat trout) versus all other known, alternate, foods in the GYE.

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.

Yellowstone's Grizzly Bears Are Vulnerable Because Of Isolation

The effects of human-caused mortality are 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.

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 and purposeful population reductions.

Yellowstone's Grizzly Bears Are Threatened by Environmental Change

All of these foundational considerations of relevance to human-caused mortality 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 I describe above, 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 I elaborate below, the losses of cutthroat trout and whitebark pine likely catalyzed dietary changes that resulted in increasing grizzly bear mortality and stalling population growth.

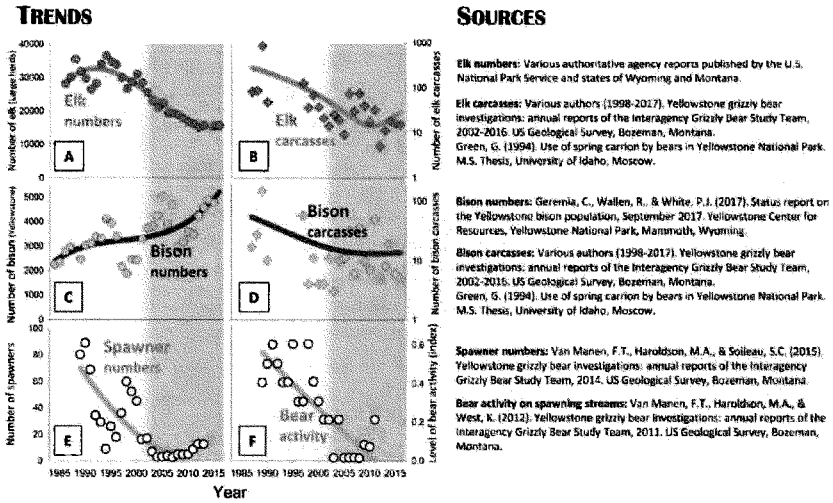


Figure 4. Summary of trends in availability of three important Greater Yellowstone Ecosystem grizzly bear foods, including: (A) size of the Northern Yellowstone and Jackson elk herds; (B) numbers of elk carcasses counted along fixed transects in Yellowstone National Park; (C) size of the Northern and 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).

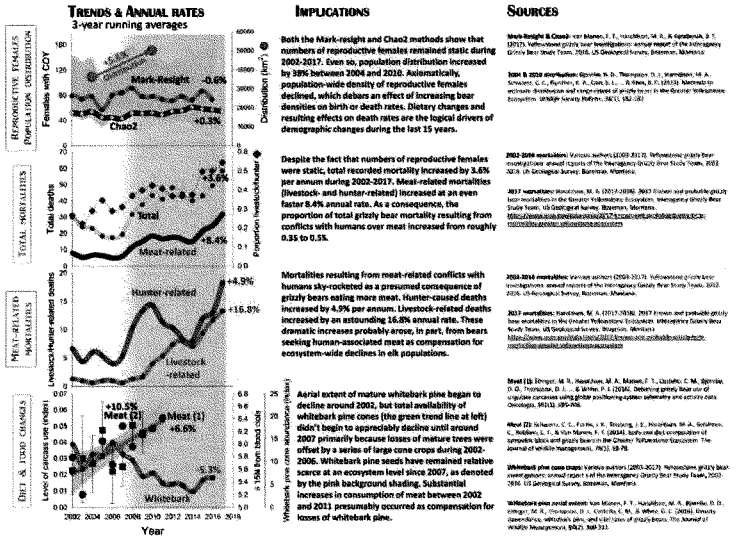


Figure 5. Synopsis of population, mortality, and dietary trends of Greater Yellowstone Ecosystem grizzly bears relevant to dynamics unfolding from 2002 to 2017. Sources for each data time series are provided farthest right, with a brief discussion of implications provided in the middle column. The pink-shaded 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, invariate 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.

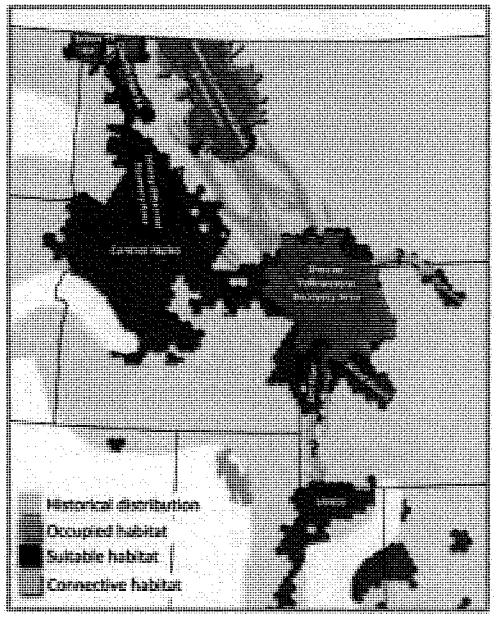
Connectivity is Necessary and Possible

Given the magnitude of historical losses (98 percent), comparatively small subsequent gains (approximately 1-2 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 state management plans promise to do the opposite and, given the problematic context that I describe above, 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, corridors sufficient to host transient grizzly bears—independent of capacity to sustain permanent residents—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.

State Management Will be Highly Lethal and Not Subject to Remedy

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 was planned to start 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.

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 FWS 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. 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 a rearview mirror, with relevant estimates lagging well behind unfolding real-time conditions.

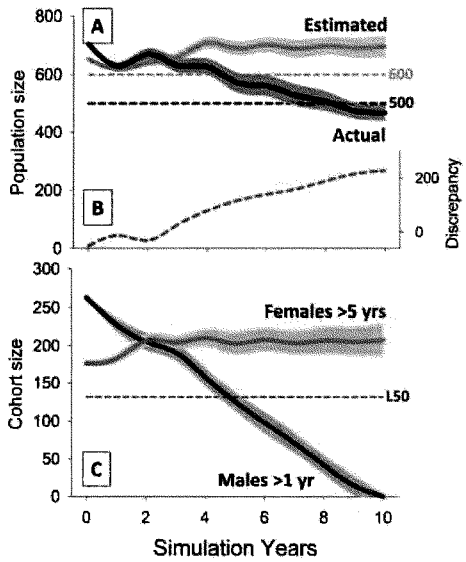


Figure 7. 10-year population projections simulating implementation of MOA protocols for management of grizzly bears inside the Yellowstone DMA. Estimated population size increasingly exceeds real population size over time (A), with over-estimates reaching near 200 bears by 10 years out (B), largely because 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 male-biased mortality, as planned by the states of Wyoming, Montana, and Idaho, will likely remain undetected and thereby debar timely correctives on the part of GYE grizzly bear managers—at the same time that these managers are purposefully instituting a hunt designed to reduce the bear population.

The Spatial Configuration of Planned Sport Hunting Will be Harmful

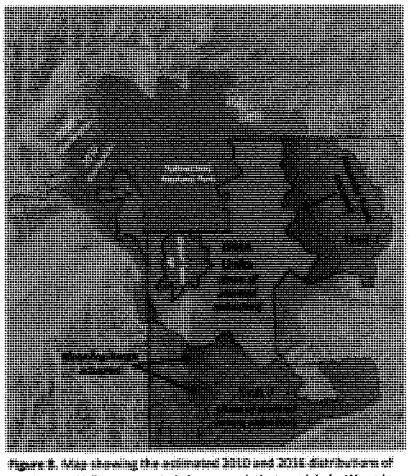


Figure 8. Map showing the estimated 2010 and 2016 distributions of the Greater Yellowstone grizzly bear population overlain by Wyoming and Idaho hunting units within which grizzlies will be sport hunted beginning September 1, 2018. Hunting units within the Demographic Monitoring Area (DMA) are differentiated 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.

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 planned 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 majority of their current distribution. In other words, hunting will directly and indirectly affect 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, 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.

State Plans Will Essentially Eliminate Grizzly Bears Outside the DMA

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 planned to sport hunt as many as twelve grizzly bears in areas outside the DMA during its fall 2018 hunting season. Two of these bears would have prospectively been adult females. Given that there are almost certainly no more than 90-100 bears outside the DMA, the sport hunt alone would have killed 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. 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, 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.

State Management of Conflicts is Deficient, More So in the Future

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 or other lethal management. As I note above, 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.

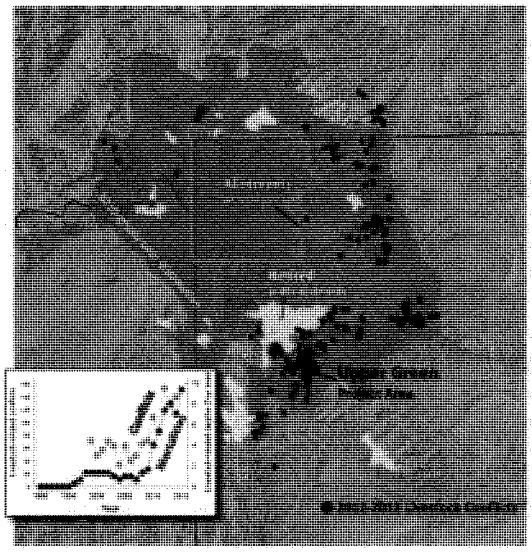


Figure 9. Distribution of grizzly bear depredation on livestock and related conflicts in the GYE during 2012-2013 (dark red dots) along with *circa* 2010 grizzly bear distribution (green), recently retired public land grazing allotments (yellow) and active allotments identified as having chronic conflicts.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

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.

Mortality During 2018 is Already Excessive

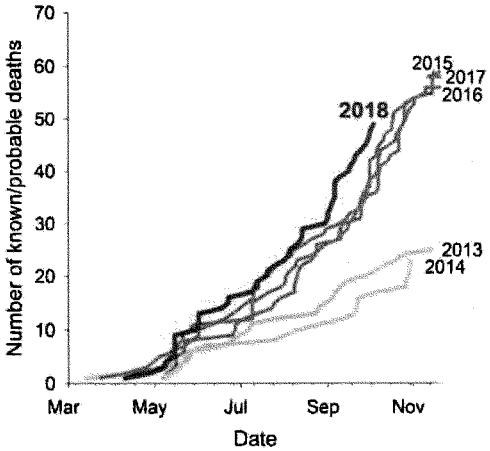


Figure 10. Annual accumulation curves for known and probable grizzly bear deaths in the GYE during 2013-2018. Deaths are attributable to all causes both inside and out of the DMA. The tally for 2018 is current through October 6th.

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 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 sport hunts that were planned in Wyoming and Idaho during September-October 2018.

Hunting Will Add Mortalities, Not Compensate for Conflict Mortalities

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), Robbinson 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.

Harm Caused By Hunting Will Be Compounded By Indirect Effects

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 depensatory effects on birth and death rates (Stringham 1980, Swenson et al. 1997, Wielgus et al. 2013, Gosselin et al. 2015, Frank et al. 2017, Bishof 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; Bishof 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 depensatory effects that amplify the more immediate negative effects of elevated mortality among grizzly bears occupying hunting units managed by the States of Wyoming, Montana, and Idaho.

As Currently Planned, State Management Will Cause Irreparable Harm

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 planning 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 depensatory, 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.

I am not alone in this conclusion. Seventy-two other scientists raised similar concerns in a 2017 letter to Governor Matt Mead of Wyoming (see Attachment 1).

David J. Mattson, Ph.D.

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Senator CARDIN. Once again, thanks to the witnesses.

Senator BARRASSO. Thank you, Senator Cardin.

Mr. Kennedy, we have some poster boards from your agency, and they show the growth in the human-bear incidents. There are a couple over there—I think it was 1990s, 2013—as the bear continues to spread out beyond the Yellowstone area into places south of Jackson, into the Wind River Reservation, surrounding communities.

How is this relisting of the bear complicating your efforts to manage the human-bear incidents that continue to occur?

Mr. KENNEDY. Chairman Barrasso, members of the Committee, as you can see with these representations up in front of us, the conflicts, that is, the conflicts in yellow in a different period of years, have increased significantly since 1990, that is for sure, and that is consequential to the increase in both density and distribution of grizzly bears as the population reached and exceeded recovery.

As you mentioned early in the introduction, Chairman Barrasso, the most grave example of increased conflicts is illustrated by the number of human deaths attributed to grizzly bear attacks. Prior to 2010 it had been over two decades since a person was killed in the Greater Yellowstone Ecosystem by a grizzly bear, and since then, unfortunately, there have been seven, with the most recent occurring just a few weeks ago, as you had referenced.

The process now is complicated, certainly compared to when it is under the State's management responsibilities. Dealing with conflict grizzly bears will now require authorization by the Grizzly Bear Recovery Coordinator for the U.S. Fish and Wildlife Service in any case where a bear needs to be removed from the populated or translocated, so this often means that a person from the Federal Government who does not live in Wyoming or have any experience dealing with conflict bears makes the final decision as to how to handle these cases.

Having said that, I would say that since this most recent decision to relist, the U.S. Fish and Wildlife Service has supported our recommendations to date. So, other than a more complicated process and perhaps more time, we are able to deal with these conflicts as fast as we can.

Senator BARRASSO. You said someone living outside of Wyoming, never ever been there; I would like to read a quote for you from the New York Department of Environmental Conservation regarding bear management. This is what they said. They said, "As bear populations increase, and more people choose to live and recreate in areas occupied by bears, human-bear conflicts also increase. Thus, managing bear populations is critically important, and managers are challenged to balance diverse public interests in bears with concern for public safety."

So, in 2017, let's talk about what State wildlife officials permitted the taking of around the country. I think you are going to see the slide over there. Oregon, 1,700 black bears; New York, 1,400 black bears; Vermont, over 600 black bears; New Jersey, over 400 black bears; Massachusetts, 268 black bears.

Now, Wyoming proposed to only take 22 bears in 2018 as a part of a hunt.

Do you agree with the statement from the New York Department that managing bear populations, including through hunts, is necessary to balance the needs of the bears with public safety?

Mr. KENNEDY. Chairman Barrasso, members of the Committee, I do agree with that. I do agree with that statement, and we have seen that, and the States have a proven track record with respect to the regulated hunting of other species. And the 22 bears that you referenced in Wyoming for the grizzly bear, what was the proposed grizzly bear hunt, was extremely conservative.

Hunting has played an instrumental role in the recovery and health of wildlife populations; it is not only a pragmatic and cost effective tool for managing populations at desired levels, but as you point out, Chairman Barrasso, it also generates public support ownership of the resource and funding for conservation. And almost of equal importance, it provides a greater tolerance for some species such as large predators that may cause safety concerns, as we are talking about here.

Senator BARRASSO. I appreciate that.

Mr. McCormick, we are going to show a chart that talks about additional species being considered for listing under the Endangered Species Act. I think you are familiar with this. What we are looking at, by 2023 it looks like the State of Mississippi is expected to get anywhere between 21 and 40 new Endangered Species Act listings coming up in the next couple of years. In fact, the entire Southeast seems to be getting a disproportionate number in terms of the impact, so each listing could have serious economic impacts to farmers and small business owners in your State.

I see Senator Boozman looking at it. It looks like Arkansas is in exactly the same situation, with anywhere from 21 to 40.

Is there concern among farmers in your State about litigation, activist judges who may move the goal posts, ignoring what your State wildlife conservation efforts have been doing if these new listings in Mississippi occur?

Mr. MCCORMICK. Mr. Chairman, thank you for the question. Absolutely would be the short answer. It seems that this has been more of a western issue that is now spreading into the Southeast, and I think the biggest thing that we probably need to recognize there is in the western States you are dealing with a lot of public lands. In the State of Mississippi, 89 percent of our land is owned by private landowners, and I suspect that to be the same in Senator Boozman's State and across the Southeast.

So, you are talking about a bigger impact on a wider range of our population that owns that land, so it is going to be challenging for us, as an organization, to get the information out on how to comply with these new regulations to those farmers and ranchers that may have smaller areas that they are going to have to deal with. But certainly, our biggest issue would be to make sure that the information flow gets out to those individuals. We want to work with the State agencies because we have a common goal, and that is for conservation of our land.

Senator BARRASSO. Thank you very much.

Senator Carper.

Senator CARPER. Thanks, Mr. Chairman.

Before I ask some questions of our witnesses, I want to make a unanimous consent request. I received any number of letters and written testimonies in response to this hearing, including a letter from the Delaware Division of Fish and Wildlife, stating the importance of the Endangered Species Act and Federal agencies in species recovery.

I also received letters from Dr. Jane Goodall, from Patagonia, from tribal leaders and Members of Congress, and I would just ask unanimous consent to enter these letter and other supplemental materials into the record.

Senator BARRASSO. Without objection.

Senator CARPER. Thanks so much.

[The referenced information follows:]

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENTAL CONTROL
DIVISION OF FISH & WILDLIFE
89 Kings Highway
Dover, DE 19901

OFFICE OF THE DIRECTOR

Phone: (302) 739-9910
Fax: (302) 739-6157

October 9, 2018

The Honorable John Barrasso and Thomas R. Carper
Senate Committee on Environment and Public Works
United States Senate
Washington, DC 20510

Dear Chairman Barrasso and Ranking Member Carper,

The Delaware Department of Natural Resources and Environmental Control, Division of Fish & Wildlife, welcomes the opportunity to profile the role of the Federal Endangered Species Act (ESA) in the recovery of the Delmarva fox squirrel. The ESA was instrumental in the collaborative recovery of the species involving the U.S. Fish and Wildlife Service and state wildlife agencies, as well as private landowners and conservation partners on the Delmarva Peninsula.

Delmarva fox squirrels historically ranged throughout the Delmarva Peninsula, comprised of portions of Delaware, Maryland and Virginia, until forest habitat loss and unregulated harvest contributed to the precipitous population decline of the species. The Delmarva fox squirrel was included on the first Endangered Species list upon the creation of the ESA in 1967, stimulating efforts by state and federal wildlife agencies and private landowners to take the actions needed to restore the species' numbers and range.

Since its initial listing under the ESA, significant conservation and recovery efforts have occurred throughout the Delmarva fox squirrel's range. Research on life history and innovative technology such as DNA analysis were pioneered to improve population studies. Relocations of Delmarva fox squirrels helped reestablish new sub-populations that, along with habitat and other protections, contributed to the recovery of the species. In Delaware, recovery efforts included relocations of squirrels from Maryland to Prime Hook National Wildlife Refuge and the state Assawoman Wildlife Area, followed by habitat and other protections, installation of nest boxes, and population monitoring that helped initiate the recovery of the species in Delaware.

The recovery of the Delmarva fox squirrel and its removal from the ESA in 2015 is a success story on the recovery of a species that was at risk of extinction. The ESA provided the necessary protection, funding, staff, and critical coordination needed to leverage resources for the benefit of

future generations. We look forward to further conservation and expansion of the Delmarva fox squirrel in Delaware, including implementation of our Delmarva Fox Squirrel Conservation Plan, by working with our federal partners and private landowners to build upon the recovery of the species made possible by the ESA.

Sincerely,

David E. Savcikis
Director

Written Testimony of Dr. Jane Goodall

Founder, The Jane Goodall Institute

U.S. Senate

Environment and Public Works Committee

October 22, 2018

Thank you for this opportunity to express my strong support for the Endangered Species Act (ESA) and the federal and state partnerships that have been so instrumental in making the act as effective as it has been. It is my considered opinion that we should continue to maintain these partnerships, otherwise it will undermine the implementation of the act and make it more difficult to protect and recover endangered species.

We, as humans, are fortunate to share the Earth with such a magnificent diversity of life forms, but Earth's biodiversity is dwindling at an alarming rate. In just over 100 years, the population of wild chimpanzees has dropped from an estimated one – two million (probably closer to two million), to as few as 350,000, many of them living in fragmented patches of forest with little hope of long term survival. This is only one example of the decline in the population of a species the same decline is evident in almost every species, of wild animals including many in the United States. Indeed, we are experiencing what science describes as "The Sixth Great Extinction." A 2017 study found that of the 27,600 land-based mammals, birds, amphibians and reptile species studied, nearly one-third are shrinking in terms of their population numbers and territorial ranges. In the last 40 years, we have lost about half of all wild animal species on Earth. Further, the rate of extinction is happening at about 100 times faster than what would be expected from studies of the fossil record.

Given this crisis, we must, at all levels of government, especially through partnerships at the federal and state levels continue to support the most successful piece of legislation for combatting species extinction - and indeed seek to continue working to strengthen it. We have a moral responsibility to protect the incredible life forms with which we share this planet for now and for future generations.

Thanks to the ESA, we've been able, to some extent, counter the rate of extinction - it has been estimated that over 200 species of animals and plants would have been wiped from our planet between 1973 and 2005 if it were not for the interventions of the ESA. Thanks to the ESA, ninety-nine percent of species listed under the Act have survived and many more have been set on a path to recovery, including the iconic American Bald Eagle, the Grizzly Bear and the Florida Manatee all of which have benefitted from support at both the federal and state levels in the United States. The ESA is one of the only pieces of legislation that has long prevented the unique American landscape from turning into barren wasteland and is one of the few that has provided critical protections to imperiled species worldwide - such as elephants and tigers, as well as marine mammals such as whales and turtles who migrate between international waters, thus necessitating international cooperation.

Any limitation to the federal and state partnerships that have facilitated these protections would make it more difficult for endangered and threatened species to recover. The recovery process is often too large and too complex for any one governmental entity to bear. By transferring key authority of wildlife management solely to state officials who all too often lack the strong legal mandate, funding and sometimes the political will to adequately address the threats to imperiled species will hinder or even prevent species recovery.

Surely, we do not want to live in a world without the great American Grizzly Bear? A world where we can no longer marvel at the magnificent flight of bald eagles or hear the howl of wolves under the moon? A world where we eliminate the great apes, our closest living relatives in the animal kingdom? What would our grandchildren think if these magical images were only to be found in books?

I urge you to continue your support of the ESA through partnerships at the federal and state level for imperiled species at risk of disappearing forever, and further extend or increase protections under the Act to help secure adequate funding for projects to protect the world's vanishing wildlife.

Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, DC 20510

October 9, 2018

Dear Committee Members,

On behalf of Patagonia, an outdoor clothing company based in Ventura, CA with retail locations spread across 18 states, we the undersigned write to encourage reflection and restraint as you consider a suite of legislative amendments that would irreparably erode the Endangered Species Act ("ESA"). Passage of the ESA by a unanimous vote of the Senate in 1973 represented a remarkable moment of bipartisanship and vision. "The most comprehensive legislation for the preservation of endangered species ever enacted by any nation," as hailed by the Supreme Court, remains a model of long-term, science-based decision-making in an era where shortsightedly cashing out decades of investment in the conservation of public lands has become politically expedient.

We oppose any and all efforts to weaken America's landmark wildlife conservation law, which serves as our last line of defense in preventing permanent species extinction.

With roughly one third of the world's species of plants and animals presently at risk of extinction, the ESA stands as a necessary bulwark whose protections have succeeded in preventing more than 99% of listed species from disappearing forever. To chip away those protections under the pretense of deference toward state management authority would betray the millions of Americans who rely on the ESA as their best hope in the midst of a global extinction crisis. There is no doubt that the proposals under consideration – including stripping citizens of their rights to petition and access to the courts, and giving away federal authority to protect and recover wildlife species that belong to *all* American citizens – would irreversibly hobble the ESA.

Patagonia employs over 1500 people across the U.S., many of whom are constituents of Committee members, and our community cares deeply about these issues. Our company's ethos is grounded in a deep care for the environment and our responsibility to protect wild places and the wildlife who live in those places. For over 30 years, we have given 1% of sales to grassroots environmental organizations to invest in critical fights for the protection of our environment - to date we have given over $90 million in grant funds. Over that time, we have invested $23 million alone into biodiversity and species protection. Any attempts to weaken the ESA undermines these investments.

Maintaining the ESA as it is written also makes economic sense. Numbers released in April 2017 from the Outdoor Industry Association on the size and impact of our recreational economy demonstrate the impact of the outdoors: $887 billion in consumer spending, 7.6 million jobs, $65.3 billion in federal tax revenue; $59.2 billion in state & local tax revenue. Visitors to national parks and other public lands spend $28 billion per year on outdoor recreation, leading to more than 400,000 private and public sector jobs. In the Greater Yellowstone Ecosystem alone, wildlife-related tourism injects more than $1 billion into the regional economy each year. The opportunity to

259 West Santa Clara Street, 93001-2717, P.O. Box 150, Ventura, CA 93002-0150 (805) 643-8616 FAX (805) 653-6355 patagonia.com
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view grizzly bears, wolves and other species, safeguarded by the law in their natural habitat, drives a significant portion of this economy.

I respectfully urge you to protect the values – and the *value* – of America's wildlife heritage by refusing to undermine the legislation upon which it depends.

Sincerely,

Lisa Pike
VP of Environmental Activism, CA

Scott Overbey
Eastern District Manager

Julia Wright
Northwest District Manager

Julia Henderson
West Coast District Manager

Brenna Cohen
New York District Coordinator, NY

Annie Wilson
Manager, Patagonia Salt Lake City, UT

Aaron Altshuler
Manager, Patagonia Reno, NV

Kelly Muedeking
Manager, Patagonia Portland, OR

Sam Dingley
Manager, Patagonia Seattle, WA

Sloan Richardson
Manager, Patagonia Atlanta, GA

Megan Duffy
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General Manager Wholesale, HI

259 West Santa Clara Street, 93001-2717, P.O. Box 150, Ventura, CA 93002-0150 (805) 643-8616 FAX (805) 653-6355 patagonia.com

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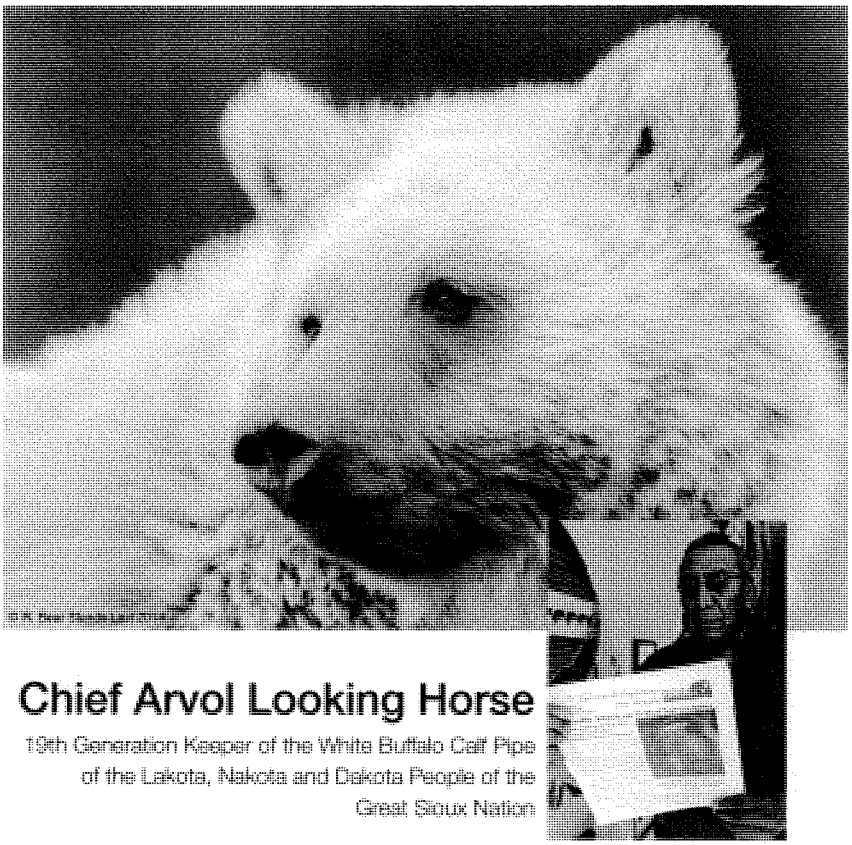

Chief Arvol Looking Horse

19th Generation Keeper of the White Buffalo Calf Pipe
of the Lakota, Nakota and Dakota People of the
Great Sioux Nation

Statement opposing the federal government's intention to remove the sacred grizzly bear from Endangered Species Act protections and allow the states of Wyoming, Montana and Idaho to trophy hunt the Great Bear on Ancestral Lakota, Nakota and Dakota Lands, and on other traditional Tribal Homelands.

"The birth of the white ones among the *Wámakaškaŋ*, the grizzly bear with a white coat, is a message that is loud and clear for us. We are at that crossroads. Our message to those in authority needs to be equally clear and direct . . ."

Mitakuye pi – my relatives, I come to you with a good heart and in a good way. My name is Arvol Looking Horse, and I am the 19th Generation Keeper of the Sacred Pipe that was brought to our people by *Pte-san win-yan*, the White Buffalo Calf Woman. I would like to speak with you about *Mato*, the grizzly bear. In our language we have no word for "animal," we say *Wámakaškaŋ*, the living beings of the earth, and we respect each as members of their own nations – *Pte Oyate*, the Buffalo Nation, *Wanbli Oyate*, the Eagle Nation, and so forth. *Mato Oyate*, the grizzly bears, have given the Lakota, Dakota and Nakota of the Great Sioux Nation many blessings. I am a medicine person and a traditional spiritual leader for our people. I was 12-years-old when I first received the sacred bundle, and I learned our way of life and how we follow the *Wámakaškaŋ*. We have to honor and respect *Mato Oyate*, the grizzly bears, and secure a place in this world for them because the grizzly bears have an important place in our ceremonies. The medicine *Mato* gives us, the Bear Medicine, is used in a lot of different ways, and those ways heal our bodies. The grizzly bear is a living spirit that is a part of our ceremonies and our ancestors have been using the medicine given by the grizzly bear for generations. *Mato Tipila* is a central place where our medicine people still come and pray for *Mato*, the grizzly bear. Our ancestors named this sacred site after the grizzly bear, but when it was made a National Monument the Department of the Interior called it Devil's Tower.

We follow what the White Buffalo Calf Woman taught us, to walk upon the earth in a sacred manner. In our ceremonies we learn that everything has a spirit. The elders who put you through those ceremonies help you to understand that, so you can speak from your heart and comprehend that life is sacred and how to value life. We have many prophecies that are related to the *Wámakaškaŋ*. The White Buffalo Calf Woman spoke of a time when a white buffalo calf would again stand upon the earth, and she warned that when that happened human beings would be at a crossroads. It would be a signal that great changes would be upon us, and they would occur because people had become spiritually disconnected in this world and had lost those traditional values of respect and honor for all things that have a spirit. We are now in that time. Since 1994, the *Wámakaškaŋ* have been showing the sacred color – white – because that is the only way they can speak to us now. The White Buffalo Calf Woman told our people that when the white ones were born it would be both a blessing and a warning. The grizzly bears shared in that inner prophecy, so that they too would one day show the sacred color, and that has now happened. In September 2014, a white grizzly bear appeared in Greater Yellowstone.

Today it is so important for people to understand that *Unci Maka*, our Grandmother Earth, is speaking to us through the *Wámakaškaŋ*; it is her voice, the voice of our Grandmother, who is speaking when the white ones are born. We, as First Nations' people, still understand that we are connected to *makoce*, the land. The *Wámakaškaŋ* are also connected to this land, and so we must realize that what happens to them, happens to us. *Mato Oyate*, *Pte Oyate*, every nation of the *Wámakaškaŋ* has its place, and the way we look upon that can be seen in the way we pray. We pray to *Mato Oyate*, the two-legged, to *Pte Oyate*, the four-legged, and to the winged ones, and when we say *Mitakuye Oyasin* it means "All Our Relations." *Mitakuye Oyasin* refers to

the interconnectedness between all beings and all things. In our prayers we appeal to *Wakan Tanka*, the Creator, to bless the *Wámakaškaŋ*, which is part of our prayer for the health and well-being of all in this cycle of life that we live. We see this relationship with the grizzly bear and all living beings of the earth as being part of a healing process, but that is not how others see it.

We talk about harmony, balance, understanding and the sacred relationship between all things, while others talk about trophy hunting. Even the white ones that are born, the sacred messengers of *Unci Maka*, our Grandmother Earth, are being killed and will continue to be killed if this abuse is not stopped. My heart is heavy because of this. These state game commissioners, wardens and government agencies don't see the spiritual nature of this. Even when our people ask, "Why are you doing this?" they will say "It's just part of our job." These are not the words or thoughts of people connected to *Unci Maka*, but we as First Nations' people are very connected to our Grandmother Earth. I am a spiritual leader of the Big Foot Ride on which we honor the 300 Lakota women, children and elders who were murdered on December 29, 1890 at Wounded Knee. I am also a spiritual leader of the Mankato Ride that remembers the 38 Dakota people who were hung in the largest mass execution in American history that happened during Abraham Lincoln's presidency. These rides are part of the process of healing, and the Big Foot Ride began mending the Sacred Hoop. Our ancestors told that the Sacred Hoop of Life was broken when our people were massacred at Wounded Knee. This was the period when those that massacred our people also wiped out the *Wámakaškaŋ*; they wiped out the buffalo, the grizzlies and the wolves, and today that mindset is still there, that "disease of the mind." They had no place for grizzly bears then, and they have no place for them now.

The birth of the white ones among the *Wámakaškaŋ*, the grizzly bear with a white coat, is a message that is loud and clear for us. We are at that crossroads. Our message to those in authority needs to be equally clear and direct: stop the abuse and the massacre of these living beings of the earth. The *Wámakaškaŋ* have a message for the world: the grizzly bear, *Mato*, is a living spirit that is sacred.

Mitakuye Oyasin!

Chief Arvol Looking Horse

"The grizzly bear is a living spirit that is a part of our ceremonies and our ancestors have been using the medicine given by the grizzly bear – *Mato* – for generations."

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Grizzly bear photography © R. Bear Stands Last.
Chief Arvol Looking Horse photographs © Kyaiyo M.

Hiinono'einino'

PO Box 67 St. Stephens WY 82524

PUBLIC COMMENT: WYOMING CHAPTER 68 GRIZZLY BEAR HUNTING SEASONS

FAO – WYOMING GAME AND FISH COMMISSION.

The Northern Arapaho Elders Society (hereafter "NAES") is appalled at the prospect of a trophy hunt for the grizzly bear, and we petition the Wyoming Game and Fish Commission to halt all plans for a grizzly bear hunt and to suspend Wyoming's Chapter 68 Grizzly Bear Hunting Seasons. Our objections are summarized in *Crow Tribe et al v. Zinke* and need not be repeated here as that complaint is in the public domain. Succinctly put, the grizzly bear is fundamental to our culture and ceremonial way of life. The grizzly bear is not a "trophy game animal"; the grizzly is our relative, an ancient teacher of sacred ways and a two-legged being, like us. What do you propose next? A trophy hunting season on us?

Both the NAES and the Northern Arapaho Business Council (hereafter "NABC") have submitted numerous documents to federal and multi-jurisdictional authorities opposing the delisting and trophy hunting of the grizzly bear in the Greater Yellowstone Ecosystem (GYE). Regardless of whether we sent letters, made statements, or presented sworn affidavits, none of these submissions or our concerns have been addressed. Roy Brown, the current chairman of the NABC, has a prominent role in the Rocky Mountain Tribal Leaders Council (RMTLC), and the RMTLC has just reaffirmed its long-held stance against trophy hunting the grizzly bear in a letter to the Wyoming Game and Fish Commission (4/27).

The NAES has governing authority under the traditional governmental system of the Northern Arapaho Tribe. The Northern Arapaho Tribe did not adopt the Indian Reorganization Act. The NABC is the elected governing body of the Northern Arapaho Tribe. Authority for matters related to the grizzly bear rests with the NAES. In a letter to the Secretary of the Interior dated 10/18/16 the NAES and NABC jointly - explicitly and without equivocation - reaffirmed the Northern Arapaho Tribe's opposition to the delisting of the grizzly bear from the ESA and the trophy or "sport" hunting of the grizzly bear.

The NAES reiterates here what it has stated multiple times: In its final rule delisting the grizzly bear in the GYE, the US Fish and Wildlife Service claims, "all three affected States and the Eastern Shoshone and Northern Arapaho Tribes of the WRR will classify grizzly bears in the GYE as game animals." This is categorically false. In a letter to the Secretary of the Interior dated 10/18/16 the NAES and NABC jointly stated: "The Northern Arapaho . . . opposes in the strongest possible terms the delisting of the grizzly in Greater Yellowstone, and the State of Wyoming's 'Grizzly Bear Management Plan,' a document that is antithetical to our culture, and that we will not adopt in any form. The idea of trophy hunting the grizzly bear is abhorrent to us; we do not condone killing, and we do not murder our relatives. The grizzly bear is sacred to our people and has been since time immemorial."

In a letter to the Interagency Grizzly Bear Committee (IGBC) – Yellowstone Ecosystem Subcommittee dated 4/13/2017 the NAES reiterated: "We will not permit the trophy hunting of our sacred relatives on our lands." With this submission, we reaffirm that position. When we say, "our lands," we do not only refer to the Wind River Indian Reservation shared with the Eastern Shoshone Tribe, but the entire Greater Yellowstone Ecosystem that the Northern Arapaho Tribe has treaty, ancestral, and reserved rights to, alongside the twenty-six other tribal nations the federal government categorizes as "Associated Tribes of Yellowstone." The lands Wyoming intends to hold this grizzly bear hunt on are ancestral tribal lands, now under the management jurisdiction of the US Forest Service and BLM.

The Northern Arapaho, in common with the other "Associated Tribes of Yellowstone," have a multitude of sacred and historic sites throughout those lands. Before any activity takes place on those lands that impacts us and the other tribes with rights and interests in this region, NHPA and NEPA must be followed to the fullest extent. A great deal of hostility has been generated toward tribes and tribal members during the delisting process, due to our opposition to this trophy killing of the grizzly, and it takes only one malcontent to destroy a cultural site. As it stands, an unknown number would be marching into our ancestral lands to kill our sacred relative for "fun," so the potential for desecration of sacred sites is intolerably high.

The NAES finds it unconscionable that Wyoming intends to allow the killing of up to 14 female grizzlies in one hunt. It is very likely that a proportion of those females will be pregnant, as this hunt is to take place in the fall. The grizzly bear has one of the slowest reproductive rates of any mammal, so what justification can there be for this? We also consider it both callous and reckless that Wyoming is going to permit the baiting of grizzly bears; by doing this, the state not only removes any pretense of "fair chase," but may very well be responsible for the death or serious injury of an unwitting recreationist who is unfortunate enough to enter an area where bait has or is being used. All contemporary, peer-reviewed scientific analysis on the grizzly and brown bear runs counter to claims being made by Wyoming to find acceptance for its grizzly trophy hunt. It is a falsehood that this trophy hunt reflects the best available science. What it does do is ensure that the grizzly will never be a recovered species, and in the GYE, will soon be back on life-support. Whether the ESA will still exist to save the grizzly when this occurs is debatable.

We refer you to the affidavit the NAES submitted to federal authorities 6-29-2017.

Thank you.

Nelson White, Sr. Crawford White, Sr.

April 28, 2018.

Rocky Mountain Tribal Leaders Council
711 Central Avenue, Suite 220, Billings, Montana 59102
Ph: (406) 252-2550 Fax: (406) 254-6355

March 20, 2018

Office of Senator John Barrasso
307 Dirksen Senate Office Building
Washington D.C., 20510

Dear Senator Barrasso,

As you are aware, throughout tribal communities there is widespread opposition to the delisting and trophy hunting of the grizzly bear in Greater Yellowstone. Two Wyoming-based member tribes of the Rocky Mountain Tribal Leaders Council (RMTLC), the Eastern Shoshone Tribe and Northern Arapaho Tribe, have been at the forefront during this issue. The Eastern Shoshone Tribe was the first tribal nation to pass a formal resolution opposing the delisting and trophy hunting of the grizzly as it is presently constituted, and the Northern Arapaho Tribe has lodged numerous complaints with the Department of Interior and US Fish and Wildlife Service (FWS) throughout this process. The Northern Arapaho Elders Society is among the multiple tribal nations, traditional governing societies, and spiritual leaders who are plaintiffs in *Crow Tribe et al v. Zinke*, in which tribes have filed suit against the FWS for failure to consult, and violations of AIRFA and RFRA.

As a point of reference, Greater Yellowstone is wholly comprised of the ancestral and treaty lands of all member tribes of the RMTLC. The grizzly bear is integral to the religious and cultural practices of the RMTLC tribes. The area where Wyoming intends to hold its grizzly trophy hunts is, in fact, a virtual matrix of sacred sites with fundamental ceremonial significance to the RMTLC member tribes. It is, therefore, deeply disturbing to learn of Wyoming's planned grizzly trophy hunt, slated to begin September 1. An analysis just released by Dr. David Mattson, a retired US FWS scientist and highly regarded author of numerous peer-reviewed and published articles, contradicts recent media presentations made by Wyoming Game and Fish Department (WGFD) officials in the following statement:

> The grizzly bear mortality rates applied this year to calculate allowable mortality are designed to reduce the population of grizzly bears in the Greater Yellowstone Ecosystem, not sustain them. Wyoming's planned trophy hunting quota (2 females and 10 males) constitutes nearly twice as many as would be prudent, even given the previously adopted MOA goal of reducing the grizzly bear population. To place this in context, applying the allowable MOA mortality to the states based on currently occupied habitat within non-NPS portions of the DMA, Wyoming's prudent portion available for trophy hunting would be approximately 1 female and 3 males. Presently, Wyoming is planning to offer licenses sufficient to kill 200-300% of these numbers. Outside the DMA, Wyoming plans on allowing trophy hunters to kill 12 bears, in what WGFD has designated Hunt Unit 7, which equates to approximately 1000% of what might be considered even remotely sustainable.

For RMTLC member tribes, and indeed tribal nations throughout the western states, this is nothing short of disastrous. In March 2017, Chairman AJ Not Afraid of the Crow Nation presented the historic treaty, *The Grizzly: A Treaty of Cooperation, Cultural Revitalization and Restoration* to the Senate Committee on Indian Affairs. This stands as the most-signed tribal treaty in history, with over 200-tribal nation signatories. Earlier this year, the RMTLC submitted public comment to the FWS on the impacts of *HSUS v. Zinke* on the grizzly delisting rule (Docket No. FWS–R6–ES–2017–0089), from which I quote:

> "Should the Service retain serious concerns about 'grizzly bear populations and their lost historical range' (USFWS release, 12/6/2018), it should give serious weight to *The Grizzly: A Treaty of Cooperation, Cultural Revitalization and Restoration,* with respect to formulating future grizzly bear management plans. Central to the treaty are the grizzly reintroduction articles. Instead of trophy hunting the grizzly, tribal nation treaty signatories advocate relocating grizzlies from the GYE to sovereign tribal lands in the grizzly's historic range where biologically suitable habitat exists among tribes that seek to explore and participate in such a program. The same quota of grizzlies that would be hunted per season by the states, could easily be trapped and relocated to lands under sovereign tribal authority and jurisdiction, removing any possible rationalization for reinstituting trophy hunts.
>
> This plan provides for cultural and environmental revitalization for participating tribal nations, as the grizzly is sacred to a multitude of tribes. Both the physical and cultural environments of tribes have been incomplete since the federal and respective state governments eradicated the grizzly. As outlined by a multitude of tribal organizations and in numerous individual tribal resolutions, returning the grizzly bear to participating tribal nations offers to provide great economic potential to communities most at need for economic impetus and investment. Several tribal nations are already working on eco-tourism plans centered upon grizzly re-introduction. Tribal management plans would feature Traditional Ecological Knowledge and offer vocational opportunity for tribal members in the field of grizzly biology and management. If trophy hunting seasons are opened upon the grizzly bear, the Service will have empowered the states to not only kill the sacred grizzly bear, but to also kill economic and cultural revitalization for tribes across the western United States in the grizzly's historic range. The tribal reintroduction plan fulfills the criteria of the ESA, which the current GYE delisting rule and state organized trophy hunts do not."

Should Wyoming formally implement its grizzly trophy hunting plan, it will strike a devastating blow to tribal communities - for which there is no justification, given the existing, viable alternative. Tribal nations want to be partners not plaintiffs, and to that end and in that spirit, the RMTLC would welcome the opportunity to meet with you to find a pathway forward that might accommodate tribal, federal and states' interests.

With sincere thanks for your consideration.

Sincerely,

William F. Snell, Jr.
Executive Director,
RMTLC

United States Senate - Environment and Public Works Committee
Hearing: "From Yellowstone's Grizzly Bear, etc."

October 10, 2018

Testimony of the Rocky Mountain Tribal Leaders Council, the Great Plains Tribal Chairman's Association, and the Blackfoot Confederacy.

Chairman Barrasso, Ranking Member Carper, and distinguished members of the Senate Environment and Public Works Committee, we appreciate this opportunity to submit testimony on this significant matter to Indian Country and we thank Ranking Member Carper for the invitation to do so.

The Rocky Mountain Tribal Leaders Council (RMTLC) serves tribal nations located in Wyoming, Montana, Idaho, and Alberta, specifically the Northern Arapaho, Eastern Shoshone, Blackfeet Nation, the Chippewa-Cree, the Confederated Salish & Kootenai Tribes, the Crow Tribe, the Fort Belknap Indian Community, the Fort Peck Tribal Executive Board, the Little Shell Tribe of Chippewa Indians, the Northern Cheyenne Nation, the Shoshone-Bannock Tribes of Idaho, and the Piikani Nation of the Blackfoot Confederacy.

The Great Plains Tribal Chairman's Association (GPTCA) is composed of the 16 Tribal Chairmen, Presidents, and Chairpersons of the federally recognized sovereign Indian Tribes within the Great Plains Region of the Bureau of Indian Affairs (the states of North Dakota, South Dakota and Nebraska), which includes the Cheyenne River Sioux Tribe, Crow Creek Sioux Tribe, Lower Brule Sioux Tribe, Oglala Sioux Tribe, Rosebud Sioux Tribe, the Yankton Sioux Tribe, Sisseton-Wahpeton Oyate, Flandreau Santee Sioux Tribe, Standing Rock Sioux Tribe, Santee Sioux Tribe, Spirit Lake Sioux Tribe, the Ponca Nation of Nebraska, the Omaha Tribe, the Winnebago Tribe of Nebraska, Turtle Mountain Chippewa, and the Three Affiliated Tribes (Mandan, Hidatsa & Arikara).

The Blackfoot Confederacy is comprised of the Piikani Nation, Sisksika Nation, Blood Tribe (Kainai) and the Blackfeet Tribe. The Blackfoot Confederacy has held a government-to-government relationship with the United States since the ratification of the 1851 Fort Laramie Treaty, a relationship that was further strengthened with the signing of the 1855 Lame Bull Treaty. In common with the Blackfoot Confederacy, many of the tribal nations represented in this testimony have a treaty relationship with the United States, several of which include territory within what is now categorized as Greater Yellowstone. These treaties are enshrined within Article VI of the US Constitution and are, per the Constitution, analogous to the Supreme Law of the Land.

The Department of Interior (DOI) recognizes the majority of the thirty-one tribes represented by this submission as "Associated Tribes of Yellowstone," which, in part, explains why a number of these tribes were plaintiffs in *Crow Tribe et al v. Zinke*, following which the grizzly bear in Greater Yellowstone was returned to Endangered Species Act status. Tribal plaintiffs prevailed in that case without our core complaints being heard, namely DOI's failure to engage in "thorough and meaningful consultation" with impacted tribal nations, as federally mandated, and violations of the American Indian Religious Freedom Act claimed under the Religious Freedom Restoration Act. Any attempt by the EPW Committee, its members, or individual senators who do not sit on the committee to legislatively nullify the Court's ruling in *Crow Tribe et al v. Zinke* - to once again strip ESA protections from the grizzly bear - will, in addition to defying the Court, suborn the federal-Indian trust responsibility. Given that the Constitution states, "all treaties made, or which shall be made, under the authority of the United States, shall be the supreme law of the land," the rights of Indian tribes cannot be treated as "temporary and precarious," as would be the case if *Crow Tribe et al v. Zinke* was legislatively subverted. The deleterious consequences of such an action upon our religious and spiritual freedoms, treaty rights, ancestral lands and sovereignty would render such an act unconstitutional. What impact, we ask, would that course have in respect to the integrity of the US Constitution?

Greater Yellowstone consists of the ancestral and treaty lands of tribes represented in this testimony. The grizzly bear is integral to the religious and cultural practices of these tribes. The area where the State of Wyoming intended to hold its grizzly trophy hunts is, in fact, a virtual matrix of sacred sites with fundamental ceremonial significance to this alliance of tribes. As we have stated repeatedly throughout this process, tribal nations wish to be partners with DOI, the US Fish and Wildlife Service (USFWS), and the states; we have no desire to be plaintiffs, but have, so far, been left with no choice but to litigate due to the flagrant violations committed by DOI/USFWS throughout this disturbing episode. These violations, though never satisfactorily addressed, have been cited in numerous tribal resolutions and declarations, public comment submissions, and even alluded to in testimony to the US Senate Committee on Indian Affairs. It is not necessary to recount each here as they are a matter of record, though, by way of example, it may suffice to recall Secretary Ryan Zinke's testimony before the House Natural Resources Committee (HNRC) on June 22, 2017. When questioned by Congressman Wm. Lacy Clay on tribal nations' opposition to the grizzly bear delisting process, Secretary Zinke was asked, "And will you commit to consult with affected tribes prior to any delisting announcement?" To which Secretary Zinke replied, "I will commit to that. I think it's not only a right, it's the law. But two things, it's the right thing to do." However, approximately two-hours after concluding his testimony to the HNRC, Secretary Zinke announced the delisting from the ESA of the grizzly bear in Greater Yellowstone. The Secretary was correct in one respect: meaningful government-to-government consultation with tribes is "not only a right, it's the law," he just chose to violate his oath, his word, and the law.

Irrespective, in the spirit of partnership and cooperation, we again offer our collective hand to Secretary Zinke and invite him to sit down with us on a government-to-government basis and discuss the implementation of the historic grizzly treaty signed by over 200 tribes, T*he Grizzly: A Treaty of Cooperation, Cultural Revitalization and Restoration* that was initiated by the Piikani Nation of the Blackfoot Confederacy. Chairman A.J. Not Afraid of the Crow Nation presented the treaty to the Senate Committee on Indian Affairs in March 2017, while Secretary Zinke was present. The treaty contains the solutions to this ongoing issue. The future of the grizzly bear - and tribal, federal, and state cooperation - rests within the grizzly treaty. We respectfully urge the members of this committee to encourage Secretary Zinke to honor the trust responsibility and engage us in productive dialogue.

In its letter of March 20, 2018, the Rocky Mountain Tribal Leaders Council informed Chairman Barrasso of tribal nations' principal objection to grizzly bear delisting, namely the states' reinstitution of grizzly trophy hunts, and offered the tribal alternative outlined in the treaty. To quote from that letter:

"Should the Service retain serious concerns about 'grizzly bear populations and their lost historical range' (USFWS release, 12/6/2018), it should give serious weight to *The Grizzly: A Treaty of Cooperation, Cultural Revitalization and Restoration*, with respect to formulating future grizzly bear management plans. Central to the treaty are the grizzly reintroduction articles. Instead of trophy hunting the grizzly, tribal nation treaty signatories advocate relocating grizzlies from the GYE to sovereign tribal lands in the grizzly's historic range where biologically suitable habitat exists among tribes that seek to explore and participate in such a program. The same quota of grizzlies that would be hunted per season by the states, could easily be trapped and relocated to lands under sovereign tribal authority and jurisdiction, removing any possible rationalization for reinstituting trophy hunts.

This plan provides for cultural and environmental revitalization for participating tribal nations, as the grizzly is sacred to a multitude of tribes. Both the physical and cultural environments of tribes have been incomplete since the federal and respective state governments eradicated the grizzly. As outlined by a multitude of tribal organizations and in numerous individual tribal resolutions, returning the grizzly bear to participating tribal nations offers to provide great economic potential to communities most at need for economic impetus and investment. Several tribal nations are already working on eco-tourism plans centered upon grizzly re-introduction. Tribal management plans would feature Traditional Ecological Knowledge (TEK) and offer vocational opportunity for tribal members in the field of grizzly biology and management. If trophy hunting seasons are opened upon the grizzly bear, the Service will have empowered the states to not only kill the sacred grizzly bear, but to also kill economic and cultural revitalization for tribes across the western United States in the grizzly's historic range. The tribal reintroduction plan fulfills the criteria of the ESA, which the current GYE delisting rule and state organized trophy hunts do not."

This is a viable alternative worthy of not only discussion and exploration, but active participation. No individual tribal reintroduction program would be pursued that set either the tribe or the grizzly bear up to fail. This course of positive, cooperative and beneficial action is surely a better use of taxpayers' dollars than perpetual litigation. As tribal nations, our recent experiences with the delisting process of the grizzly bear in Yellowstone reflects upon some of the proposed changes to the Endangered Species Act. Though DOI and USFWS officials consistently refused to answer questions about the influence of extractive industry companies in the Service's delisting decision making, it became evident that the removal of protections from the grizzly was coveted by energy companies; lifting protections from the grizzly would result in the relaxation of stringent land leasing criteria on the lands the grizzly occupies. In July 2016, the Oglala Sioux Tribe petitioned for a Congressional investigation into conflicts of interest involving USFWS officials who were central to grizzly delisting. Former Acting USFWS Director, Matt Hogan, advanced grizzly delisting in his position as Assistant Regional Director of the Mountain-Prairie Region. Hogan, who was once trophy hunting behemoth Safari Club International's chief lobbyist to Capitol Hill, consistently refused to answer questions about his apparent association with Anadarko Petroleum Gas. Anadarko, which made one of the largest settlements in history with the DOJ in 2014, including $1 billion for uranium spills that polluted water on the Navajo Nation, is known throughout Indian Country for that catastrophe.

Anadarko describes itself as "one of the largest landowners and leaseholders in the state of Wyoming." Before entering the ranks of the USFWS, Hogan was Legislative Director for former Secretary of the US Army,

Congressman Preston M. Geren III, who retired from Anadarko's board of directors in 2014. Like all of Wyoming's Congressional Delegation, Chairman Barrasso is familiar with Anadarko, and may, in the interests of transparency, be able to compel Hogan to reveal what ties he has to the multinational energy giant. Chairman Barrasso's former campaign manager, Joe Milczewski, is presently Government Relations Manager at Anadarko Petroleum, and Anadarko has supported Senator Barrasso through financial contributions to Political Action Committees. Anadarko was among the first to support the Chairman's proposed *Endangered Species Act Amendments of 2018* in a letter dated June 8, 2018. Hogan was barely more forthcoming when tribes inquired as to the rationale behind USFWS engaging multinational oil and gas services group, Amec Foster Wheeler, for the peer review of its grizzly delisting rule. In response, Hogan said only, "The peer reviewers were selected by an independent, third-party contractor, not by the Service." That "independent, third-party contractor," Amec Foster Wheeler, appointed Halliburton executive Jonathan Lewis as CEO in the same timeframe as USFWS contracted the company.

It is clear from Chairman Barrasso's proposed amendments to the ESA that a far greater emphasis would be placed upon the input of energy companies, with considerable influence being accorded extractive industry executives in ESA listing and delisting decisions. This approach is consistent with that enacted by Secretary Zinke at DOI, where vast swathes of public lands have now been opened to extractive industry, including large-portions of Bears Ears National Monument, which contains numerous sacred and historic sites to tribal nations in the Four Corners region. Clearly, the objectives of energy companies are not oriented toward conservation or endangered species protection, quite the contrary. Irrespective of Jonah Energy's PR campaign, nobody can seriously consider that constructing some 3,500 gas wells over 10-years in critical greater sage grouse habitat on the boundary of Greater Yellowstone is going to contribute to the preservation and perpetuation of the species. Nevertheless, the project was recently approved by the BLM. Some 96% of that development will take place on public lands, potentially yielding a projected $17-billion in revenue, with the State of Wyoming being the beneficiary of a billion-plus in royalties. Should these proposed amendments to the ESA become law, this scenario is likely to become the norm. If such circumstances had prevailed in prior decades, it is highly uulikely that species recovered by the ESA that are integral to tribal cultures, such as the bald eagle, grey wolf, humpback whale, green sea turtle and California condor, would now exist anywhere outside of zoos or taxidermy displays. The same can be said of the grizzly bear if *Crow Tribe et al v. Zinke* is legislatively reversed.

The disregard of the federal-Indian trust responsibility by the USFWS in the grizzly delisting process coupled with the uncertainty surrounding the ESA, has prompted tribal nations to move forward with the formulation of a Native American Endangered Species Act (NA-ESA) as a counterweight. Sovereign tribal lands hold several T&E species and vital habitat, and it is time for tribal people to have a greater input into the management and protection of these species. In the present political climate, for some species an NA-ESA may be the only viable path to survival. As tribal nations, our sovereignty is consistently compromised by the USFWS and the states in respect to wildlife management, including USFWS's administration of the ESA on tribal lands. A NA-ESA would enhance tribal sovereignty, provide vocational opportunity for tribal members, and enable the melding of contemporary biological discipline with tribal Traditional Ecological Knowledge in management policies and practices. The NA-ESA would, in essence, be a framework document that could be adopted and amended according to the criteria of individual tribal nations, be they cultural or economic, as opposed to a "one-size fits all" imposition.

Throughout this testimony, we have emphasized the absolute necessity for the federal-Indian trust responsibility to be honored. We will not compromise our sovereignty, our religious and spiritual freedoms, or our treaty rights.

Cultural preservation is not up for negotiation. To date, both the House and the Senate have ignored tribal nations' appeals to intercede and stop National Historic Preservation Act (NHPA) violations by the USFS and BLM in Wyoming that literally threaten to obliterate 10,000-years of tribal history in the region. The lands where Wyoming intended to hold its trophy hunt for the sacred grizzly contain myriad sacred and historic sites to over 30 tribes. The precedent for leasing and energy development in such lands has been set by the BLM with approval of Jonah Energy's NPL project near Pinedale, which is entirely consistent with both Secretary Zinke's policy at DOI of opening more public lands to extractive industry, and these proposed amendments to the ESA that provide industry with disproportionate influence in the process. This triumvirate increases the urgency for action to ensure that the BLM and USFS follow the law.

These agencies are required under NHPA to undertake a Section 106 review; they must undergo a review process for all federally funded and permitted projects that will impact sites eligible for listing under NHPA. In this section of Greater Yellowstone, neither has initiated a Section 106 review for a single cultural or historic site, let alone the hundreds that are on those lands. The Rocky Mountain Tribal Leaders Council, the Piikani Nation of the Blackfoot Confederacy, and the Great Plains Tribal Chairman's Association all raised this matter with the State of Wyoming, the BLM and the USFS in letters submitted during the last week of April 2018. No responses were forthcoming from either BLM State Director (Wyoming), Mary Jo Rugwell, or USFS Regional Forester, Brian Ferebee (Rocky Mountain Region). For these agencies to ignore over thirty tribal nations for undisclosed reasons threatens irreparable harm to our sovereignty, in addition to the cultural catastrophe that will befall us if these sites are not cataloged and protected. The law must be adhered to, and this situation remedied forthwith.

In his address to the Senate before the cloture vote to advance the nomination of Judge Kavanaugh, Majority Leader McConnell reassured the American people that "facts matter," which was a welcome if not contradictory departure from what has become the norm in Washington, DC since January 2017. The actions of this committee in respect to the issues cited herein and the preservation of a viable Endangered Species Act as opposed to one in name only, will be among the first tests of if Leader McConnell was right, that "facts matter," or whether facts only matter if they are politically beneficial to the majority party.

Thank you.

Respectfully submitted:

William F. Snell, Jr.
Executive Director, Rocky Mountain Tribal Leaders Council.

Chief Stanley C. Grier,
President of the Blackfoot Confederacy Chiefs and Chief of the Piikani Nation.

Harold C. Frazier,
Chairman, Great Plains Tribal Chairman's Association.

OUR LAND IS OUR FUTURE

UNION OF BRITISH COLUMBIA INDIAN CHIEFS

FOUNDING HEAD OFFICE
209 - 345 Chief Alex Thomas Way
Kamloops, B.C. V2H 1H1
Tel: 250-828-9746
Fax: 250-828-0319

VANCOUVER OFFICE
401 - 312 Main Street
Vancouver, B.C. V6A 2T2
Tel: 604-684-0231
Fax: 604-684-5726
1-800-793-9701
Email: ubcic@ubcic.bc.ca
Web: www.ubcic.bc.ca

News Release

October 18, 2018

UBCIC Statement of Solidarity for US Tribes Protection of the sacred Grizzly Bear

(Coast Salish Territory/Vancouver, B.C. – Oct 18, 2018) The Union of British Columbia Indian Chiefs (UBCIC) stands in solidarity with the 31 Tribal Nations that recently submitted a joint testimony to the United States Senate Committee on Environment and Public Works (EPW), on the future of the Endangered Species Act (ESA), and particularly the survival of the sacred grizzly bear.

The UBCIC supports the steadfast defense of Indigenous rights by the tribes of the Rocky Mountain Tribal Leaders Council, the Blackfoot Confederacy, the Great Sioux Nation tribes and their allies of the Great Plains Tribal Chairman's Association. These tribes and organizations have been steadfast in the defense of treaty rights, religious and spiritual freedoms, and sovereignty of all Tribal Nations that the removal of ESA protections from the grizzly bear in the Greater Yellowstone ecosystem threatened.

The grizzly bear holds immense significance in the spiritualities of many First Nations people in British Columbia, reflecting the reverence and importance of this sacred being to our relatives south of us, from the states of Montana to Arizona.

The UBCIC represents over half of the 203 First Nations in British Columbia, Canada. Our mandate is to work towards the implementation, exercise and recognition of our inherent Title, Rights and Treaty Rights and to protect our Lands and Waters, through the exercise and implementation of our own laws and jurisdiction. The UBCIC works collectively amongst Indigenous Nations in BC and acts as an advocacy body to provide a cohesive voice (regionally, nationally and internally) in support of Indigenous Nations and communities, and to promote and protect each Nation's exercise of Sovereignty within their traditional territories.

The UBCIC is mandated to advocate for the protection of grizzly bears from trophy hunting and to protect the territories on which they live by Resolution 2011-55, "Support for Qat'muk Declaration and Opposition to the Proposed Jumbo Glacier Report" and Resolution 2013-37, "Support for Bears Forever Campaign."

It is evident from the maneuvers of Senator John Barrasso (Republican-Wyoming), Chairman of the EPW Committee, and the evidence presented in the testimony of Tribal Nations, that relationships between elected representatives in the Republican Party and extractive industry moguls are driving this assault on the ESA, on tribal peoples' lands and rights. All of which represents a significant attempt to subvert the Court's ruling in *Crow Tribe et al v. Zinke* that returned protections to the sacred grizzly bear in Greater Yellowstone. Attempting to overturn a court ruling with a legislative provision that will deny due process to tribes and citizens alike is not reflective of the tenets of a democracy. Clearly, it is time for Tribal First Nations to again take the lead in the defense of the sacred, of our relatives and Mother Earth. The UBCIC supports the creation of a First Nations/Native American Endangered Species Act.

The Grizzly: A Treaty of Cooperation, Cultural Revitalization and Restoration, initiated by the Piikani Nation of the Blackfoot Confederacy and signed by the UBCIC Executive and numerous First Nations chiefs in BC, promises innovative and sound conservation strategy. It will also nurture cultural revitalization and offer economic opportunity to Native Americans and participating tribal nations.

Both Canada and the United States have clear duties in upholding their international human rights commitments, including under the *United Nations Declaration on the Rights of Indigenous Peoples*. The UN Declaration affirms:

> **Article 25**: Indigenous peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, and waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard;
>
> **Article 26**:
> 1. Indigenous peoples have the right to the lands, territories and resources which they have traditionally owned, occupied or otherwise used or acquired;
> 2. Indigenous peoples have the right to own, use, develop and control the lands, territories and resources that they possess by reason of traditional ownership or their traditional occupation or use, as well as those which they have otherwise acquired;
> 3. States shall give legal recognition and protection to these lands, territories and resources. Such recognition shall be conducted with due respect to the customs, traditions and land tenure systems of the Indigenous peoples concerned.

The UBCIC joins our allies in calling for Secretary of the Interior Zinke to meet with tribal leaders to hold open discussions on implementing this treaty.

Media inquiries:
Kukpi7 Judy Wilson, Secretary-Treasurer, Union of BC Indian Chiefs
Phone: 1 250 320 7738

Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, DC 20510

October 9, 2018

Dear Members of the Senate Committee on Environment and Public Works:

We live and ranch east of Livingston, Montana, a few short miles from the Absaroka-Beartooth Wilderness, roughly an hour from Yellowstone Park, and are visited by grizzlies at least annually. Very briefly, here's the story: we have no (known) cattle losses to them (but occasionally to black bears), would not live in this part of the country but for the presence of wildlife/top predators, try as best we can to accommodate their presence. To de-list the grizzly at this point would symbolize that they are no longer "endangered" (which is good), but at the same time indicate that there are "enough" of them, which is misleading at best. This is a quasi-wilderness area. Perhaps paradoxically, for that reason it draws tourists from all parts of the world. To delist now would undermine the draw, and harm all of us who live here.

Vanessa and Gordon Brittan
215 Mission Creek Road
Livingston, MT 59047

October 9, 2018

The Honorable John Barrasso
Chairman, Committee on Environment and Public Works
United States Senate
410 Dirksen Senate Office Building
Washington, DC 20510

The Honorable Thomas Carper
Ranking Member, Committee on Environment and Public Works
United States Senate
456 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Barrasso and Ranking Member Carper:

Thank you for the opportunity to provide a written statement for the Committee's October 10, 2018 hearing entitled, *"From Yellowstone's Grizzly Bear to the Chesapeake's Delmarva Fox Squirrel -- Successful State Conservation, Recovery, and Management of Wildlife"*.

I am a resident of Moose, Wyoming and have worked since the early 1970s as a professional nature photographer. I operate eight "Mangelsen – Images of Nature" galleries in the West and Midwest. I have exhibited photos internationally and have had my work published in National Geographic, BBC Wildlife, Life, Audubon, American Photo, National Wildlife, Smithsonian, Natural History, and Newsweek, among others. I have authored six books of my photographic images, including "Polar Dance: Born of the North Wind" and "The Last Great Wild Places." I have recently given interviews and talks on 60 Minutes on CBS and with TEDx. My work has taken me to numerous locations around the globe to photograph wildlife species including bald eagles, polar bears, Bengal tigers, and African lions. But of all the wildlife in my portfolio—which consists of hundreds of species encompassing millions of images—I have felt the strongest connection to the grizzly bears near my own home in the Jackson Hole valley of northwest Wyoming, and especially to one extraordinary bear identified as 399 and her family.

I moved to the Jackson Hole area 40 years ago. At that time, there were no grizzly bears in this area; they had been killed off by ranchers and tropby hunters many years earlier. That began to change in the early 2000s. I had my first experience with a grizzly bear in the Tetons one early morning in 2005 when I woke up because my dog was barking and saw a grizzly bear standing on the porch of my house near the small community of Moose.

In the spring of 2006, friends began to tell me about a female grizzly with triplets that had been observed in Grand Teton National Park east of the Teton Mountains. In September of that year, I caught my first glimpse of this bear—identified by government biologists as 399—while she and her cubs were feeding on a moose carcass on the shore of the

Oxbow Bend of the Snake River. I was intrigued by the presence of this mother grizzly and her cubs in Grand Teton National Park after such a lengthy absence of grizzlies from Jackson Hole. In the spring of 2007, I began following 399 daily and photographing her. I spent several weeks in 2007 rising at dawn every morning and staying out past dusk watching 399 and her cubs. Two of my photographs of 399 that have been popular with the public, images called "Snow Mittens" and "Grizzly Comfort", date from this period and are attached along with this statement as **Exhibits 1 and 2.**

One particularly memorable observation of 399 and her cubs that year occurred in the area of Willow Flats near Jackson Lake Lodge in Grand Teton National Park. In the late spring, cow elk often graze in the open meadows of Willow Flats and use the protective cover of the extensive willow stands in that area as a safe place to give birth to their calves. One evening in 2007, I watched from the hotel patio at Jackson Lake Lodge—along with hundreds of other onlookers—as 399 and her cubs hunted the willows below the lodge in search of recently born elk calves. To have a beautiful sow and three cubs so visible doing the things that wild grizzlies are supposed to do, and with the Tetons rising above them as a backdrop, that is as dramatic a setting as you are ever going to find.

Another significant incident involving 399 also happened in 2007. Based on reports that I received, I understand that in June of that year a guest at the Jackson Lake Lodge inadvertently walked up to within a few yards of 399 and her cubs while they were standing over a dead elk calf. As a result, 399 charged the man, knocked him down, and bit him on the back and rump—and then she left him alone. News of this encounter went viral on social media and public interest in 399 and her cubs skyrocketed overnight. In the weeks following this incident, 399 and her cubs were highly visible at locations in Grand Teton National Park including the Oxbow Bend and Willow Flats and also Pacific and Pilgrim Creeks and Colter Bay. People began to flock to the park to see them and crowds would gather where they were sighted—30 to 50 people at first but then growing into "bear jams" of cars on park roads sometimes involving hundreds of people. These situations had the potential to be dangerous for both bears and people, so Grand Teton National Park formed a volunteer "Wildlife Brigade" to direct traffic and clear a space for bears to cross the road when such incidents occurred. To my mind, it was a miracle in those early years that 399 stayed alive, that she kept her cool and did not feel threatened as she and the cubs moved around cars and people. She showed herself to be a very intelligent bear, oftentimes stopping to look both ways for traffic before leading her small cubs across a busy highway.

One of these "bear jam" incidents led to another of my remarkable experiences observing 399 and her cubs. One day 399 was feeding in tall sage near Colter Bay. She was somewhat far away from her yearling cubs and they could not see her because of the intervening vegetation. While they were separated in this way, the cubs ran across the park road that runs through the area. Immediately they were spotted by people driving by, who stopped their vehicles to view the bears. The resulting "bear jam" ended up further separating the cubs from their mother as traffic backed up on the highway that separated 399 from her offspring. The cubs and 399 began bawling in an effort to locate each other, but the noise emanating from the "bear jam"—which at this point included a

couple of large diesel trucks—was too loud for them to hear each other's calls. As this went on, 399 became increasingly frantic in her search for her cubs. Finally, after an extended separation, they caught up with each other and 399 immediately began nursing her cubs. To my eye, this appeared to be nothing less than a loving reunion. In my experience, when you see something like that, you start looking at bears differently—not as monsters but as sentient, emotional, intelligent beings.

Over the ensuing years, 399 has become the matriarch of an extended grizzly family in Grand Teton. In 2011, one of her cubs from that 2006 litter—a bear that researchers identified as 610—emerged from her winter den with her own set of twin cubs. That same year, 399 emerged with her second brood of triplets. This was frosting on the cake. The presence of the two grizzlies, mother and daughter, both with cubs drew even more onlookers to Grand Teton National Park and made national and international news. An Associated Press story about this phenomenon ran in over 225 different media outlets that summer. One day I received an email from the eminent primatologist Dr. Jane Goodall, whom I had met when she visited Jackson Hole to deliver a speech, telling me that she had seen a story and photos about these bears in the London Daily Mail. Remarkably, during the course of that summer one of 399's cubs was adopted by her daughter, 610, leaving 399 with twins and abruptly vesting 610 with triplets. 399 had her third set of triplets in 2013, while 610 had a single cub in 2014 that did not survive and her second set of twins in 2015. In all, 399 is known to have birthed 13 cubs between 2004 and 2017.

In the intervals between weaning one set of cubs and birthing another, 399 has ranged by herself, sometimes consorting with big male grizzly bears nicknamed Brutus and Bruno. I have continued to watch and photograph 399 during these periods. She was without any cubs for two years and the years that she did have cubs, when they were approximately 2 ½ years old, she would "kick" them out to be on their own, usually in late May. She would then be without cubs during summer, fall and winter. The point being there were many fall seasons during her life that a hunter would have no idea whether she was a female or a male, or a female that was pregnant. I have seen literally thousands of grizzlies from Alaska, Canada and the Greater Yellowstone that unless they had cubs with them I could not sex them positively. One October day in 2010, I was ready with my camera when, shortly before sunrise a bear, who I believed to be 399, emerged from the willows just north of Oxbow Bend and forded the Snake River. The resulting picture, "First Light—Grizzly Bear," became the cover image for my 2014 book, "The Last Great Wild Places" and is attached along with this statement as **Exhibit 3.**

I have continued to rise at dawn to seek out and photograph 399 or one of her descendants—or any of the other grizzlies that have reclaimed their historic territory in Jackson Hole. In 2016, writer Todd Wilkinson and I collaborated on a book about 399 and her family called "Grizzlies of Pilgrim Creek." The book features many of my photographs of 399 and other grizzlies in Jackson Hole, Yellowstone and nearby areas. In the spring of 2017, 399—who is now believed to be 21 years old—emerged from her winter den with yet another set of cubs, this time twins. Every spring I breathe a sigh of relief when I first see her or hear of her return. The crowds still gather to see her and the

other grizzlies. In fact, today they are larger than ever. In the past few years I have begun making and distributing stickers for the onlookers in these crowds. The stickers say "I Saw Grizzly 399" and people tell me they have seen them on vehicles from all over the country.

On June 30, 2017, the U.S. Fish and Wildlife Service issued a decision to remove the Yellowstone-area grizzly bear population from the list of threatened species under the Endangered Species Act. Wyoming and Idaho moved immediately to schedule recreational trophy hunts of the newly delisted bears, with Wyoming acting particularly aggressively to open a trophy hunting season for as many as 22 grizzlies on the overwhelmingly public lands adjoining Yellowstone and Grand Teton National Parks. These state-led hunts were scheduled to begin on September 1 of this year.

But things changed on August 30. In response to a court challenge, a federal judge in Montana issued a temporary restraining order to prevent the hunts from moving forward. Then, on September 24, the judge issued a final decision that the delisting of Yellowstone grizzlies was illegal and returned the bears to federal protection and relisted them as threatened under the Endangered Species Act.

I was particularly concerned about removal of federal protections for these bears because 399, 610, and other grizzlies living in Jackson Hole and the Teton Range do not spend all of their denning or non-denning period in the refuge of Grand Teton National Park. In particular, 399 and 610 are documented to travel out of the park up Pacific Creek and Pilgrim Creek into the Bridger-Teton National Forest. I have also frequently observed these bears in the fall consuming gut piles and other remains of elk left by hunters, which is a food source that draws grizzlies out of the park and into the surrounding national forest and the proximity of hunters. I have personally viewed 399's winter denning area in the high reaches of the upper Pilgrim Creek drainage, which is also outside the park. These transboundary grizzlies have no idea where they are in relation to the administrative boundaries of the national park or hunting authorizations. Also, these bears are very tolerant of people from their many years of exposure to crowds in Grand Teton, therefore, they would be easily approached by grizzly hunters. Each of these factors threatens to subject these bears to killing due to state-sponsored hunting that the states of Wyoming and Idaho planned to commence this fall and, potentially, in a future spring hunt.

The fact that state-sponsored hunting is not intended to target female bears does not negate this threat. It would be difficult for any hunter to discern the difference between 399 or 610 and a male bear during those years when these females do not have any cubs, or at any time when they are observed away from their cubs as I have frequently seen them. In those situations, the threat is very real that 399, 610, or other female grizzly bears would be shot regardless of any state limitations on hunting of females.

In my experience, the world is already very dangerous for these grizzly bears. While 399 and her line of cubs have remarkably added 18, and counting, new grizzlies to the Greater Yellowstone population, half of them are documented dead, an unknown number are also

likely dead. Those documented dead are due to instances ranging from conflicts with deer and elk hunters, management removals and auto strikes. The above figures point out the importance of each female grizzly in the ecosystem. I fear that state-sponsored hunting would simply add to these already substantial losses.

For the record – I grew up in Nebraska on the Platte River in a family of avid hunters and fishermen. My father taught me a great deal about sportsmanship and fair chase in the act of pursuing our quarry. Our whole lives centered around hunting and fishing. We always treated what we hunted with respect and dignity and ate everything we killed. Killing for killings sake was never part of my upbringing. We built blinds and made our own duck and goose decoys. My father taught me how to call ducks and geese so well that I won the World's Goose Calling Championship twice, the youngest to do so at the time. My father would roll over in his grave at the thought of shooting a species like grizzly bears, wolves or cougars purely for fun. I no longer hunt with a gun only with my camera. I have no problem with hunters that are ethical and hunt for food.

If 399 or 610 were killed in a state-sponsored hunting season, the loss to millions of Americans and people around the world who come specifically for the opportunity to get a glimpse of bears in the Greater Yellowstone is unimaginable. It is a joy for me and for all the other visitors who flock to the area year after year to see 399 and her progeny every spring. Maybe once in a lifetime an animal like this appears and her mere presence seems to galvanize everything. An icon of motherhood. An emblem of wildness. A sentient creature who has taught us new ways to think about others of her kind.

Should we be managing OUR nation's wildlife or for that matter the earth's wildlife for so few members of special interest groups only to provide them a "Recreational Hunting Opportunity"? Doing so undermines the use of science as prescribed by the Endangered Species Act, and robs all other stakeholders of the experiences and wonders of so many species I have been blessed to enjoy and to photograph. The gift of a bear like 399 and her seventeen descendants will not come our way again.

Thomas Mangelsen

Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, DC 20510

October 5, 2018

Dear Committee Members,

We are writing to you as concerned citizens and small business owners in Livingston, Montana. Please consider the collateral damage you would set in motion to many communities in our region if the Endangered Species Act or its protections for the grizzly bear are in any way reduced. Our restaurant and catering business could not function without the ESA, as the Act is the primary driver for the economy and tourism here. I say this because it's a widely accepted fact that this community and many others like it in the Greater Yellowstone region strictly rely on tourist dollars for our survival all year-round.

One need only look at the hard tourist dollar figures which range from the hundreds of millions into the billions - not to mention the attendant jobs. As Todd Wilkinson of the Mountain Journal in Bozeman recently wrote, "Each year, more than $1 billion nature-tourism-related dollars are generated for the regional economy by people coming to Yellowstone and Grand Teton national parks alone. Seeing grizzlies, wolves and other wildlife are among the highest priorities for tourists." The ESA is effective as currently written, delivering crucial protections that benefit wildlife populations while supporting our business and our town. Please don't try to fix what isn't broken.

Dan and Carole Sullivan
Mustang Fresh Food
Livingston, MT

Professor Rob Wielgus, Ph.D.
61536 SE Lorenzo Dr
Bend, Oregon, 97702
wielgus.rob@gmail.com

October 5, 2018

U.S. Senate Committee on Environment and Public Works

4410 Dirksen Senate Office Building
Washington, D.C. 20510

456 Dirksen Senate Office Building
Washington, D.C. 20510

Re: Retaining Endangered Species Act Protections for Yellowstone-are grizzly bears

To the Honorable Members of the Senate Public Works Committee:

I am Dr. Rob Wielgus, former Professor and Director (retired) of the Large Carnivore Conservation Lab at Washington State University. I have captured, radio-collared and monitored hundreds and hundreds of large carnivores (grizzly bears, cougars, wolves) over the past 35 years. I have published over 35 peer-reviewed scientific papers on carnivores. My research was instrumental in banning trophy hunting of grizzly bears in Alberta and British Columbia, Canada because of my findings.

Because of their natural history, grizzly bears (also known as "brown bears") (*Ursus arctos*) are a "conservation-reliant" species; that is, they need to be cared for into perpetuity or they will likely *face extinction*. Because of their biology, brown bears are not resilient to persecution from hunting.[1]

Because they produce extremely slowly: they are late to breed and only produce a few cubs in their lifetimes. Female brown bears' age of reproduction varies from three to eight years.[2] They produce only a few cubs per litter and extensive time spans occur between litters making them

[1] Sterling D. Miller et al., "Trends in Intensive Management of Alaska's Grizzly Bears, 1980-2010," *Journal of Wildlife Management* 75, no. 6 (Aug 2011 2011), http://dx.doi.org/http://dx.doi.org/10.1002/jwmg.186; S. D. Miller, J. W. Schoen, and C. C. Schwartz, "Trends in Brown Bear Reduction Efforts in Alaska, 1980-2017," *Ursus* 28, no. 2 (Nov 2017), http://dx.doi.org/10.2192/ursus-d-17-00002.1.

[2] U.S. Fish and Wildlife Service, "Northern Continental Divide Ecosystem: Grizzly Bear Conservation Strategy," *https://www.fws.gov/mountain-prairie/science/PeerReviewDocs/NCDE_Grizzly.pdf* (2013).

one of the slowest-reproducing, terrestrial mammals.[3] It can take a female a decade to replace herself in a population.[4]

Several traits peculiar to the social structure and life cycle of grizzly bears make them particularly sensitive to hunting. They are a large-bodied carnivore only sparsely populated across vast areas; they invest in few offspring; they provide extended parental care to their young; they have a tendency towards infanticide; their females limit reproduction and social stability promotes their resiliency.[5] Human persecution affects their social structure[6] and harms their persistence.[7] The consequence of these characteristics is that the effect of human persecution on grizzly bears is "super additive," meaning that hunting result in mortalities that exceed the simple 1:1 ratio that state wildlife managers contemplate when setting harvest quotas, and this generates pressures on the population that far exceed what would occur in nature.[8]

Trophy hunting grizzly bears outside the national parks threatens the entire GYE population – including bears within Yellowstone and Grand Teton national parks. They die from indirect effects as a result of hunting–because of the mortality "multiplier effect" resulting from the take of dominant males.

Because park bears may be killed from hunting outside the parks, causing population disruption or decline within the parks, GYE grizzly bears should not be delisted. Trophy hunting of older, male breeding carnivores is now widely accepted to result in increased sexually selected infanticide (SSI) of cubs by non-fathers, sexually segregated habitat use by females (females avoid new non-fathers), and reduced forging and reproductive success of females—by causing

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[3] Andrea L. Lyons et al., "Spatially Explicit Carrying Capacity Estimates to Inform Species Specific Recovery Objectives: Grizzly Bear (Ursus Arctos) Recovery in the North Cascades," *Biological Conservation* 222 (2018/06/01/ 2018): 25, http://dx.doi.org/https://doi.org/10.1016/j.biocon.2018.03.027. (Lyons et al. (2018) citing Nowack and Paradiso (1983); Schwartz et al. (2003a,b)

[4] Lyons et al. (2018) citing USFWS (1993).

[5] e.g., A. D. Wallach et al., "What Is an Apex Predator?," *Oikos* 124, no. 11 (Nov 2015), http://dx.doi.org/10.1111/oik.01977; R. B. Wielgus et al., "Effects of Male Trophy Hunting on Female Carnivore Population Growth and Persistence," *Biological Conservation* 167 (Nov 2013), http://dx.doi.org/10.1016/j.biocon.2013.07.008; S. Creel et al., "Questionable Policy for Large Carnivore Hunting," *Science* 350, no. 6267 (Dec 2015), http://dx.doi.org/10.1126/science.aac4768; J. L. Weaver, P. C. Paquet, and L. F. Ruggiero, "Resilience and Conservation of Large Carnivores in the Rocky Mountains," *Conservation Biology* 10, no. 4 (Aug 1996), <Go to ISI>://A1996VC10300014.

[6] Wallach et al; Heather M. Bryan et al., "Heavily Hunted Wolves Have Higher Stress and Reproductive Steroids Than Wolves with Lower Hunting Pressure," *Functional Ecology* (2014), http://dx.doi.org/10.1111/1365-2435.12354; C. T. Darimont et al., "Human Predators Outpace Other Agents of Trait Change in the Wild," *Proceedings of the National Academy of Sciences of the United States of America* 106, no. 3 (Jan 2009), http://dx.doi.org/10.1073/pnas.0809235106; Wielgus et al.

[7] Chris T. Darimont et al., "The Unique Ecology of Human Predators," *Science* 349, no. 6250 (2015); Wielgus et al; A. Zedrosser et al., "Determinants of Lifetime Reproduction in Female Brown Bears: Early Body Mass, Longevity, and Hunting Regulations," *Ecology* 94, no. 1 (Jan 2013), <Go to ISI>://WOS:000316186900025.

[8] Darimont et al; Jacinthe Gosselin et al., "The Relative Importance of Direct and Indirect Effects of Hunting Mortality on the Population Dynamics of Brown Bears," *Proceedings of the Royal Society B* 282 (2015); Wielgus et al.

turnover of breeding males. This phenomenon has been studied for a variety of carnivores: for North American grizzly bears;[9] for European brown bears;[10] for cougars (*Puma concolor*);[11] for African lions (*Panthera leo*);[12] and for African leopards (*Panthera pardus*) [13].

For *Ursus arctos*, Wielgus et al. (2001), Wielgus (2002), Swenson et al. (1997, 2001a, b) and Swenson (2003) demonstrated that trophy hunting of resident male North American grizzly bears and European brown bears (*Ursus arctos arctos)* corresponds with increased male turnover (compensatory immigration), increased sexually selected infanticide, and reduced female population growth. [14] For protected park grizzly bears, Wielgus (2002) showed that trophy

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[9] R. B. Wielgus et al., "Estimating Effects of Adult Male Mortality on Grizzly Bear Population Growth and Persistence Using Matrix Models," *Biological Conservation* 98, no. 3 (Apr 2001), http://dx.doi.org/10.1016/s0006-3207(00)00168-3; R. B. Wielgus and F. L. Bunnell, "Dynamics of a Samll Hunted Brown Bear Population in Southwestern Alberta, Canada," *Biological Conservation* 67, no. 2 (1994), http://dx.doi.org/10.1016/0006-3207(94)90362-x; R. B. Wielgus and F. L. Bunnell, "Sexual Segregation and Female Grizzly Bear Avoidance of Males," *Journal of Wildlife Management* 58, no. 3 (Jul 1994), http://dx.doi.org/10.2307/3809310.

[10] J. E. Swenson, B. Dahle, and F. Sandegren, *Intraspecific Predation in Scandinavian Brown Bears Older Than Cubs-of-the-Year*, vol. 12, *Ursus, Vol 12* (2001); J. E. Swenson et al., *Factors Associated with Loss of Brown Bear Cubs in Sweden*, vol. 12, *Ursus, Vol 12* (2001); J. E. Swenson et al., "Infanticide Caused by Hunting of Male Bears," *Nature* 386 (1997); J. E. Swenson, "Implications of Sexually Selected Infanticide for the Hunting of Large Carnivores," in *Animal Behavior and Wildlife Conservation*, ed. M. Festa-Bianchet and M Apolloio (Washington, D.C.: Island Press, 2003).

[11] C. M. S. Lambert et al., "Cougar Population Dynamics and Viability in the Pacific Northwest," *Journal of Wildlife Management* 70 (2006); H. S. Robinson et al., "Sink Populations in Carnivore Management: Cougar Demography and Immigration in a Hunted Population," *Ecological Applications* 18, no. 4 (Jun 2008), http://dx.doi.org/10.1890/07-0352.1; H. S. Cooley et al., "Does Hunting Regulate Cougar Populations? A Test of the Compensatory Mortality Hypothesis," *Ecology* 90, no. 10 (Oct 2009), http://dx.doi.org/10.1890/08-1805.1; H. S. Cooley et al., "Source Populations in Carnivore Management: Cougar Demography and Emigration in a Lightly Hunted Population," *Animal Conservation* 12, no. 4 (Aug 2009), http://dx.doi.org/10.1111/j.1469-1795.2009.00256.x; Wielgus et al; Jon R. Keehner et al., "Effects of Male Targeted Harvest Regime on Sexual Segregation in Mountain Lion," *Biological Conservation* 192 (12// 2015), http://dx.doi.org/http://dx.doi.org/10.1016/j.biocon.2015.09.005; J. R. Keehner, R. B. Wielgus, and A. M. Keehner, "Effects of Male Targeted Harvest Regimes on Prey Switching by Female Mountain Lions: Implications for Apparent Competition on Declining Secondary Prey," *Biological Conservation* 192 (Dec 2015), http://dx.doi.org/10.1016/j.biocon.2015.09.006.

[12] C. Packer et al., "Effects of Trophy Hunting on Lion and Leopard Populations in Tanzania," *Conservation Biology* 25, no. 1 (Feb 2011), http://dx.doi.org/10.1111/j.1523-1739.2010.01576.x; Craig Packer et al., "Sport Hunting, Predator Control and Conservation of Large Carnivores," *PLOS ONE* 4, no. 6 (2009), http://dx.doi.org/10.1371/journal.pone.0005941.

[13] G. A. Balme and Braczkowski AR, "Applicability of Age-Based Hunting Regulations for African Leopards," *PLOS ONE* 74, no. 4 (2012); Guy A. Balme et al., "Reproductive Success of Female Leopards Panthera Pardus: The Importance of Top-Down Processes," *Mammal Review* 43, no. 3 (2013), http://dx.doi.org/10.1111/j.1365-2907.2012.00219.x.

[14] R. B. Wielgus, "Minimum Viable Population and Reserve Sizes for Naturally Regulated Grizzly Bears in British Columbia," *Biological Conservation* 106, no. 3 (Aug 2002), http://dx.doi.org/10.1016/s0006-3207(01)00265-8; Wielgus et al; Swenson, in *Animal Behavior and Wildlife Conservation*; Swenson, Dahle, and Sandegren; J. D. C. Linnell, J. E. Swenson, and R. Anderson, "Predators and People: Conservation of Large Carnivores Is Possible at High Human Densities If Management Policy Is Favorable," *Anim Conserv* 4 (2001), http://dx.doi.org/10.1017/s1367943001001408; Swenson et al.

hunting of park fathers outside of protected parks resulted in increased infanticide, sexually segregated habitat use, and reduced female reproductive success within parks - because of increased turnover of fathers in the parks.

Hunting mortality has direct effects on population growth rates because of multiplicatively increased mortality, but it can also have indirect effects, such as disrupting the sex and age structure of a population.[15] Gosselin et al. (2015 p. 1) state: "In species with sexually selected infanticide (SSI), hunting may decrease juvenile survival by increasing male turnover." Hunting mortality can change social organization of species, because it "promotes" male turnover and this increases sexually-selected infanticide, and this is especially true when carnivores are hunted as trophies. Gosselin et al. (2015) add: "In species with SSI, harvesting males can have an indirect negative effect on the population by reducing juvenile survival."[16] Females with cubs generally avoid males as a strategy of avoiding sexually-selected infanticide, but this means that they often choose suboptimal habitats, including in closer proximity to humans, and this affects their diet quality and reduces their reproductive potential.[17]

Hunting makes the risk of sexually-selected infanticide greater, which leads to increased avoidance of males by females, this leads, ultimately, to lower fecundity.[18] For cubs of the year, the removal of adult males through hunting causes sexually-selected infanticide on them, and for two-year-old cubs, death due to hunting could be a direct factor.[19] Because of sexually-selected infanticide due to hunting, it limits both population growth and increases juvenile mortalities.[20] Breeding females actively implement strategies to avoid sexually-selected infanticide by engaging in aggression with males, avoiding infanticidal males including by restricting their foraging behaviors, all of which have individual and population-level costs because of a loss of reproduction.[21] Bear hunting also increases poaching activities.[22]

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[15] Wielgus et al; Gosselin et al. Gosselin et al (2015 p. 1) state: "In species with sexually selected infanticide (SSI), hunting may decrease juvenile survival by increasing male turnover." Hunting mortality can change social organization of species, because it "promotes" male turnover and this increases sexually-selected infanticide, and this is especially true when carnivores are hunted as trophies.

[16] Gosselin et al.

[17] T. J. McDonough and A. M. Christ, "Geographic Variation in Size, Growth, and Sexual Dimorphism of Alaska Brown Bears, Ursus Arctos," *Journal of Mammalogy* 93, no. 3 (Jun 2012), http://dx.doi.org/10.1644/11-mamm-a-010.1; Gosselin et al.

[18] Gosselin et al.

[19] R. Bischof et al., "Regulated Hunting Re-Shapes the Life History of Brown Bears," *Nature Ecology & Evolution* 2, no. 1 (Jan 2018), http://dx.doi.org/10.1038/s41559-017-0400-7; S. C. Frank et al., "Indirect Effects of Bear Hunting: A Review from Scandinavia," *Ursus* 28, no. 2 (Nov 2017), http://dx.doi.org/10.2192/ursus-d-16-00028.1.

[20] Frank et al. citing Swenson et al. (1997); Swenson (2003); Gosselin et al. (2015, 2017).

[21] Ibid. (Frank et al. (2017) also cite Wielgus and Bunnell (1994, 2000) and Wielgus et al. (2001a); Bischof et al.

[22] Guillaume Chapron and Adrian Treves, "Blood Does Not Buy Goodwill: Allowing Culling Increases Poaching of a Large Carnivore," *Proceedings of the Royal Society of London B: Biological Sciences* 283, no. 1830 (2016-05-11 00:00:00 2016), http://dx.doi.org/10.1098/rspb.2015.2939; G. M. Koehler and D. J. Pierce, "Survival, Cause-Specific Mortality, Sex, and Ages of American Black Bears in Washington State, USA," *Ursus* 16, no. 2 (2005), http://dx.doi.org/10.2192/1537-6176(2005)016[0157:scmsaa]2.0.co;2. Caitlin M. Glymph, "Spatially Explicit Model of Areas between Suitable Black Bear Habitat in East Texas and Black Bear Populations in Louisiana, Arkansas, and Oklahoma" (M.A., Stephen F. Austin State University, 2017), https://scholarworks.sfasu.edu/etds/128/; B. J. Wear, R. Eastridge, and J. D. Clark, "Factors Affecting

Trophy hunting bears particularly puts breeding females into peril. Artelle et al. (2013) found that grizzly bear hunters often exceeded hunting quotas in British Columbia, and especially upon the breeding segment of the population—sometimes by margins of 30%.[23]

Because of these effects (infanticide, sexual segregation), hunting mortality of grizzly bears is not like the hunting of traditional game animals such as deer and elk. When managers increase the hunting of game animals, one sees decreased natural mortality, and additional increases in reproduction, which can increase both population growth and population stability. Hunt grizzlies makes their losses *super-additive* or *multiplicative*.[24] That is because hunting creates additional mortalities from infanticide of cubs, decreases reproduction (sexual segregation), which results in decreased population growth, and subsequently population decline. Since the current population growth rate in Yellowstone and Grand Teton national parks is unity (1.0), any additional hunting mortalities in the boundary zone will cause the park populations to decline.

Hunting removes the oldest animals from the population, which reduces population growth rates because older females are the most successful breeders.[25] Hunting also removes the oldest and largest male bears, which can reduce successful reproduction as females choose their mates.[26] The removal of large males will reduce lower-quality cubs; that is, those with less ability to survive because of a lack of fitness; those less fit cubs will have a decreased ability to reproduce when they are adults.[27] The loss of older, male bears, the ones preferred by trophy hunters, could, as Frank et al. (2017) found, "artificially select for smaller and less reproductively successful phenotypes."[28]

In short, the trophy hunting around Yellowstone and Grant Teton national parks will result in hunting-caused deaths of park fathers outside the parks, infanticide of cubs within the parks, sexual segregation into food-poor habitats by females within the parks, reduced reproductive success of females within the parks, and population declines. Because of sexually selected infanticide, when one kills an adult male grizzly bear father, one kills his kids as well. Because the states of Idaho and Wyoming immediately set up a trophy hunt for grizzly bears, a plan to delist them, Congress should not make an end-run around the court and delist them.

Sincerely,

Rob Wielgus, Ph.D.

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[23] Kyle A. Artelle et al., "Confronting Uncertainty in Wildlife Management: Performance of Grizzly Bear Management," *PLOS ONE* 8, no. 11 (2013): 5, http://dx.doi.org/10.1371/journal.pone.0078041.

[24] Wielgus et al; Gosselin et al.

[25] Frank et al.

[26] Ibid.

[27] Ibid.

[28] Ibid., 156.

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MARKWAYNE MULLIN
2ND DISTRICT, OKLAHOMA

1113 LONGWORTH HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
(202) 225-2701

1 E CHOCTAW, SUITE 175
MCALESTER, OK 74501
(918) 423-5961

3109 AZALEA PARK DRIVE
MUSKOGEE, OK 74401
(918) 687-2533

Congress of the United States
House of Representatives
Washington, DC 20515–3602

ENERGY AND COMMERCE COMMITTEE
SUBCOMMITTEES
ENERGY
HEALTH
DIGITAL COMMERCE AND CONSUMER PROTECTION

April 18, 2017

The Honorable Ryan Zinke
Secretary
U.S. Department of the Interior
1849 C Street, N.W.
Washington, DC 20240

Dear Secretary Zinke,

I write today to urge you to honor the mandatory pre-decision and meaningful government-to-government consultation with tribes when considering the delisting of the grizzly bear from the Endangered Species Act (ESA).

Numerous tribes have contacted me about the previous administration's lack of cooperation, specifically the U.S. Fish and Wildlife Service (FWS), in efforts regarding the delisting of the grizzly bear. As a result of FWS's actions, the Oglala Sioux tribe petitioned former Department of Interior Secretary Sally Jewell for an inquiry into FWS's conduct. Additionally, the Northern Arapaho tribe sent a Cease and Desist order to former Secretary Jewell due to the FWS's persistent misrepresentations in the media of the tribe's position regarding the delisting of the grizzly bear.

Former FWS Director Dan Ashe assured tribes they would be included in ongoing conversations involving the grizzly bear, but they were largely left out. As a result, nearly 50 tribes passed resolutions and more than 120 tribes joined together to sign a treaty entitled: "The Grizzly: A Treaty of Cooperation, Cultural Revitalization and Restoration," illustrating their opposition to delisting the grizzly bear following the process conducted by the former administration. The treaty also proposes reintroducing the grizzly bear into its historic range within several tribal nations that have biologically suitable habitats. This proposal would include relocating the hunting quota from Greater Yellowstone and the Crown of the Continent to sovereign tribal lands. Crow Nation Chairman AJ Not Afraid testified at the Senate Committee on Indian Affairs Oversight hearing entitled "Identifying Indian Affairs priorities for the Trump Administration," and outlined the blueprint for the Department of Interior to positively engage with tribes.

I am confident that if this process is conducted with consultation and engagement with tribal leaders, a satisfactory conclusion can be reached that is acceptable to all impacted entities. I urge you to take this opportunity to set the benchmark for how this process should be conducted in the future.

Sincerely,

Markwayne Mullin
Member of Congress

United States Senate

WASHINGTON, DC 20510

June 2, 2017

The Honorable Ryan Zinke
Secretary
U.S. Department of the Interior
1849 C. Street, N.W.
Washington, DC 20240

Dear Secretary Zinke:

We are writing to express our concern with the reported lack of meaningful consultation with tribes on the proposed rule to delist the Greater Yellowstone Ecosystem grizzly bear from the Federal Lists of Endangered and Threatened Wildlife under the Endangered Species Act.

As you know, the federal government has a trust and treaty responsibility to engage in meaningful government-to-government consultation with tribes when tribal interests may be impacted by actions of the federal government. However, tribes have indicated that the federal government, in particular the Fish and Wildlife Service, has abandoned that responsibility in its delisting process. More than 20 tribes are formally associated with Yellowstone National Park, and more than 100 tribal nations have signed a treaty speaking to their concerns about the delisting. Grizzly bears are profoundly important to North American tribes, so any federal action to delist grizzly bears must take into consideration tribal input on any impacts to tribal sovereignty, treaty rights, and spiritual and religious freedoms.

Federally recognized tribes are not simply stakeholders who would be affected by delisting, but sovereign governments that must be included in management planning. We respectfully request that you revisit your delisting process and provide meaningful consultation on grizzly bear management with affected tribes as soon as possible. We stand ready to assist you in any way possible.

Sincerely,

Tom Udall
United States Senator

Cory A. Booker
United States Senator

Bernard Sanders
United States Senator

Senator CARPER. First question I would like to ask of you, Ms. Dohner. I understand you have helped create an exemplary model for collaborative species conservation in the Southeast region. Is that true, yes or no?

Ms. DOHNER. Yes, sir.

Senator CARPER. Thank you.

This model works for species and for landowners. Is that true, yes or no?

Ms. DOHNER. Yes, sir.

Senator CARPER. We know that the Fish and Wildlife Service can do more for species with additional financial resources. Would you elaborate on how the Service could provide better regulatory certainty for landowners with additional financial resources and do so within the current framework of the Endangered Species Act?

Ms. DOHNER. Yes, sir. Thank you very much for the question, sir. So, as part of conservation for conflict, one of the things that the Service and the whole coalition—which is industry, States, private landowners all working together, and NGOs—is to use the incentives and the tools already established through the ESA, safe harbors, candidate conservation agreements with assurances.

But sir, it takes time, and it takes staff to develop those resources. It takes the Service staff; it takes the staff of the States, because species that aren't listed are the State's jurisdiction, so the State and the Service both need resources. You also need time and the private landowners need help. Private landowners need to get better engaged in these efforts.

The Fish and Wildlife Service could also improve the ESA through Section 7 consultation and recovery, and I would just like to give you one example. In the Southeast, where I was Regional Director, we had about 389 species that were currently listed, not counting those we had to evaluate.

We had $14 million in our recovery budget. About five of those species took about $1 million apiece; the rest had to go to the 384 species on how we would do things. It is just an example of how the resources are not adequate and how you have to make difficult decisions.

Senator CARPER. OK, thank you.

If I could, maybe a follow up question for you. This is with respect to judicial review, which several people have discussed today.

In your testimony you mention litigation challenges. Litigation over new listings led to the development of the Service's 7 year workplan, which is helping the Service prioritize listings and critical habitat designations.

In the case of the Service's relationship with Florida, you stated that litigation regarding manatee recovery actually improved your relationship with the State, actually improved your relationship with the State.

Would you further elaborate on the importance of judicial review and how you believe the Service can work through litigation to maintain public trust and improve species conservation?

Ms. DOHNER. Yes, sir. Thank you for the question. We were sued by the Save the Manatee Club, and both the State and the Fish and Wildlife Service had their lawsuits in different districts. The first thing we realized is that we were having challenges as we

worked through the lawsuits because they were very similar lawsuits, so we worked together, and we actually had the suits combined and we worked through those together.

Because of this, we realized that we had to figure out how we could make a difference by the State using their authorities and the actions they could take and the Service using their authorities and the actions they could take together to deal with the lawsuit and the recovery of the manatee. Part of that process was to bring all the stakeholders together to talk about the science, to talk about the actions, and to talk about the issues we were addressing.

That included boat dock builders, the Army Corps of Engineers, private landowners, all that were being impacted, because when we were sued, all boat dock buildings in Florida had been shut down, so nobody could do anything at that point. We had to figure out how we could find a creative solution to go forward, allow those on the lands or the waters to work and conserve a species.

Before we got sued, the Service and the State of Florida didn't get along the best. After the lawsuit, to this date, the Service and the State of Florida, and the Southeastern States with the Southeast Regional Director, work well together, in a collaborative fashion, and many times we work seamlessly on restoration, recovery, conservation issues for endangered species.

Senator CARPER. All right; well, thanks.

I have another question or two. Maybe we will have a second round. If we do, I would like to ask those. Thanks so much.

Senator BARRASSO. Thank you.

Senator Rounds.

Senator ROUNDS. Thank you, Mr. Chairman.

Deputy Director Kennedy, as you know, States have periodically been required to submit for approval State Wildlife Action Plans to the U.S. Fish and Wildlife Service in order to qualify for State and tribal wildlife grants. How would you characterize the State of Wyoming's relationship with the U.S. Fish and Wildlife Service?

Mr. KENNEDY. Chairman Barrasso, members of the Committee, Senator, in relation to specifically State Wildlife Action Plans, or in general?

Senator ROUNDS. Yes, State Wildlife Action Plans.

Mr. KENNEDY. Our development of State Wildlife Action Plans and our work with the U.S. Fish and Wildlife Service through the State's Wildlife Grants program has been extremely productive. Certainly, in Wyoming, we have developed a very aggressive State Wildlife Action Plan to address those species that aren't listed yet.

And all this discussion about the Endangered Species Act and the importance of keeping species off the list, that is exactly the primary purpose of those State Wildlife Action Plans. And again, our relationship with the Fish and Wildlife Service has been mostly in the form of review of those plans and the provision of funding to accomplish projects.

Senator ROUNDS. Are there any legislative changes that you would see helpful with regard to promoting and furthering that relationship?

Mr. KENNEDY. Chairman Barrasso, Senator, I think the relationship is working just fine. There could be some improvements, certainly, in the level of funding that is provided to State fish and

wildlife agencies specific to sensitive species, especially when you look at the fact that our model is very specific to being provided by hunters and anglers. There is a lot of money needed to go into those species for that constituency.

But in terms of general coordination with the U.S. Fish and Wildlife Service for State Wildlife Action Plans, I guess I don't see the need for additional legislation.

Senator ROUNDS. Thank you.

Mr. McCormick, I believe you would agree with me that the greatest conservationists this country has are its farmers and its ranchers. However, Congress has responsibility to the farmers and ranchers to provide them with tools, when available, to protect habitats and prevent environmental degradation.

One of those tools in my home State of South Dakota has been the Conservation Reserve Program. Many of us would like to see as many acres of CRP in the upcoming Farm Bill as we can get. Could you speak to the value of this program from a conservation perspective?

Mr. MCCORMICK. I can speak to the value of the program on a personal basis. My father-in-law's farm is in CRP, or was at one point in time, and it was a highly erodible tract of land that should have been in there and has been a big tool to be used for the enjoyment of wildlife and the protection of wildlife in the area, so it has been a good program.

The Farm Bureau has supported the CRP program. We understand that it has some challenges when it becomes competitive with farmers that may want to lease the land and put it back in production, and that it may have some unfair advantages there to keep that land out of production, so I think we are in the corner of supporting the Conservation Reserve Program. We know that it has been a valuable tool to not only help our farmers, but to protect wildlife around the U.S., and we support the program.

Senator ROUNDS. Really, the issue there should be to get the land which is the most vulnerable, which is probably the least productive land, and yet that is the land that really belongs in the CRP program.

Mr. MCCORMICK. Yes, Senator, I completely agree. I spent a number of years on our county committee for farm service agency, and it was disheartening to see that maybe some of the land that should've been in the program didn't rank high enough, and then the most productive land that needs to be out growing crops to feed our Nation was put in because it scored higher. I guess that is what I am saying, is that when we write these rules, we need to be aware that the land that we are trying to protect is probably best for the habitat for our wildlife needs to be the ones that scores the highest.

Senator ROUNDS. Couldn't agree more with you. Thank you.

Ms. Dohner, I am just curious. You indicated flexibility is not always being used today with regard to the programs. Could you elaborate just a little bit in terms of who has that flexibility? Can you think of a time in which that occurred that you were thinking of when you made that statement?

Ms. DOHNER. Yes, sir. Thank you very much for that question. Sir, I was actually in the Washington, DC, office when the Service

developed Habitat Conservation Plans, Safe Harbor agreements, and the Kennedy Conservation agreements. Then I moved to the Southeast. At the time they weren't known that well, what those flexibilities are. They are basically voluntary programs that provide assurance or incentives to private landowners to get involved, and they have no additional regulatory burden as they go forward with these.

So, part of the problem is people don't know how flexible they can be and how you can use them. They also don't understand how to use them sometimes. So that is part of the problem.

I believe, sir, that there are also other flexibilities that we could use when it comes to recovering and conserving species, and some of the work that we did in the Southeast, working closely with the States, together with the States, sometimes the States lead, sometimes the Service leads. I think that we need to do that type of work more.

Senator ROUNDS. Thank you.

Thank you, Mr. Chairman.

Senator BARRASSO. Thank you, Senator Rounds.

Senator Whitehouse.

Senator WHITEHOUSE. Thank you very much, Chairman, and thank you for holding this hearing.

Mr. Kennedy, welcome. I am from Rhode Island, which is very different than Wyoming in a lot of respects. Your Senator and I have done a lot of good work together on a variety of issues, and I have come to know a little bit about the Wyoming ecosystem, and I have had the pleasure of visiting out there, both hiking in the high timber areas and fishing for your wonderful trout. So, although it is beautiful in a different way than Rhode Island, it is a very beautiful place.

There is a Wyoming State Wildlife Action Plan from 2017, and it has a 34 page report in it on the effect on climate change on your State in particular, and I would like to ask you about the two areas that I just mentioned. In one part the report says, "Warming water temperatures may drive cold and cool water fish species"—and I think we agree that trout is a cold and cool water fish species—"to new ranges or lead to local extirpation or extinction."

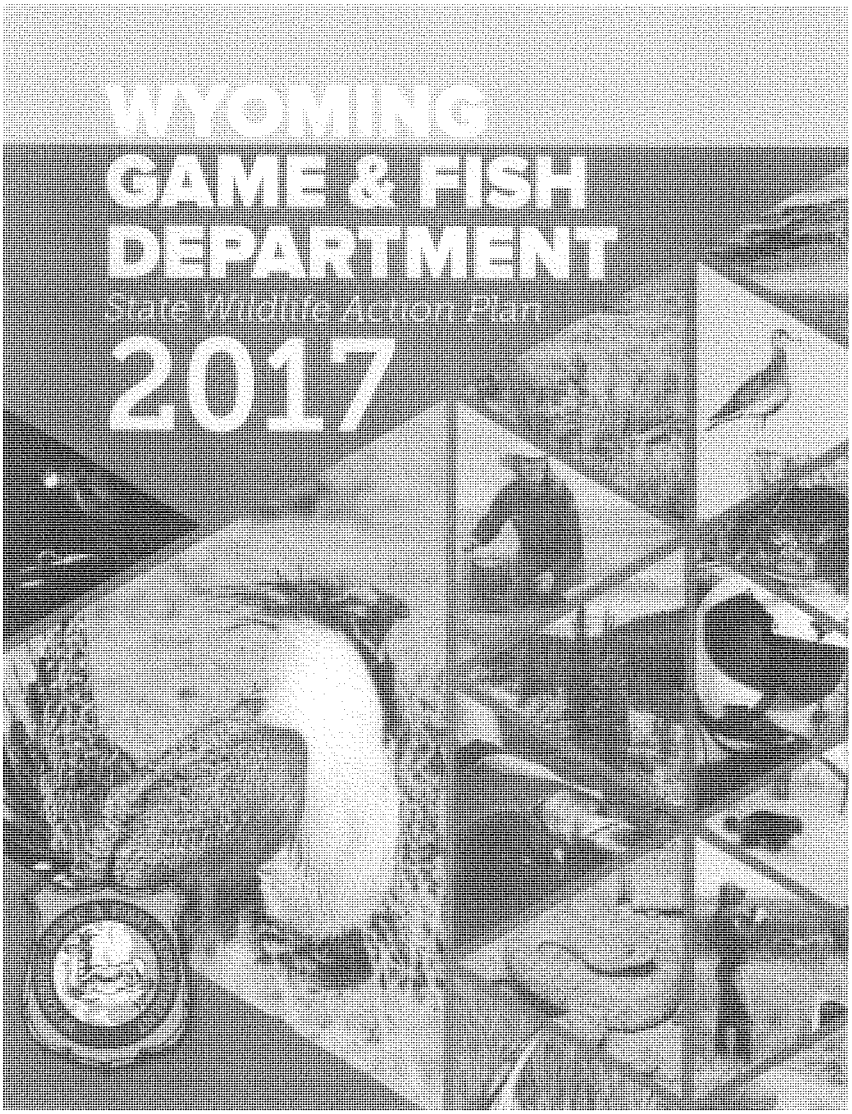
I am wondering what you are hearing from Wyoming fishermen and outfitters about the effect of climate change on trout streams.

Mr. KENNEDY. Chairman Barrasso, members of the Committee, Senator, thank you for the question. We had talked earlier about making reference to our State Wildlife Action Plan, and we certainly take that plan very serious.

Senator WHITEHOUSE. May I just interrupt? Is that in the record of the proceedings? If not, I would like to ask that the 34-page section on climate change be added to the record of the proceedings, since we are talking about it.

Senator BARRASSO. Without objection.

[The referenced information follows:]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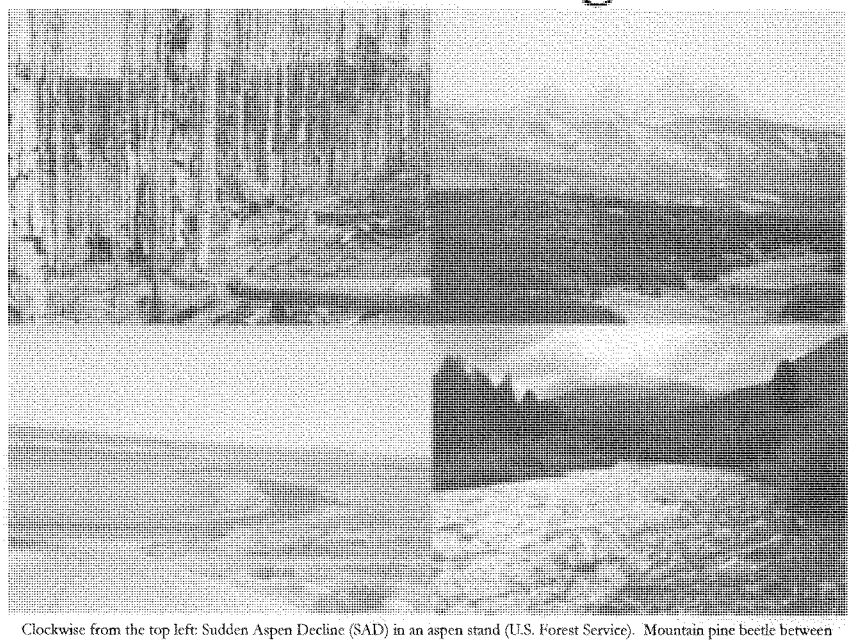
DEPARTMENT
State Wildlife Action Plan
2017

Climate Change



Clockwise from the top left: Sudden Aspen Decline (SAD) in an aspen stand (U.S. Forest Service). Mountain pine beetle between Dubois and Grand Teton National Park (National Parks Traveler). Wood River near Meteetsee (WGFD). Greyrocks Reservoir during the height of the recent drought (WGFD).

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Background

Climate is a compilation of many meteorological features occurring over a long period of time. Primary elements include temperature, humidity, atmospheric pressure, air flow, and precipitation. "Weather" refers to short-term variation in these elements (i.e., two weeks or less), while "climate" refers to these dynamics over months, years, decades, centuries, and longer (NOAA 2008). Climate is controlled by many factors. It is influenced by Earth's orbit and tilt, which determine interannual changes such as the seasons. Latitude, elevation, terrain, ground cover, and presence or absence of water bodies also impact climate. These factors may affect atmospheric composition, temperature, precipitation patterns, and the many other elements mentioned previously. Climate is also affected by variables such as dust, aerosols, solar output and absorption, and concentrations of greenhouse gases in the atmosphere, namely water vapor, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

Paleoclimatology, the study of ancient climates using proxy climate records (e.g., tree rings, ice cores, sediment cores), demonstrates that climate varies naturally over long periods of time. Climate is subject to natural variability from decade to decade primarily as a result of cyclical phenomena such as El Niño-Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO), and North Atlantic Oscillation (NAO), which highlights the importance of long-term data when considering anthropogenic, or human-influenced, impacts to the climate system (Wiens and Bachelet 2009). The study of climate in the 20th century adds to scientific data pertaining to climate dating back thousands of years, painting a historical picture that shows both the warming and cooling of Earth's surface temperatures, as well as various drought and pluvial periods. Simply stated, historical records indicate that Earth's climate is variable and changes over time. Any scientifically recognizable, long-term variability in the aforementioned climatic elements (e.g., temperature, precipitation) is described as "climate change."

The Intergovernmental Panel on Climate Change (IPCC) was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 as the leading body for the review and assessment of worldwide scientific, technical, and socio-economic information on climate change. This scientific body *does not* perform research or monitor the earth's climate. The IPCC is charged with reviewing voluntary scientific contributions in the field of climate change and translating and conveying to the public the presently documented and potential future consequences of this global phenomenon.

Scope and Challenges of Climate Change and Wildlife Conservation and Management

Global to Local

While climate change is a global phenomenon with broad-scale ramifications at the global level, the ecological impacts are more readily observed, experienced, and addressed at the local level. The western United States has a more diverse landscape with climate variations that are difficult to model on a fine scale, areas that are remote and inaccessible for climate research and monitoring, and a patchwork of publicly and privately owned land that influences management strategies and policy making (Joyce et al. 2007). Wyoming is a unique mixture of mountain and plains landscapes, causing the state's climate to be varied from east to west and north to south. Wyoming is also faced with several unique challenges relating both directly and indirectly to climate and climate change.

According to paleoclimatic records dating back thousands of years, drought—a period of unusually low precipitation—is a defining feature of Wyoming's climate (Gray and Andersen 2009). Examination of western climates over

centuries, which is established primarily by lake sediments, tree ring cores, and packrat middens (McWethy et al. 2010), demonstrates that severe drought is a natural part of Wyoming's climate (Gray and Andersen 2009). However, the baseline for state climate is established using records of climate variability throughout the past century (Gray and Andersen 2009). Most importantly, climate records over the past 30 years are most often used to establish resource management practices. A longer historical record indicates that the 20th century was an unusually wet time period in Wyoming relative to the past several millennia (Gray and Andersen 2009).

In addition to frequent drought, Wyoming is also challenged by the regional semi-arid climate. In other words, even in non-drought periods Wyoming is a rather dry area. Wyoming is the fifth driest state in the U.S.—over 70% of the state receives less than 16 inches of precipitation annually (Gray and Andersen 2009, Water Resources Data System undated). The state also relies almost exclusively on mountain snowpack as its major water source, with 70–80% of precipitation arriving as snow (Hays 2008). A majority of the snowpack is concentrated in a relatively small area (Gray and Andersen 2009), namely the higher elevations in the northwestern and southeastern mountain ranges. Ninety percent of Wyoming's runoff is snowmelt from these areas (Hays 2008). Wyoming is clearly a headwaters state, as its mountains form the beadwaters of many major rivers, including the Snake-Columbia, Green-Colorado, Yellowstone-Missouri, and Platte systems (Gray and Andersen 2009). Consequently, water that originates within the state's political boundaries is allocated to downstream states, which means that Wyoming has important water-management responsibilities and also that water availability in this state has the potential to significantly impact other states.

Warming has shifted the periodicity and intensity of snowfall and subsequent runoff in much of North America (Mote et al. 2005, Regonda et al. 2005, Stewart et al. 2005, Wilcox 2010). April 1st snowpack in western watersheds has decreased between the middle of the 20th century and the end of the century (Joyce et al. 2007). The hydrological impacts of potential warmer surface temperatures and subsequently changing snow regimes in areas of high elevation are vast and may have countless secondary implications over time. Snowpack melt will occur earlier and, consequently spring runoff will come earlier and occur faster (Backlund et al. 2008, Wilcox 2010, Gray and Andersen 2009). As a result, late-season water flows will decrease (Joyce et al. 2007), which could exacerbate drought stress and contribute to increasing water temperatures (Wilcox 2010, The National Academies 2009). Overall warmer temperatures will likely lead to increased water loss due to evaporation and plant water use and decreased water yield to lakes, streams, and wetlands (Hoerling and Eischeid 2007).

Warmer winter temperatures might also cause seasonal precipitation to fall as rain instead of snow, subsequently decreasing annual snowpack and inhibiting the recharge of ground water reservoirs (Field et al. 2007). In the western mountain region of North America, the amount of annual precipitation in the form of rain that would normally fall as snow has been significantly increasing since the middle of the 20th century (Knowles et al. 2006), and spring and summer snow cover has been decreasing (Groisman et al. 2004). The West will become more vulnerable to shifts from snow to rain if winter temperatures continue to increase (Joyce et al. 2007). Warmer surface temperatures also will likely intensify drought events, mucb like those on historical record (Gray and Andersen 2009). Even a small increase in average temperatures with no decrease in annual precipitation would greatly impact Wyoming's water resources (Gray and Andersen 2009). The increase in water evaporation resulting from warmer temperatures would likely offset any increase in total precipitation (Joyce et al. 2000); it would also exacerbate the drought effects of decreasing amounts of total precipitation (Stonefelt et al. 2000, Pulwarty et al. 2005). In other words, conditions that currently define drought could become more of

the norm in a future climate for Wyoming (Hoerling and Eischeid 2007, Seager et al. 2007).

Water and drought are a challenge for Wyoming regardless of climate change. Future projections for the western U.S. depict an increasingly warm and consequently drier climate that would alter regional and local hydrology and further strain limited water resources. Wyoming's resource managers, who are already familiar with drought planning and allocating scarce water resources for multiple uses and users, will continue to deal with these challenges in perpetuity. Good water management and planning are strong policies for the state of Wyoming under any realistic climatic scenario, and current projections of a drier climate emphasize this point.

Potential Impacts of Climate Change on Terrestrial and Aquatic Species

Species have evolved according to certain regional and local climate norms and much of their individual phenology and range is directly influenced by climate (Walther et al. 2002, Parmesan and Yohe 2003, Root et al. 2003, Parmesan and Galbraith 2004). Species respond to environmental change based on habitat needs, competitive ability, and physiological tolerances (Manley 2008). Climate change has the potential to alter species' fundamental interactions with other species, organisms, and the physical environment, which could lead to a cascade of impacts throughout the entire ecosystem (The National Academies 2009). The effects of climate change will impact both Species of Greatest Conservation Need (SGCN) and species that are not classified in this category (non-SGCN), including many invertebrates, plants, fungi, and microbes that are typically not directly addressed hy state agencies.

Phenology[1]

Many species operate on seasonal cues that are directly related to climate and so changes in climate may lead to shifts in the phenologic trends of some species, impacting breeding and migration patterns and the timing of germination or flowering of plants (Parmesan 2006, Root et al. 2003). The onset of spring, as measured by the timing of a variety of natural phenomena, has been occurring earlier since the 1960s (Walther et al. 2002), which in turn has been impacting some species' observable climate-sensitive behaviors such as breeding, hibernation, migration, productivity, and range (Joyce et al. 2007). Species movement patterns may change according to the duration of the seasons, food availability, and altered migratory routes (Backlund et al. 2008). Migratory species may begin arriving at seasonal and transitional feeding grounds earlier and leaving later in reaction to climate change, or continue arriving and leaving on time even though climate has altered the seasonal processes of stop-over and breeding grounds (Visser and Both 2005).

Not all species are expected to alter their behavior in response to changing climate factors in the same way or at the same rate (Visser and Both 2005, Visser et al. 2004), and there is no guarantee that species responses will be synchronized to the responses of their forage resources. Such mistiming could have significant impacts on the structure of the ecosystem and the relationships of the species within that system. Changing species relationships will have a more significant impact on ecosystem structure and function than changes to any one particular species (Harrington et al. 1999, Visser and Both 2005).

Abundance and Biodiversity

The mis-timing of specific species' behaviors and forage resources to climate change and subsequent impacts to species relationships

[1] Phenology is the study of plant and animal life-cycle events that are influenced by variations in climate on an annual or interannual timescale. See Cayan et al. 2001 and Inouye et al. 2000 in the Literature Cited section for specific examples of studies that have documented phenologic changes in species in the western U.S.

such as competition and pollination could result in complex changes to population sizes and densities. For instance, population size may decline if breeding is mis-timed with a seasonal food source that peaks at a different time than historically observed, but may increase if forage is available earlier and lasts longer. More directly, populations and species may be affected by changing climate extremes. Changes in species abundance can lead to shifts in community make-up, changing interactions among species and the environment, and the emergence of new, novel communities and species interactions (Walther et al. 2002). Overall biodiversity may be altered by changing climate conditions as some species manage to adapt, some species move, and some become extirpated or extinct.

Genetic Diversity and Morphology

Climate change may also impact genetic diversity and species' morphology (Root et al. 2003). Genetic diversity fluctuates with population size and connectivity, and for many species the transition to a warmer and drier environment will translate to a rapid fragmentation of suitable habitat. Habitat fragmentation and landscapes that are increasingly being altered by human activities severely hinder species mobility and dispersal capacity (Pitelka and The Plant Migration Working Group 1997). Furthermore, warmer and drier conditions may select for individuals with smaller body sizes or other morphological adaptations, eventually resulting in populations with substantially different physical or physiological characteristics than today (Koopman 2008, Root et al. 2003).

Range

Not all species have the same level of plasticity in the face of environmental change, and many may not evolve quickly enough to adapt to changing climate conditions in situ (Parmesan 2006). Some species may shift their range in order to track the physical and biological conditions to which they are already adapted (Root et al. 2003). Climate change may cause species' ranges to expand, contract, or fragment (Ruggiero et al. 2008, Koopman 2008).

Warming temperatures are expected to result in a general movement of species' ranges up in both elevation and latitude as a result of physiological tolerances and/or specific habitat needs. Populations of species currently persisting only at high elevations may fragment, forming small isolated populations on mountaintop islands. For example, some low-elevation pika (Ochotona princeps) populations that have been studied in the Great Basin have reportedly gone extinct since the 1930s, while populations inhabiting higher elevations remain intact (Beever et al. 2003, Parmesan and Galbraith 2004).

Similarly, warming water temperatures may drive cold- and cool-water fish species to new ranges or lead to local extirpation or extinction, while high-elevation fisheries may become more productive as temperatures warm. Ranges of cold-water species may contract, while species that are tolerant of warmer water temperatures may continue to expand their range (Stefan et al. 2001). The range of some plant species may also be affected by climate change, and vegetation redistributions may occur as a result of climate factors such as temperature tolerances, water limitations, pollinator interactions, and seed dispersal ability.

Both native terrestrial and aquatic species may increasingly be impacted by nonnative species that cross political boundaries in an effort to disperse and capitalize on opportunities for range expansion resulting from the decline of native species (Walther et al. 2002). Invasive species may contribute to the loss of biodiversity, changes in the abundance and distribution of native species, and alteration of species community structure, and may even cause local population extinctions (Joyce et al. 2000) (see Wyoming Leading Wildlife Conservation Challenges – Invasive Species). Some species will be successful in fulfilling habitat needs in more favorable climate and some, which are less mobile or adaptable, will not (Midgley et al. 2002).

Species with specific trophic relationships likely will not respond to climate changes in the same way or at the same rate, which may lead to local

extirpations, extinctions, community breakdown, and structural reorganization (Root and Schneider 2002, Schmitz et al. 2003). Research indicates that species have responded to rapid climate change in the past, and some have already begun responding to the warming and other changing climate conditions that have occurred in the 20th century. Natural resource managers need to begin considering how both the direct and indirect effects of climate change may unfold across the landscape (Joyce et al. 2007). However, resource managers must also take into consideration a variety of non-climate drivers that impact species distribution (McWethy et al. 2010).

Other Stressors

Many of the potential effects of climate change on wildlife may occur as a result of the exacerbation of other challenges and stressors that affect species irrespective of climatic conditions. Other stressors include habitat fragmentation, loss, and disturbance; limited and declining quality of water resources; invasive species and disease; and declining species populations; among other things.

In particular, warmer surface temperatures could alter the survival and reproduction rates of some pathogens and vectors, which may currently be constrained by temperature minimums and maximums, potentially affecting the virulence and incidence of wildlife diseases like brucellosis, chronic wasting disease, whirling disease, West Nile virus, and bluetongue disease, as well as important plant pathogens such as white pine blister rust and mountain pine beetle.

Although all species will be affected by changing climate conditions, not all species will experience the same effects—some will benefit, while others will struggle. The species that may be at highest risk for dramatic impacts from climate change are those with limited ability to adapt. Species that are endemic to a particular area may be at greater risk than those that are geographically widespread. Similarly, species with an ability to move and adjust their range with changing conditions may have more success adapting than those that are unable to disperse or are relatively sedentary. Boreo-alpine taxa, which are already restricted to high elevations, will have limited options for population migration/dispersal as the climate warms and becomes more arid. Species that are habitat specialists or rely on specific interactions with other species, organisms, or physical aspects of the environment may be at greater risk of adverse effects of climate change than species that are more generalist in nature. Additionally, climate change has the potential to negatively impact species with low physiological tolerances to changing atmospheric, local weather, or environmental quality conditions. Finally, populations of species that have low genetic diversity or that have experienced recent or ongoing declines in population size may be more vulnerable to the effects of climate change than those species that have populations that are both rich and abundant (Midgley et al. 2002).

Potential Impacts of Climate Change on Habitat

Species survival depends largely on sufficient and healthy habitat; intact critical areas, such as breeding grounds or spawning beds; and connectivity among these areas (Joyce et al. 2000). Here again, non-climate stressors and natural ecological occurrences that are exacerbated by climate change may have the biggest impacts on habitat quantity and quality.

Terrestrial Habitat

The 11 terrestrial habitat types that are described in this SWAP include various types of forested land, shrublands, and grasslands; riparian areas and wetlands; and rocky areas with little vegetation (see Wyoming Habitat Descriptions – Terrestrial Habitat types). Wyoming's diverse terrestrial habitats are home to SGCN and non-SGCN alike, and all are influenced by regional climate and will be affected in some way by changing climate conditions. The structural components of an ecosystem may be significantly altered by changing interactions among species, which can impact the quality and quantity of habitat. Natural landscape disturbances, which may be

compounded by changing climate factors, will likely have profound effects on Wyoming's terrestrial habitat.

Wildfire is increasingly causing stress to mid-elevation forests as both the length of the fire season and the average area burned each year increases in the U.S. The length of the fire season has increased 78 days over the past 3 decades (Westerling et al. 2006), and is expected to grow by an additional 2–3 weeks by 2070 (Barnett et al. 2004). Over the past 20 years, the average area burned in the West has increased six-fold (Westerling et al. 2006). Climate is one factor among many that may influence the frequency and severity of wildfire (see Wyoming Leading Wildlife Conservation Challenges – Disruption of Historic Disturbance Regimes). Wildfire is a natural occurrence that regularly alters vast expanses of wildlife habitat. Coupled with the effects of climate change—namely warming temperatures, drought, and vegetation changes—wildfire may lead to more major ecosystem changes in the future. Water limitations resulting from the increased intensity of regional drought could hinder forest regeneration, causing meadow and grassland ecosystems to permanently replace current woodlands and forests (Joyce et al. 2007). Frequent fire also discourages the recovery of shrublands, and thus some of Wyoming's sagebrush habitat could be permanently converted to grassland (Bureau of Land Management undated).

Forests are natural water filters and flow regulators. The general loss of forested land predicted under a warmer and drier climate may compound water-quality issues and irregular hydrological flows, which are also being impacted more directly by rising surface temperatures. Overall declines in vegetative cover as a result of increased intensity and severity of wildfire may lead to further habitat alteration by damaging organic soils and causing increased soil erosion (Spigel and Robichaud 2007). Erosion can lead to increased runoff, sedimentation, and debris flow in streams and rivers, which can negatively impact aquatic habitat and associated species (Rieman and Clayton 1997, Dunham et al. 2003).

Bark beetle outbreaks are a natural part of forest ecology; however, researchers suggest that warmer winters in recent decades coupled with drought have caused forests to become more susceptible to the prolonged and more intense epidemics (Hicke et al. 2006, Romme et al. 2006). Warmer temperatures may be allowing for enhanced beetle population growth and range expansion to higher-elevation forests (Joyce et al. 2007). Large, contiguous tracts of dead and fallen trees as a result of beetle kill also increases the risk for high intensity fires, as well as impacts on local and regional hydrology including changes in annual water yields, peak flows, and low flows. Research also suggests that the loss of large numbers of trees in concentrated areas impacts local weather and atmospheric conditions by causing changes in precipitation, temperature, and air quality, which may further impact wildlife by leading to more vegetative restructuring (ScienceDaily 2008). Wildlife managers may also encounter difficulty with maintaining hunter access to public lands resulting from increasingly hazardous forest conditions.

Climate change has the potential to intensify periodic drought. Prolonged and more severe drought will significantly alter terrestrial habitat, affecting a range of species that rely on these habitats and associated resources. The combination of drought and increased evaporation from surface water and terrestrial ecosystems as a result of warming surface temperatures may have severe effects on wetlands and riparian areas. These areas could become increasingly sparse and/or less connected, or may dry up completely. Wetlands and riparian habitat are vitally important to aquatic and terrestrial species in Wyoming, providing both shelter and forage. A vast majority of species use these areas either daily or seasonally as part of their lifecycle, and many of Wyoming's bird species are wetland or riparian obligates (Nicholoff et al. 2003, Copeland et al. 2010). These habitats also serve as migration and dispersal corridors. The alteration of

wetlands and riparian areas may also compound other hydrological effects of climate change by contributing to a decrease in surface water storage, less flood control, decreased filtration of sedimentation, and uncontrolled stream flow (Copeland et al. 2010), all of which impact the quality of species' habitat.

Long periods of drought may cause a decline in forested area as the land becomes too arid to support forest ecosystems (Joyce et al. 2007, The National Academies 2009), and may further increase the susceptibility of forests to insect epidemics (Logan et al. 2003). Decreasing soil moisture could also kill trees planted for shelterbelts and cottonwood galleries, both of which provide important habitat for numerous terrestrial species. Finally, drought may cause terrestrial habitats such as shrublands, sagebrush, and perennial grasses and forbs to decline due to water limitations (Bureau of Land Management undated). Such habitats may convert to other types or may simply become more barren of vegetation, consequently decreasing the forage value of the land, increasing susceptibility to the invasion of drought-tolerant species and wildfire, and leading to the decline of associated wildlife species.

As ecosystems and landscapes are altered by changing climate conditions and other disturbances, the opportunity for exotic and invasive species to establish populations in Wyoming may increase. Terrestrial habitat may be increasingly affected by invasive flora that can outcompete native flora in a warmer climate and in a landscape that is more frequently being disturbed by wildfire, insect outbreaks, and drought (Bureau of Land Management undated). Increasing amounts of valuable and structurally diverse habitat may be altered by invasive plant species, which in some cases may result in a naturally diverse mosaic of native communities being converted into a more monotypic habitat (see Wyoming Leading Wildlife Conservation Challenges – Invasive Species).

The viability of riparian areas, which are highly productive and provide critical habitat for species (see Wyoming Habitat Descriptions – Riparian Areas), is also being affected by invasive species such as Russian olive and tamarisk (Bureau of Land Management undated, Archer and Predick 2008, Wilcox 2010), and the impacts of these invasive species may be exacerbated by the effects of climate change (see Wyoming Leading Wildlife Conservation Challenges – Invasive Species). As changing climate conditions alter average seasonal temperatures and the hydrology of the West, riparian areas may become increasingly important as corridors for species movement to more suitable habitat, refuge, and also important areas for terrestrial grazers (Western Governors' Association 2008).

Figure 1.

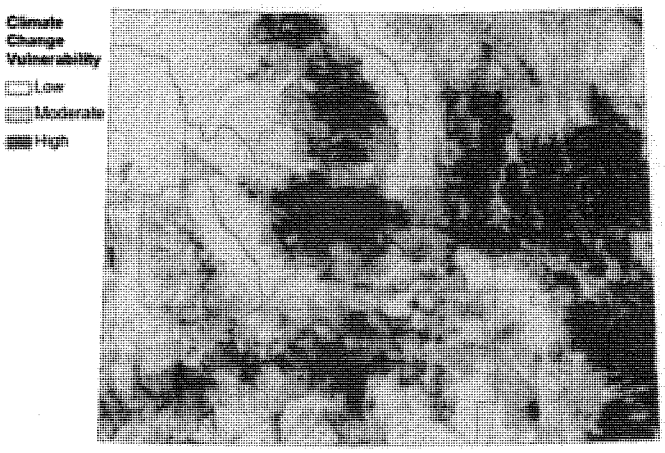


Figure 2.

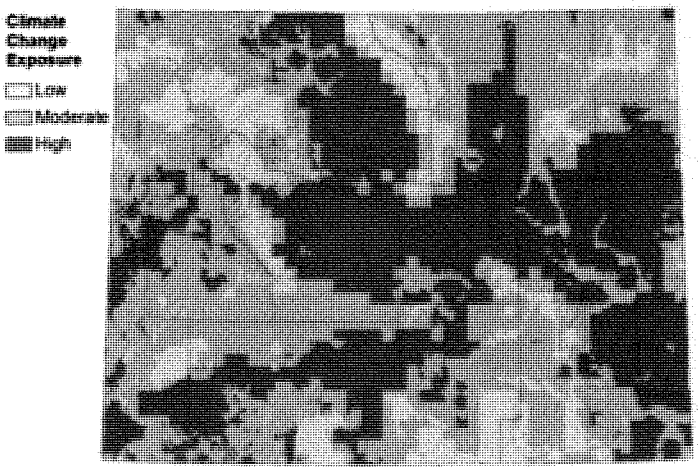
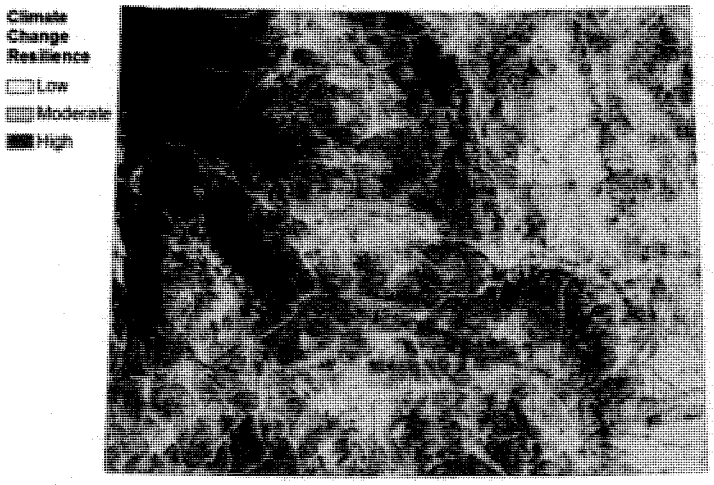


Figure 3.



Climate change vulnerability was calculated as exposure to climate change minus resilience to climate change, for 30-m raster cells across Wyoming (Pocewicz et al. 2014). Exposure to climate change represents the relative impact of changes in temperature and moisture on the landscape. Cell values ranged from 0, which reflects minimal potential for change, to 1, which reflects a maximum change in climate conditions. Two metrics were combined to represent climate change exposure, annual mean temperature change rate (°C/yr) from 1951-2006 and projected moisture deficit (Pocewicz et al. 2014). Resilience represents the relative ability of habitats within a landscape to survive or recover from a change. Cell values ranged from 0, which reflects minimal resilience, to 1, which reflects maximal resilience. Resilience was calculated from three datasets: topographic diversity and water availability, land management status, and landscape integrity or intactness (Pocewicz et al. 2014). For each climate change raster dataset, the scores ranging from 0 to 1 were assigned to categories as follows: low (<0.33), moderate (0.34-0.66), and high (>0.67).

Aquatic Habitat

The State Wildlife Action Plan (SWAP) identifies six aquatic basins in Wyoming (see Wyoming Habitat Descriptions – Aquatic Basin types). The potential impacts of climate change on water resources in Wyoming may significantly affect aquatic habitats and, like terrestrial habitats, exacerbate existing stressors to these ecosystems and the species they support.

Climate change may significantly impact hydrology in terms of both water quality and quantity, which could have far reaching impacts on aquatic habitat and the species that rely on that habitat. Warmer water temperatures resulting from increasing average surface temperatures decrease the oxygen saturation of the water and may negatively affect the viability of the habitat for some native aquatic species (Ficke et al. 2007, Western Governors' Association 2008). Increased air temperature, combined with changing atmospheric composition may also change water chemistry and the primary productivity of aquatic habitat (e.g., algal blooms).

Climate change has been causing mountain snowpack to melt earlier and run off faster in recent decades. Coupled with more severe storms in the future, this could cause more incidents of flooding (Backlund et al. 2008), especially when the previously discussed landscape changes are taken into consideration. Flooding has the potential to alter water quality by modifying aquatic root systems that filter sediments (Manci and Schneller-McDonald 1989), alter geomorphic features of streams and rivers, change riffle and pool distributions, and scour spawning beds (Joyce et al. 2007, Western Governors Association 2008). Decreasing late-season water flows resulting from early runoff and increased evaporation may cause the disappearance of isolated pools, contribute to warming water temperatures, and further lead to aquatic habitat fragmentation and fish mortality (Rahel et al. 1996, Field et al. 2007).

Wyoming's waters are already home to many nonnative species (e.g., walleye), some of which are deliberately promoted by managers, and some which are threatened to be spread from neighboring states (e.g., zebra and quagga mussels) (see Wyoming Wildlife Conservation Challenges – Invasive Species). As aquatic habitat continues to be altered by climate change and non-climate stressors, rivers, streams, lakes, and other bodies of water may become increasingly susceptible to invasive flora and fauna that are more tolerant of and/or adaptable to changes in water quality and quantity.

Climate Change and Uncertainty Regarding Impacts on Species and Species Interactions

The potential impacts of climate change on fish and wildlife and alterations to habitat in Wyoming are uncertain. While a high probability for change exists, the changes may play out in a variety of ways that, at times, will be unpredictable. Examining the ecological and biological impacts of long-term changing climate conditions may be confounded by the natural short-term and interdecadal cycles of changing trophic relationships (Schmitz et al. 2003). Peaks in the populations of some species and declines in others are often a natural part of the ecological narrative in relationships among species. Determining which changes are related to long-term climate trends may prove difficult depending on monitoring protocols and the availability of long-term data.

Modeling can be a useful tool to evaluate regional climate changes and to determine potential future critical habitat locations and species distributions that may result from climate changes. Regional climate modeling may help resource managers identify ecosystems at risk of transformative change. Bioclimatic models, also called envelope models or ecological niche models, may be used for predicting the future range and distribution of native and invasive species (Jeschke and Strayer 2008). Resource managers may be able to use these models to help target management strategies on focal areas where plant or animal species are most likely to survive in the future given climate constraints on the landscape (Bradley 2010). However, these models may also oversimplify estimates of suitable range and habitat by not accounting for non-climate drivers of species distribution, and so while these models may help paint a broad picture of future conditions, management actions should not be based solely on one model and should consider or address change at the appropriate level (e.g., regional or basin level, as opposed to sub-basin level).

Current Initiatives to Understand the Implications of Climate Change[2]

Strategies developed by government agencies and conservation organization to address climate change range from international monitoring and modeling efforts, to federal legislation, to efforts of national and regional

[2] The majority of the information in this section was obtained from the specific website of each initiative, unless otherwise noted.

conservation organizations, to state and local working groups holding public forums for discussion and completion of on-the-ground projects. The initiatives that follow do not constitute an all-inclusive list of climate change initiatives relevant to Wyoming, but are meant to paint a picture of the various agencies, organizations, and institutions that are providing leadership in the field of climate change science, mitigation, and adaptation.

International

The North American Regional Climate Change Assessment Program (NARCCAP) (http://www.narccap.ucar.edu/) is an international partnership using regional climate models (RCMs), atmosphere-ocean general circulation models (AOGCMs), and special report emissions scenarios (SRES) to generate future climate change scenarios for the purpose of analysis, impact studies, or further downscaling. The climate scenarios that are generated model historical climate trends (1971–2000) and project future climate trends (2041–2070) for the conterminous U.S., northern Mexico, and most of Canada. NARCCAP evaluates and estimates the uncertainty associated with the regional-scale climate change scenarios and aims to produce high-resolution (50 kilometers) climate change scenarios, which will aid resource managers in performing impact assessments on the resources that they are charged with protecting.

NatureServe (http://www.natureserve.org/) is a nonprofit conservation organization established in 1994 with guidance and resources from The Nature Conservancy. The organization is an association of natural heritage programs in the U.S., Canada, Latin America, and the Caribbean. These programs are widely drawn on by resource managers because they are the best source of information on rare and endangered species and sensitive ecosystems. The goal of NatureServe is to provide a clearinghouse for information on biodiversity that is easily accessible to resource managers and policymakers. NatureServe is responsible for the development of the Climate Change Vulnerability Index (CCVI), which is a tool that can be used to rank the level of vulnerability of individual species to climate change. The Wyoming Natural Diversity Database (WYNDD) is the state's natural heritage program, which is located at the University of Wyoming.

National

At the federal level, the U.S. Fish and Wildlife Service (USFWS) is at the forefront of developing strategies and evaluating the potential impacts of climate change on wildlife and habitat. In 2009, the USFWS released a revised draft of its strategic plan for responding to climate change (U.S. Fish and Wildlife Service 2009). The strategy emphasizes the need to move forward with decisive conservation action to address climate impacts despite the uncertainty tbat surrounds climate change in the future. The document is focused on three main strategies: adaptation, mitigation, and engaging partners. The USFWS also emphasizes landscape-scale approaches as part of the agency's National Fish and Wildlife Climate Adaptation Strategy (http://www.fws.gov/home/climatechange/). Twenty-one Landscape Conservation Cooperatives (LCCs) have formed that encompass all regions of the U.S. and some areas in Canada and Mexico. The purpose of the LCCs is to coordinate regional science and resources to address climate change and provide conservation delivery. Wyoming is divided unevenly by five LCCs, but the majority of the state's land area is covered by two cooperatives, the Plains and Prairie Potholes LCC and the Great Northern LCC.

The U.S. Geological Survey (USGS) established the National Climate Change and Wildlife Science Center (NCCWSC) (http://nccwsc.usgs.gov/) in response to the climate change science gaps that exist that may prohibit the development of sound management strategies for wildlife adaptation. Working with various partners at all levels, including eight regional Climate Science Centers (CSCs) established by the Department of the Interior, the NCCWSC is focusing on using scientific data and modeling to make predictions

about future species response to climate change and habitat and ecosystem changes that may occur. The CSCs will work in coordination with LCCs to gather information and make resources and management tools accessible to resource managers. The USGS also supports research that explores ecosystem responses to climate change, including a project called Exploring Future Flora, Environments, and Climate through Simulations (EFFECTS).

In 1990, the U.S. Congress passed the Global Change Research Act (P.L. 101-606), which established the U.S. Global Change Research Program (USGCRP) (http://www.globalchange.gov/). The USGCRP is comprised of 13 federal departments and agencies and is charged with leading the nation in understanding global changes (e.g., climate, ozone, land cover) and making assessments and predictions to aid decision-making regarding the potential outcomes of these global changes. The USGCRP produces an annual report for Congress, *Our Changing Planet*, documenting its findings and recommending response actions.

The National Wildlife Federation (http://www.nwf.org/) and the National Fish Habitat Action Plan (http://fishhabitat.org/) are examples of wildlife conservation organizations and protection and restoration initiatives that are addressing the issue of climate change through research, mitigation, partnerships, and public education efforts. See Additional Resources within this section for more information on these organizations and relevant publications.

Regional

The Northern Rocky Mountain Science Center (NOROCK) (https://www.usgs.gov/centers/norock) has stations located in western Montana and Wyoming. The goal of NOROCK scientists and staff is to research and disseminate information specific to species and ecosystems in the northern Rocky Mountain region to aid federal, state, and local resource managers in developing effective management strategies. One of the center's projects focuses is on climate change in mountain ecosystems, including research on glaciers, snow and avalanches, and the structure and function of mountain ecosystems.

The Western Governors' Association (WGA) (http://www.westgov.org/) is a coalition of governors from 19 states and 3 U.S.-flag Pacific islands. The WGA focuses on issues that challenge western resources and economies. In addition to a policy resolution on climate change mitigation measures, the WGA has adopted a policy resolution that supports research into adaption measures. The association has developed a number of initiatives and internal working groups to address natural resource issues facing the West including water, forest and rangeland health, wildlife corridors, renewable energy, carbon sequestration, and alternative transportation fuels.

State and Local

In 2009, Wyoming passed a trio of laws clarifying the regulatory framework for geologic sequestration of carbon. The Wyoming State Climate Office oversees studies and research on climate change impacts to wetlands and water resources in the state. Their work includes developing drought-monitoring products for the online dissemination of water and climate data. They also support a number of stake-holder groups by assisting the development of the State Water Plan and helping to coordinate long-term climate and hydrologic monitoring efforts throughout Wyoming. The WGFD published its Wetlands Conservation Strategy in September 2010, which includes a section on climate change impacts and adaptation planning. Wyoming Wetlands Conservation Strategy

The University of Wyoming houses and supports many different research organizations whose research may directly or indirectly involve climate and the impacts of climate change. The Wyoming Cooperative Fish and Wildlife Research Unit (http://wyocoopunit.org/) is a partnership between the U.S. Geological Survey, U.S. Fish

and Wildlife Service, University of Wyoming, Wyoming Game and Fish Department, and the Wildlife Management Institute. The research unit is located at the University of Wyoming in the Zoology and Physiology Department. Recently, the research unit has started to examine the past effects and potential future impacts of climate change on ungulates in the Rocky Mountain region.

The Water Resources Data System (WRDS) (http://www.wrds.uwyo.edu/) and the Wyoming State Climate Office (SCO) (http://www.wrds.uwyo.edu/sco/climate_office.html) provide Wyoming citizens, managers, and policymakers with comprehensive hydrological and climatological data from throughout the state. The offices are funded by the Wyoming Water Development Office and are located at the University of Wyoming. The WRDS and SCO compile information on hydrologic and climatic conditions from various resource managers and monitoring sources such as the Bureau of Reclamation and the National Weather Service, and develop the information into usable formats such as maps that depict climate trends over multiple decades. The offices are Wyoming's leading sources on drought information for the state, and the data products they develop help resource managers to identify climate trends and extremes.

Current Challenges for Effectively Managing Climate Change

Climate Change Certainties and Uncertainties

The study of climate over the past century has provided scientists with information about recent climate trends resulting from a combination of natural forces and anthropogenic influences. Studies indicate that Earth's surface temperatures gradually increase and decline over periods of time spanning hundreds of years as a result of solar activity, volcano eruptions, sea surface temperature, and pressure anomalies (McWethy et al. 2010). An examination of temperature records over the past two centuries demonstrates that surface temperatures generally have been increasing worldwide (International Panel on Climate change 2013). Many uncertainties also exist with regard to the science of modeling and projecting future climate variability and associated ecosystem outcomes. However, uncertainty does not necessarily mean that historical observations and future projections are wrong or inaccurate, but they maybe qualified as inexact due to many uncontrollable variables.

The general scientific consensus on temperature change is that average global temperatures will continue to increase, as will temperatures in North America and the Rocky Mountain West, including Wyoming (Christensen et al. 2007). Temperature records over the past 100 years indicate that the West is already experiencing warming trends, particularly in winter and spring (Joyce et al. 2007). Recent research efforts have put forth a range of projections regarding temperature increases over various spatial (e.g., global, regional, national, statewide) and temporal (e.g., mid-century, late-century) scales, but the rate and magnitude of changes may depend on a suite of factors including global economic growth, adoption of climate change mitigation measures, and interactions between natural variability and the consequences of changing greenhouse gas concentrations.

Consensus on precipitation is more elusive than consensus on temperature. The IPCC projects that overall global precipitation will increase as a result of warmer ocean temperatures (Christensen et al. 2007). However, precipitation is not expected to increase everywhere: currently wet regions are expected to get wetter and dry areas drier. The western United States, including Wyoming, is likely to become drier (Backlund et al. 2008). The past 100 years of precipitation records do not demonstrate any definitive precipitation trends in the West but do indicate a high level of variability (Joyce et al. 2007). Additionally, certain climatic events are expected to intensify. Storms may become more severe with more precipitation in a shorter amount of time, and

droughts may extend over longer periods of time much like the megadroughts identified in the historical record (Gray and Andersen 2009).

Climate and Ecosystems

The fact that climate affects biological systems is well established, but how rapid or transformative climate change will impact these systems is less certain. Climate may alter the physical structure of the ecosystem, which includes living organisms (i.e., aquatic and terrestrial wildlife) and non-living, chemical, and physical environmental attributes (Westerling et al. 2006, Rosenzweig et al. 2008). Climate change may also lead to changes in core ecosystem functions such as energy exchange, nutrient cycling, and primary productivity, which form the basis of the ecosystem services (e.g., clean air and water) on which human populations depend.

Large and rapid changes have the potential to place a greater amount of stress on components of the system than long-term gradual changes, which is a concern for many species and ecosystems (Schneider and Root 1998). "Abrupt" climate change is defined as a rapid change in climate over a relatively short period of time, which causes significant disturbance to ecosystems (U.S. Climate Change Science Program undated). Currently, the rate of change is likely a greater threat to ecosystem viability than the actual amount of projected change. Ecosystem change may occur in step-like transitions involving long periods of time with minimal change, followed by a relatively rapid development when conditions are right (Jackson et al. 2009, Gray et al. 2006, Lyford et al. 2003).

Climate may directly or indirectly impact ecosystem structure and function in many ways. Climate impacts average seasonal temperatures and temperature extremes. In turn, temperatures have profound effects on hydrology, including the spatial and temporal patterns of snowpack accumulation and ablation, runoff, water storage and recharge (e.g., glaciers and aquifers), evaporation, and soil moisture (Gray and Andersen 2009, Barnett et al. 2004, Christensen et al. 2007). Climate influences the frequency and intensity of disturbances such as drought, insect and disease outbreaks, storm severity, flash flooding, erosion, and wildfire, and may promote the establishment of invasive and/or exotic species in arid landscapes (Backlund et al. 2008). It may extend or curtail the growing season and impact primary production (Backlund et al. 2008). Climate influences plant and animal migration, distribution, and interaction patterns, and also the survival and proliferation of pathogens and parasites (Backlund et al. 2008, Harvell et al. 2002).

The physical manifestations of climate change have been observed and documented throughout the 20th century and up to present day (e.g., Parmesan 2006). Since 1901, the average surface temperature across the contiguous 48 states has risen at an average rate of 0.14°F per decade. Average temperatures have risen more quickly since the late 1970s (0.29 to 0.46°F per decade since 1979) (U.S. Environmental Protection Agency's Website). Global sea levels have risen by 15–20cm and global overland precipitation has risen by about 2% since the beginning of the 20th century (Backlund et al. 2008). Most of the continental United States experienced increased precipitation, stream flow, stream temperatures, and glacial retreat (Backlund et al. 2008, Wilcox 2010).

The ecological manifestations of climate change have been similarly documented. Increased vegetation growth, vegetation redistribution, and changes in flora phenologic trends have been observed (Backlund et al. 2008, Cayan et al. 2001). Net primary production (NPP) increased approximately 10% from 1982–1998 (Boisvenue and Running 2006). The advance of the spring season has caused earlier blooming and onset of spring greenness; warming temperatures, which are more pronounced at high elevations and latitudes, may be contributing to the infilling of sub-alpine conifers in alpine tundra; and increasingly limited water resources may be causing drought-tolerant vegetation to shift its range (Myneni et

al. 2001, Lucht et al. 2002, Joyce et al. 2007). Changes in the migration and phenologic patterns of some terrestrial species and the displacement of native high-latitude species also have been observed (Walther et al. 2002). Research on the direct and indirect impacts of climate change will likely increase in the future as changes continue to materialize or become more apparent.

Climate change may present human populations and fish and wildlife populations with various tradeoffs. Seasonal changes, such as an earlier spring and a later fall, will increase the length of the growing season resulting in increased agricultural production and extended foraging time for wildlife. However, if warmer temperatures are not coupled with increased precipitation, summer and late-season drought stress will likely adversely impact primary production. Forage quality may be negatively impacted by changing CO2 concentrations (Joyce et al. 2000), and invasive species, which may be more tolerant of changing climate conditions (Joyce et al. 2007). Warmer and milder winters may entail less wildlife winter mortality, but increasingly severe storms, changing temperature extremes, wildfires, and drought may adversely affect reproduction and the survival of young. Climate change is not inherently good or bad, but it is a shift from a previously managed state or structural organization, which will entail tradeoffs, new management goals and strategies, and winners and losers.

As long as global surface temperatures continue to increase and precipitation patterns become more variable, biological systems will be in a constant state of transition. Consequently, using a historic range of variation, formally or informally, to guide future management strategies may be insufficient and even inappropriate for facing the additional challenges that rapid climate change will bring to wildlife and habitat management (Wiens and Bachelet 2009, Joyce et al. 2007). Using 100 years or less of past climate data to inform future management strategies does not capture the variability that long-term proxy data can depict (McWethy et al. 2010) and likely will not accurately account for the ecosystem changes that will occur as a result of recent and future climate change. Goals and conservation strategies may need to be redefined in order to address the needs of wildlife in transitioning systems.

Climate Modeling

Climate change is a global phenomenon driven by large-scale dynamics that affect weather and climate conditions at the regional and local levels (Wiens and Bachelet 2009). At present, General Circulation Models (GCMs) use simplified representations of Earth's oceans, atmosphere, and land surface, and the interactions among these units to help paint a broad picture of general climate patterns and trends and to make projections regarding future possibilities. GCMs can also be run under various assumptions about future greenhouse gas emission levels to output projections about future climate across a variety of social and economic scenarios.

Unlike efforts aimed at short-term weather forecasting, the goal of most GCM-based research is to understand general patterns of climate variability and climate averages. As such, GCMs perform reasonably well in recreating both historical climates seen in instrumental observations and paleoclimates preserved in various proxy archives (e.g., tree rings). This, in turn, generates reasonable confidence in future climate projections, with the major caveat that economic and social variables that relate to greenhouse gas production are highly uncertain (Gray, personal communication, July 9, 2010). However, the usefulness of GCMs in applications related to wildlife management can be greatly limited by their course-scale output and the fact that they do not fully account for topography and ecosystem boundaries that often impact regional and local climate (Barnett et al. 2004).

Based on their ability to reproduce paleo and historical patterns, as well as the underlying chemistry and physics of climate change, scientists have much more confidence in the

ability to predict future temperatures than they do for precipitation (Gray, personal communication, July 9, 2010). However, difficulty may still arise when attempting to distinguish between variations associated with climate change and variations driven by forces such as the El Niño-Southern Oscillation (Wiens and Bachelet 2009). Despite the noted uncertainties and shortcomings of climate modeling, the information produced by these models may be useful for predicting the potential vulnerability of an area to climate change, possible vegetation shifts, and future habitat suitability.

Given the uncertainty associated with global modeling, resource managers should avoid developing management strategies based on a single set of climate projections (Wiens and Bachelet 2009). Managers should instead take action by integrating a wide range of possible climate change scenarios into planning, conservation, and management efforts.

Recommended Conservation Actions

In light of the uncertainty regarding future climate conditions and the natural variability of climate in Wyoming, the overall goal of the WGFD is relatively simple and straightforward: continue to develop sound wildlife and habitat management policies and continue to employ sound wildlife and habitat conservation practices while evaluating a range of possibilities of future climate conditions and bringing climate into the planning and management processes as appropriate.
Projections of a warmer and drier climate in the western U.S. warrants the consideration of wildlife and habitat managers. Strategies that are practical across a range of possible future climate conditions will provide wildlife and habitat managers with the flexibility needed to adjust those strategies as appropriate and will not limit or inhibit future management options. Mitigating current threats to aquatic and terrestrial wildlife populations and habitat integrity; monitoring species and ecosystem health; and managing species populations, communities, and landscapes in accordance with what is known about natural disturbance regimes and ecosystem processes are good wildlife and habitat management strategies, as well as good climate change management strategies. Regardless of the accuracy of messages concerning climate change, it is important to maintain realistic and attainable management goals and objectives.

Scenario planning is a strategy that allows resource managers to evaluate current goals and objectives in light of climate change and to identify management actions that will address a range of issues facing aquatic and terrestrial wildlife populations.
Building scenarios involves the consideration of several likely directions and intensities of future climate change without requiring exact temperature and precipitation predictions. This type of planning acknowledges the uncertainty in climate projections and biotic response and provides resource managers a framework in which to better consider how various future climate conditions may impact the ecosystems, system components, and processes that they manage. Further, resource managers can evaluate how current goals may need to change and assess the future efficacy of current management strategies given a variety of climate scenarios.

In addition to scenario planning, adaptive management techniques may help wildlife and habitat managers deal with the uncertainty surrounding future climate conditions.
Adaptive management involves the continual reevaluation through monitoring and improvement of management strategies as climate change plays out and causes sometimes predictable and sometimes unpredictable impacts on ecosystems and species communities. Given what is known about historical climate variation in the West and the future climate projections for this region, the

coming decades may prove to be quite different than recent previous decades. Predictive models, flexibility, and adaptive management will be key to dealing with this uncertainty, as will a policy-making and management environment that supports creativity and moderate risk-taking.

Wildlife and habitat managers will likely pursue a combination of mitigation and adaptation measures as they employ strategies to maintain the health of aquatic and terrestrial flora and fauna and the integrity of the Wyoming landscapes that support these species.
Mitigation strategies that involve actions that lessen the input of greenhouse gases into the atmosphere are more likely to develop as state-level policy. Adaptation strategies, on the other hand, are not meant to resist inevitable changes or slow their occurrence, but are measures adopted to build the capacity of a species or ecosystem to deal with the impacts of climate change while maintaining stability and ultimately adapting and thriving under new conditions. An adaptation strategy may involve enhancing the quality, quantity, and connectivity of wildlife habitat so that wildlife populations are able to adjust their range according to physiological tolerances to changing climate conditions. Building and maintaining ecosystem health in order to accommodate change as opposed to resisting it is fast becoming the preferred method for wildlife management in the face of climate change.

Recommendations – General

Pursue financial, technical, and human resources to develop and implement a structure to coordinate the incorporation of climate change into WGFD activities at the agency level.
The WGFD will need a coordinated approach in order for climate change considerations to be effectively incorporated into WGFD planning and monitoring, and also to aid the timely development and implementation of projects and strategies addressing the impacts of changing climate conditions.

A point person from within the department could serve as a contact for communication with federal resource management agencies and the public, and would also aid with the intra-agency dissemination of information regarding climate change and the coordination of all other climate change-related efforts.

As wildlife and habitat managers begin to consider the potential impacts of climate change on the species and landscapes that they manage, it will be necessary to periodically evaluate the actual impacts of climate conditions on current management goals and strategies. The efficacy of some management techniques and the practicality/cost of some management goals may change with changing climate conditions. WGFD should take the appropriate steps to consider these impacts.

Identify and prioritize implementation actions that will benefit management targets by addressing a range of stressors given various future climate scenarios as an ongoing strategy.
After the potential impacts of several scenarios have been assessed and current management challenges considered in light of climate change, a range of no regret actions may be identified that address multiple issues and management challenges relating to both species and habitat. Adaptive management techniques supported by internal policies that encourage creativity and moderate risk-taking may aid wildlife and habitat managers in developing and implementing strategies that safeguard these resources against multiple stressors.

Partner with other agencies and organizations, and support initiatives related to climate change and wildlife and habitat management as an ongoing strategy.
Engaging in a variety of partnerships is an effective means of cost-sharing, compensating for limited human and technical resources, and avoiding the duplication of effort. Statewide

and regional interagency collaboration will facilitate information sharing, the assignment of appropriate roles to partner agencies, the request of appropriate data products from partner agencies, and the more efficient allocation of scarce resources for wildlife and landscape conservation. Additionally, partnerships may offer funding opportunities for climate-related research, mitigation, and adaptation projects. Coordinating efforts with federal, state, local, and non-profit partners should be an ongoing priority when dealing with climate issues.

Offer additional education opportunities for WGFD employees about climate change issues pertaining to wildlife and habitat management in Wyoming as an ongoing strategy.
The development of appropriate goals and the implementation of timely and successful strategies will require that agency employees are well-informed on how to integrate climate change into monitoring, planning, and management within the context of their current jobs. Fostering an environment of increased awareness about climate and wildlife/landscape-related issues through individual and group education opportunities is important. WGFD has organized climate change workshops in the past and should continue to organize workshops to discuss future climate projections and to specifically aid employees with the scenario building process, the enhancement of existing data-gathering programs to account for climate factors, and the development of adaptive management techniques.

Disseminate information to the public about climate change issues pertaining to wildlife and habitat management in Wyoming.
Hunters, anglers, and wildlife viewers are important stakeholder groups within the state. The dissemination of information to the public regarding the observed and future potential impacts of climate change on wildlife and habitat in Wyoming will be necessary. The use of existing forms of media provides an opportunity to convey climate-related issues to Wyomingites and to gain public feedback on proposed mitigation and adaptation measures. WGFD should consider using *Wyoming Wildlife* magazine and existing newsletters as forums for discussing appropriate and timely climate-related issues. Additionally, WGFD should consider developing future climate change workshops for public attendance and participation, and relate the topic of climate change to current and accepted wildlife management issues.

Work with regional organizations to evaluate existing laws and regulations and make recommendations in light of climate change as a long-term consideration.
Existing regulations and policies may need to be reexamined and/or modified to safeguard wildlife and habitat and to support reasonable conservation expectations as changes in climate occur. Dealing with certain laws will be a challenge if species become increasingly threatened by climate change and variability. Much like the development of strategies, policies should be flexible and should be revisited or revised more often to assess the need for changes and to avoid the use of scarce resources on hopeless causes. Timely recommendations on policy adjustments to either mitigate the effects of climate change or aid climate change adaptation should be welcomed and given due consideration. WGFD should work with regional organizations such as the Western Governors' Association and the Association of Fish and Wildlife Agencies to identify and recommend needed statutory and regulatory changes at the state and federal levels.

Recommendations – Species Management

Wildlife managers should continue to focus on good wildlife management techniques, including reducing non-climate stressors and promoting biological and genetic diversity.
Continuing to enhance efforts to minimize the impacts of non-climate stressors and continuing to manage for species and genetic diversity will help safeguard individual species populations

and species communities from any current or future threats (e.g., development pressures, natural disturbances, climate change) by increasing species' ability to adapt to environmental changes. WGFD should continue management practices that balance the abundance of wildlife populations with the carrying capacity of the land (e.g., big game management using harvest quotas), while also focusing on biodiversity (e.g., SGCN), and use existing knowledge about non-climate stressors affecting aquatic and terrestrial species to continue to enhance strategies to address these wildlife stressors (e.g., Aquatic Invasive Species program and initiatives to control invasive terrestrial flora).

Wildlife managers should build an understanding of past responses to climate change and climate as a driver of species behavior, range, and distribution.
Climate change and variability impacts species individually and may result in previously unforeseen vulnerabilities on Wyoming's wildlife. Climate change may have significant ecological and economic effects, including impacting hunter and angler recruitment and retention, causing the decline of SGCN, and leading to the establishment and continued proliferation of populations of nonnative species in the state.

Understanding how species have responded to stresses and disturbances in the past may provide wildlife managers with important insight about how species may respond in the future to climate change and stressors that are expected to be compounded by climate change. The use of existing research, literature, and experience, as well as utilizing historical data sets compiled by the USA National Phenology Network (http://www.usanpn.org/), may aid wildlife managers in building an understanding of climate as a driver of species behavior, range, and distribution. Wildlife and habitat managers should identify research and information needs and develop strategies to bridge knowledge gaps regarding the relationship of individual species and climate.

Assess the vulnerability of SGCN to climate change and evaluate the impacts of climate on select species.
The Wyoming Nature Conservancy, WYNDD, and WGFD completed research evaluating the vulnerability of Wyoming SGCN and the 11 SWAP terrestrial habitat types to climate change, residential and energy development, and wildlife disease, as well as cumulative vulnerability to all three of these stressors. Results for 2010 SGCN are listed in Appendix A. Vulnerability is a function of a species' or habitat's exposure to changes and its resilience to those changes.

Research results give an indication of which species and taxonomic groups are potentially vulnerable to climate change, as well as helps to direct future research to address information gaps. The project was jointly funded jointly by the U. S. Geological Survey, Wyoming Landscape Conservation Initiative, and WGFD and can be found at: http://www.nature.org/media/wyoming/wyoming-wildlife-vulnerability-assessment-June-2014.pdf.

Since the 2010 SWAP revision, the WGFD also conducted research regarding the impacts of climate change on Colorado River cutthroat trout. Results will help to target priority conservation areas for these species and better understand interactions with populations of non-native fish (Roberts et al. 2013). The WGFD is also an active supporter of climate research being done by Forest Service researchers. The Climate Shield website hosts geospatial data and related information that describes specific locations of cold-water refuge streams for native cutthroat trout and bull trout across the American West. Predictions about the locations of refugia could enable the improve the odds of preserving native trout populations into the future http://www.fs.fed.us/rm/boise/AWAE/projects/ClimateShield.html.

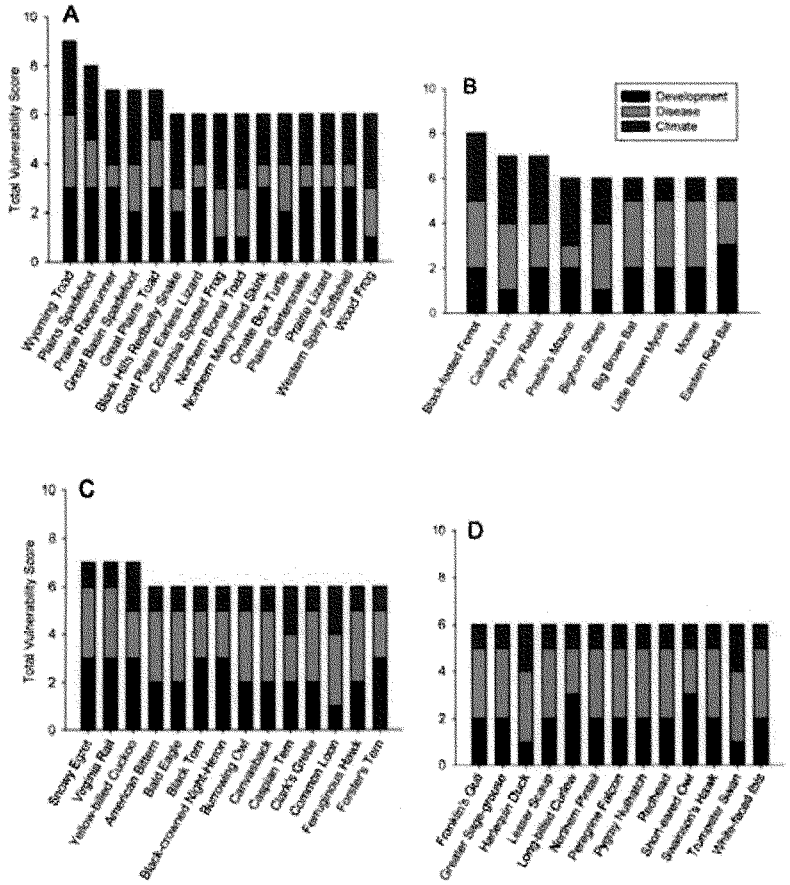


Figure 4.

The contribution of development, disease and climate change vulnerability to the overall vulnerability for the 51 species ranked as highly or very-highly vulnerable, for amphibians and reptiles (A), mammals (B), and birds (C, D). Categorical rankings for individual vulnerability components were assigned numeric values to illustrate relative contributions, where high =3, moderate = 2, and low =1 (Pocewicz et al. 2014).

Evaluate the feasibility of developing approaches to model future species distribution based on multiple drivers, including climate change. Build databases and produce maps depicting future species distribution including climate as a driver as a long-term consideration.

The SWAP includes current distribution maps for SGCN. Consideration should be given to developing maps of the potential future distribution of both SGCN and non-SGCN species based on key drivers of distribution, including climate factors. Evaluating the feasibility of using current species distribution maps to model the future distribution of species is a first step to understanding the potential impacts of climate change on individual species. Additional baseline information may be needed to produce maps that accurately depict future species distribution contingent upon multiple drivers, and knowledge gaps should be filled through continued research efforts or by obtaining data from the appropriate sources. Wildlife managers should identify the key drivers of SGCN and non-SGCN distribution and assess the feasibility, the quality, and the completeness of data for mapping the future distribution of SGCN and non-SGCN as a goal before the next SWAP revision. Producing maps for species with sufficient data and clear drivers of distribution may be a long-term consideration.

Downscaled climate data and finer-scale climate models may be necessary to make appropriate species management decisions in the future, and the availability of this data should be evaluated.

Modeling future species distributions and developing a clearer understanding about future climate scenarios across Wyoming will require more precise information about temperature and precipitation predictions. Through regional partnerships involving scientists and organization that are working on downscaling climate data to a relevant level for wildlife managers, asses the availability and quality of downscaled climate models for Wyoming and identify information gaps to guide development of finer scale models.

Assess the impacts of climate on disease dynamics. Incorporate this information in ongoing disease monitoring, and enhance disease distribution mapping, both current and projected

WGFD currently tracks and monitors diseases that are specific to certain species or populations, and has updated a wildlife disease manual that describes diseases that affect species in Wyoming. The Nature Conservancy, WYNDD, WGFD vulnerability analysis researched future potential changes in wildlife disease prevalence http://www.nature.org/media/wyoming/wyoming-wildlife-vulnerability-assessment-June-2014.pdf.

Additional research on the influence of climate factors on disease incidence and/or prevalence would complement existing knowledge and may benefit wildlife managers in the future by allowing them to establish a network of early detection sites where future cases of disease are likely to emerge given climate conditions and other factors. WGFD should continue to support research efforts to establish links between climate factors and the ecology of both aquatic and terrestrial wildlife diseases, including pathogens, vectors, and hosts. WGFD should also work with other agencies to understand the links between climate and mountain pine beetle, as the drastic alteration of Wyoming's conifer forests or precautionary closure of public lands will have significant implications for future wildlife and habitat management. WGFD should enhance wildlife disease monitoring efforts to describe the current distribution of diseases and predict potential future distribution or locations conducive to outbreaks based on known drivers as a long-term consideration.

Recommendations – Habitat Management

Habitat managers should continue to focus on sound conservation, restoration, and management practices as outlined in the WGFD Strategic Habitat Plan, which will help maintain the integrity of ecosystem structure and function in the face of many ecosystem stressors, including climate change.
Continuing to implement good aquatic and terrestrial habitat management practices will help maintain regular hydrological flows by regulating peak flows, increasing terrestrial water storage, and controlling late-season flows. WGFD should utilize existing data systems and tools to identify natural watershed storage features to aid in land management decision-making and continue to develop and execute wetland and riparian restoration projects, which will increase the distribution and function of the quantity of stored water.

Ecosystem restoration, or on a smaller scale habitat restoration, may be considered both a mitigation and adaptation strategy as intact systems store more CO_2 and positively feed into species health and biodiversity. Habitat managers may want to consider emphasizing ecosystem function and diversity over the maintenance of specific communities of species as climate change may cause managing for historic conditions to become increasingly costly, challenging, and impractical. WGFD should continue to work with private landowners, government agencies, and conservation organizations to manage landscapes to meet the needs of wildlife and to address access issues, and continue to support conservation programs, such as NRCS habitat extension programs, that aid landowners with the restoration and long-term protection of natural ecosystems.

Promote connectivity as outlined in the Strategic Habitat Plan as an ongoing strategy, and undertake additional mapping efforts that depict critical areas of wildlife movement, transition, and refuge as an ongoing strategy.
Increasing the overall amount and connectivity of habitat, including migration corridors, transitional areas, and refugia, is a strategy that will build ecosystem health and species resilience to a variety of stressors. Porous landscapes, or those that are easily traversed by fish and terrestrial wildlife, will allow some species to adjust to changing environmental conditions through population movement. Riparian areas may become particularly important as wildlife movement corridors and may require special focus. WGFD should continue to work with private landowners, government agencies, and conservation organizations to restore and maintain habitat connectivity and to connect core conservation areas by encouraging the development of solutions to help wildlife bypass obstructions, such as wildlife-friendly fencing and highway underpasses for terrestrial species and channels for aquatic species to move around waterway obstructions. WGFD should also continue to build the fish passage database to catalogue obstructions on Wyoming waters.

WGFD should use existing knowledge to map and prioritize wildlife corridors, transitional grounds, and refugia as an ongoing strategy to aid future management and land conservation efforts under changing climate conditions

Consideration should be given to conducting habitat vulnerability assessments as an ongoing strategy.
The Nature Conservancy, WYNDD, WGFD terrestrial and habitat vulnerability analysis should be updated as part of the 2027 SWAP revision.
http://www.nature.org/media/wyoming/wyoming-wildlife-vulnerability-assessment-June-2014.pdf

Evaluating/monitoring Success

After wildlife and habitat managers have developed an idea of how climate change may affect the species and landscapes that they manage and have ranked the relative vulnerability of species and/or habitats, incorporating the predicted impacts into species and land management plans will be the next step. Modifying existing protocols or developing new protocols and enhancing existing programs for monitoring the impacts of climate change on wildlife and ecosystems requires wildlife and habitat managers to determine what to monitor and to identify indicators of climate-driven change or early warning signs of climate-related stress.

WGFD should continue to identify species and climate-driven behaviors that may provide an early indication of climate-related environmental change. For instance, species that are particularly susceptible to hydrological changes or species that have observable phenology such as migration and breeding patterns may provide wildlife managers with indicators of ecosystem change resulting from changing climate conditions from which they can begin to anticipate other changes or start to re-evaluate management goals and strategies. Similarly, WGFD should identify and monitor climate-driven landscape changes that may impact the efficacy of current management strategies and provide insight on potential future conditions.

Develop standard monitoring protocols.
In order to effectively monitor the impacts of current and future climate conditions on wildlife and landscapes, the WGFD may need to modify existing protocols or develop new protocols to capture specific climate-related information that will be valuable for the future development of mitigation and/or adaptation strategies for wildlife and habitat. Standardizing these monitoring protocols across the WGFD should be an ongoing effort, and the department may want to consider investigating methods and assessment tools that have been developed and successfully implemented by other states or regular partner agencies/organizations. Factors that should be assessed in terms of climate trends and local impacts include habitat, physiology, phenology, and species interactions.

Establish a reasonable planning timeline as part of a long-term strategy.
It is not practical to carry out all strategies and recommendations at once. WGFD should continue to determine which actions are now feasible and which should be done in the future. A planning timeline could help in successfully evaluating the impacts of climate on species, ecosystems, and processes, as well as in implementing timely mitigation and adaptation strategies. WGFD should develop a planning timeline for developing and implementing new climate monitoring protocols and programs for the most sensitive species and the most vulnerable landscapes.

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Assessments and Publications

Assessing the Future of Wyoming's Water Resources: Adding Climate Change to the Equation. An assessment conducted by the Ruckelshaus Institute of Environment and Natural Resources at the University of Wyoming, 2009. Available online at http://www.uwyo.edu/enr/.

Beyond Seasons' End: A Path Forward for Fish and Wildlife in the Era of Climate Change. A collaboration of Ducks Unlimited, Trout Unlimited, BASS/ESPN Outdoors, Izaak Walton League of America, Association of Fish & Wildlife Agencies, Coastal Conservation Association, American Sportfishing Association, Pheasants Forever, and Boone and Crockett Club. Published by the Bipartisan Policy Center, 2009.

Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment. By Patty Glick and Bruce A. Stein. Published by the National Wildlife Federation, 2010 (draft).

The State of the Birds: 2010 Report on Climate Change. An assessment conducted by the North American Bird Conservation Initiative, American Bird Conservancy, Association of Fish & Wildlife Agencies, Cornell Lab of Ornithology, Klamath Bird Observatory, National Audubon Society, National Fish and Wildlife Foundation, The Nature Conservancy, U.S. Fish and Wildlife Service, U.S. Forest Service, and U.S. Geological Survey.

Voluntary Guidance for States to Incorporate Climate Change into State Wildlife Action Plans & Other Management Plans. A collaboration of the Association of Fish & Wildlife Agencies and Teaming with Wildlife, 2009.

Government Departments and Organizations

Bureau of Reclamation
Wyoming Area Office
P.O. Box 1630
Mills, WY 82644-1630
Phone: (307) 261-5671
http://www.usbr.gov/gp/wyao/

Great Northern Landscape Conservation Cooperative
http://greatnorthernlcc.org/

Greater Yellowstone Coalition
Climate Change in the Greater Yellowstone Ecosystem
http://www.greateryellowstone.org/issues/climate/index.php?category=climate

National Fish Habitat Action Plan
http://fishhabitat.org/

Western Native Trout Initiative
http://westernnativetrout.org/

Desert Fish Habitat Partnership
http://www.nature.nps.gov/water/DFH_partnership.cfm

Great Plains Fish Habitat Partnership
http://www.prairiefish.org/

NatureServe
Climate Change Vulnerability Index
http://www.natureserve.org/conservation-tools/climate-change-vulnerability-index

Plains and Prairie Pothole Landscape Conservation Cooperative
https://plainsandprairiepotholeslcc.org/

U.S. Fish and Wildlife Service
Ecological Services Wyoming Field Office
5353 Yellowstone Road, Suite 308A
Cheyenne, WY 82009
Phone: (307) 772-2374

USA National Phenology Network
http://www.usanpn.org/home

Water Resources Data System
Chris Nicholson, Director
University Avenue
Laramie, WY 82071
wrds@uwyo.edu
Phone: (307) 766-6651

Wildlife Conservation Society
Corridor Conservation Initiative
http://www.wcs.org/conservation-challenges/climate-change.aspx

World Wildlife Fund
North Great Plains ecoregion
http://www.worldwildlife.org/what/wherewework/ngp/index.html

Wyoming Game and Fish Department Climate Change Workshop
http://gfi.state.wy.us/ClimateChangeWS/index.asp

Wyoming State Climate Office
Chris Nicholson, State Climatologist
cnichol5@uwyo.edu
Phone: (307) 766-6651

Appendix A

Table 1a. Vulnerability ranking results for 2010 SGCN bird species, sorted alphabetically within each overall vulnerability category (Pocock et al. 2014).

Name	Overall	Climate Change	Development	Disease	Landscape-level
American Bittern (Botaurus lentiginosus)	High	Low	Moderate	High	Moderate
Bald Eagle (Haliaeetus leucocephalus)	High	Low	Moderate	High	High
Black Tern (Chlidonias niger)	High	Low	High	Moderate	High
Black-crowned Night-Heron (Nycticorax nycticorax)	High	Low	High	Moderate	High
Burrowing Owl (Athene cunicularia)	High	Low	Moderate	High	High
Cerulean Warbler (Setophaga cerulea)	High	Low	Moderate	High	Moderate
Cooper's Hawk (Accipiter cooperii)	High	Moderate	Moderate	Moderate	Moderate
Clark's Grebe (Aechmophorus clarkii)	High	Low	Moderate	High	Moderate
Common Loon (Gavia immer)	High	Moderate	Low	High	Moderate
Ferruginous Hawk (Buteo regalis)	High	Low	Moderate	High	High
Forster's Tern (Sterna forsteri)	High	Low	High	Moderate	High
Franklin's Gull (Larus pipixcan)	High	Low	Moderate	High	Moderate
Greater Sage-grouse (Centrocercus urophasianus)	High	Low	Moderate	High	High
Harlequin Duck (Histrionicus histrionicus)	High	Moderate	Low	High	Low
Lesser Scaup (Aythya affinis)	High	Low	Moderate	High	Moderate
Long-billed Curlew (Numenius americanus)	High	Low	High	Moderate	High
Northern Pintail (Anas acuta)	High	Low	Moderate	High	Moderate
Peregrine Falcon (Falco peregrinus)	High	Low	Moderate	High	Low
Pygmy Nuthatch (Sitta pygmaea)	High	Low	Moderate	High	Low
Redhead (Aythya americana)	High	Low	Moderate	High	High
Short-eared Owl (Asio flammeus)	High	Low	High	Moderate	High
Swainson's Hawk (Buteo swainsoni)	High	Low	High	High	High
Swainson's Thrush (Catharus ustulatus)	High	Low	Moderate	High	High
Trumpeter Swan (Cygnus buccinator)	High	Moderate	Low	High	Low
Virginia Rail (Rallus limicola)	High	Low	High	High	High
White-faced Ibis (Plegadis chihi)	High	Low	Moderate	High	High
Yellow-billed Cuckoo (Coccyzus americanus)	High	Moderate	High	Moderate	Moderate
Barrow's Goldeneye (Bucephala islandica)	Moderate	Low	Low	High	Low
Bobolink (Dolichonyx oryzivorus)	Moderate	Low	High	Low	High
Brewer's Sparrow (Spizella breweri)	Moderate	Low	Moderate	Moderate	Moderate
Burrow (Rodgersia [illegible])	Moderate	Low	Moderate	Moderate	Moderate
Chestnut-collared Longspur (Calcarius ornatus)	Moderate	Low	High	Low	High
Columbian Sharp-tailed Grouse (Tympanuchus phasianellus columbianus)	Moderate	Low	Moderate	Moderate	Low
Dickcissel (Spiza americana)	Moderate	Low	High	Low	High
Grasshopper Sparrow (Ammodramus savannarum)	Moderate	Low	High	Low	High

Name	Overall	Climate Change	Development	Disease	Landscape-based
McCown's Longspur (Calcarius mccownii)	Moderate	Low	High	Low	High
Merlin (Falco columbarius)	Moderate	Low	Moderate	Moderate	Moderate
Upland Sandpiper (Bartramia longicauda)	Moderate	Low	High	Low	High
American Three-toed Woodpecker (Picoides dorsalis)	Low	Low	Low	Low	Low
Ash-throated Flycatcher (Myiarchus cinerascens)	Low	Low	Moderate	Low	Moderate
Black Rosy-Finch (Leucosticte atrata)	Low	Moderate	Low	Low	Low
Black-backed Woodpecker (Picoides arcticus)	Low	Low	Low	Low	Low
Burrowing Owl (Athene cunicularia)	Low	Low	Low	Low	Low
Brown-capped Rosy-Finch (Leucosticte australis)	Low	Low	Low	Low	Low
Great Gray Owl (Strix nebulosa)	Low	Low	Low	Moderate	Low
Greater Sandhill Crane (Grus canadensis)	Low	Low	Moderate	Low	Moderate
Juniper Titmouse (Baeolophus ridgwayi)	Low	Moderate	Low	Low	Moderate
Lark Bunting (Calamospiza melanocorys)	Low	Low	Moderate	Low	High
Lewis' Woodpecker (Melanerpes lewis)	Low	Low	Moderate	Low	Moderate
Mountain Plover (Charadrius montanus)	Low	Low	Moderate	Low	High
Northern Goshawk (Accipiter gentilis)	Low	Low	Low	Moderate	Low
Northern Pygmy-Owl (Glaucidium gnoma)	Low	Low	Low	Moderate	Low
Sage Sparrow (Amphispiza belli)	Low	Low	Moderate	Low	Moderate
Sage Thrasher (Oreoscoptes montanus)	Low	Low	Moderate	Low	Moderate
Western Scrub-Jay (Aphelocoma californica)	Low	Low	Low	Moderate	Moderate
Willow Flycatcher (Empidonax traillii)	Low	Low	Moderate	Low	Moderate

Table 1b. Vulnerability ranking results for 2010 SGCN amphibian species, sorted alphabetically within each overall vulnerability category (Pocewicz et al. 2014)

Name	Overall	Climate Change	Development	Disease	Landscape-based
Plains Spadefoot (Spea bombifrons)	Very High	High	High	Moderate	High
Wyoming Toad (Anaxyrus baxteri)	Very High	High	High	High	High
Columbia Spotted Frog (Rana luteiventris)	High	High	Low	Moderate	Low
Great Basin Spadefoot (Spea intermontana)	High	High	Moderate	Moderate	Moderate
Great Plains Toad (Anaxyrus cognatus)	High	Moderate	High	Moderate	High
Northern Boreal Toad (Anaxyrus boreas boreas)	High	High	Low	Moderate	Low
Wood Frog (Lithobates sylvaticus)	High	High	Low	Moderate	Low
Northern Leopard Frog (Lithobates pipiens)	Moderate	Low	Moderate	Moderate	Moderate

Table 1c. Vulnerability ranking results for 2010 SGCN reptile species, sorted alphabetically within each overall vulnerability category (Pocewicz et al. 2014)

Name	Overall	Climate Change	Development	Disease	Landscape-based
Plains Rattlesnake (Pituophis catenifer sayi)	High	High	High	Low	High
Black Hills Redbelly Snake (Storeria occipitomaculata pahasapae)	High	High	Moderate	Low	Moderate
Great Plains Earless Lizard (Holbrookia maculata)	High	Moderate	High	Low	High
Northern Many-lined Skink (Eumeces multivirgatus)	High	Moderate	High	Low	High
Plains Gartersnake (Thamnophis radix)	High	Moderate	High	Low	High
Plains Lizard (Sceloporus consobrinus)	High	Moderate	High	Low	High
Western Spiny Softshell (Apalone spinifera hartwegi)	High	Moderate	High	Low	High
Great Basin Skink (Plestiodon multivirgatus utahensis)	Moderate	Moderate	Moderate	Low	Low
Midget Faded Rattlesnake (Crotalus oreganus concolor)	Moderate	High	Low	Low	Moderate
Northern Tree Lizard (Urosaurus ornatus wrighti)	Moderate	High	Low	Low	Moderate
Ornate Box Turtle (Terrapene ornata ornata)	Moderate	Moderate	Moderate	Moderate	High
Pale Milksnake (Lampropeltis triangulum multistrata)	Moderate	Low	High	Low	High
Plains Hog-nosed Snake (Heterodon nasicus)	Moderate	Low	High	Low	High
Rubber Boa (Charina bottae)	Moderate	High	Low	Low	Low
Smooth Green Snake (Opheodrys vernalis)	Moderate	Moderate	Moderate	Low	Low
Valley Gartersnake (Thamnophis sirtalis fitchi)	Moderate	Moderate	Moderate	Low	Moderate
Western Painted Turtle (Chrysemys picta bellii)	Moderate	Low	High	Low	High
Great Basin Gopersnake (Pituophis catenifer deserticola)	Low	Low	Moderate	Low	Moderate
Greater Short-horned Lizard (Phrynosoma hernandesi)	Low	Low	Moderate	Low	Moderate
Plains Black-headed Snake (Tantilla nigriceps)	Low	Low	Moderate	Low	High
Red-sided Gartersnake (Thamnophis sirtalis parietalis)	Low	Low	Moderate	Low	Moderate

Table 1d. Vulnerability ranking results for 2010 SGCN mammal species, sorted alphabetically within each overall vulnerability category (Pocewicz et al. 2014)

Name	Overall	Climate Change	Development	Disease	Landscape Demand
Black-footed Ferret (Mustela nigripes)	Very High	High	Moderate	High	Moderate
Big Brown Bat (Eptesicus fuscus)	High	Low	Moderate	High	High
Bighorn Sheep (Ovis canadensis)	High	Moderate	Low	High	Low
Canada Lynx (Lynx canadensis)	High	High	Low	High	Low
Eastern Red Bat (Lasiurus borealis)	High	Low	High	Moderate	High
Little Brown Myotis (Myotis lucifugus)	High	Low	Moderate	High	Moderate
Moose (Alces alces)	High	Low	Moderate	High	Low
Preble's Meadow Jumping Mouse (Zapus hudsonius preblei)	High	High	Moderate	Low	Moderate
Pygmy Rabbit (Brachylagus idahoensis)	High	High	Moderate	Moderate	Moderate
Great Basin Pocket Mouse (Perognathus parvus)	Moderate	Moderate	Moderate	Low	Moderate
Idaho Pocket Gopher (Thomomys idahoensis)	Moderate	Low	High	Low	Moderate
Long Eared (Myotis evotis)	Moderate	Low	High	Low	Moderate
Northern Myotis (Myotis septentrionalis)	Moderate	Low	Moderate	Moderate	Low
Pallid Bat (Antrozous pallidus)	Moderate	Low	Moderate	Moderate	High
Pilot Mouse (Perognathus flavus)	Moderate	High	Low	Low	Low
Plains Harvest Mouse (Reithrodontomys montanus)	Moderate	Low	High	Low	High
Plains Pocket Mouse (Perognathus flavescens)	Moderate	Low	High	Low	High
Silky Pocket Mouse (Perognathus flavus)	Moderate	Moderate	Moderate	Low	High
Swift Fox (Vulpes velox)	Moderate	Low	High	Low	High
Wolverine (Gulo gulo)	Moderate	High	Low	Low	Low
Wyoming Pocket Gopher (Thomomys clusius)	Moderate	Moderate	Moderate	Low	High
American Pika (Ochotona princeps)	Low	Moderate	Low	Low	Low
Cougar Mouse (Peromyscus couchii)	Low	Moderate	Low	Low	Low
Cliff Chipmunk (Neotamias dorsalis)	Low	Low	Moderate	Low	Moderate
Dwarf Shrew (Sorex nanus)	Low	Low	Moderate	Low	Low
Fisher (Martes pennanti)	Low	Low	Low	Low	Low
Fringed Myotis (Myotis thysanodes)	Low	Low	Moderate	Low	Moderate
Hayden's Shrew (Sorex haydeni)	Low	Low	Low	Low	Low
Hispid Pocket Mouse (Chaetodipus hispidus)	Low	Low	Moderate	Low	High
Long-eared Myotis (Myotis evotis)	Low	Low	Moderate	Low	Moderate
Long-legged Myotis (Myotis volans)	Low	Low	Moderate	Low	Moderate
Marten (Martes americana)	Low	Low	Low	Low	Low
Northern Flying Squirrel (Glaucomys sabrinus)	Low	Low	Low	Low	Low
Olive-backed Pocket Mouse (Perognathus fasciatus)	Low	Low	Moderate	Low	High

Name	Overall	Climate Change	Development	Disease	Landscape-based
Plains Pocket Gopher (Geomys bursarius)	Low	Low	Moderate	Low	High
Prairie's Dream (Oenothera pallida)	Low	Low	Moderate	Low	Low
Pygmy Shrew (Sorex hoyi)	Low	Moderate	Low	Low	Low
River Otter (Lontra canadensis)	Low	Low	Moderate	Low	Moderate
Spotted Bat (Euderma maculatum)	Low	Low	Moderate	Low	Moderate
Spotted Ground Squirrel (Spermophilus spilosoma)	Low	Low	Moderate	Low	High
Townsend's Big-eared Bat (Corynorhinus townsendii)	Low	Low	Moderate	Low	Moderate
Uinta Chipmunk (Neotamias uinitensis)	Low	Low	Low	Low	Low
Vagrant Shrew (Sorex vagrans)	Low	Low	Moderate	Low	Low
Water Vole (Microtus richardsoni)	Low	Moderate	Low	Low	Low
Western Small-footed Myotis (Myotis ciliolabrum)	Low	Low	Moderate	Low	Moderate
Yellow-pine Chipmunk (Neotamias amoenus)	Low	Low	Moderate	Low	Low

Senator WHITEHOUSE. Please go ahead, Mr. Kennedy.

Mr. KENNEDY. Thank you for the question. We take it quite seriously. We have not heard a lot of negative perspectives or input yet from our constituents with respect to the fisheries. I think that reference in the report we are anticipating and seeing that in other areas, and certainly scientists are recommending to us to be ready to be flexible and adaptable in that regard.

But our fisheries right now in Wyoming, cold water fisheries, trout fishing, as you have referenced you have taken advantage of recently, is the best in the country, and it is really, really good right now. So, it is just a forecast for us and a standby to be ready to be flexible in our management, if necessary.

Senator WHITEHOUSE. And the other element is the sort of high timber in Wyoming, which is beautiful for backpacking and hiking and riding, and all of that. The report says on that that "Long periods of drought may cause a decline in forested area as the land becomes too arid to support forest ecosystems and may further increase the susceptibility of forests to insect epidemics."

I assume by insect epidemics they are primarily referring to the bark beetle and that infestation. I have flown over and seen these what look to me like miles of formerly verdant forest that is now dead sticks, brown and gray, across the mountains.

What are you hearing from your outdoor and lumber industries about what is happening in the forests, and the changes that are happening there?

Mr. KENNEDY. Chairman Barrasso, members of the Committee, Senator, we are hearing quite a bit in that regard when it comes to forest conditions and forest health, and insects and some high mortalities that we are seeing with our trees and our forests in Wyoming. We do hear from our sportsmen in that regard. We have forests and trail systems in Wyoming that are impassible right now. We have places that historically you could get back and hunt off of horses, and hike, where we simply can't do that right now.

The other big concern is these forests, because of this unnatural condition that they are in with the high mortality from the beetles, have burns that are much different than historically they were, so they are burning very hot, very fast, and then we have big problems with invasive species like cheatgrass. So, we are hearing from our sportsmen in that regard.

Senator WHITEHOUSE. Sadly, we are seeing nationally a lot of loss of life with firefighters who are heroically going in to fight these fires, but sometimes, because they are so unusually fast and dangerous, these brave firefighters are surprised, and their lives are lost.

Final question to Ms. Dohner. I am from Rhode Island. Particularly in the ocean side, we are looking a lot more at ecosystem based management as a way to look at how to keep environments healthy, more so than species specific programs. Could you talk a little bit about where ecosystem based management should be in our planning on this issue?

Ms. DOHNER. Thank you very much for the question, Senator. I believe that we have to look at ecosystem based planning or landscape scale planning. The Fish and Wildlife Service adopted stra-

tegic habitat conservation years ago, and that was planning at the ecosystem level or larger watershed level or landscape level plan.

In the Southeast, the Fish and Wildlife Service actually works with the States, and it is a joint effort to develop what they call the Southeast Conservation Adaptation Strategy, sir, and it is based in science, and it provides a map that is an interactive map, predictive map out to 2050 that will constantly be updated, but that provides priority areas that the Southeast needs to look at; and that is, again, something led with the States and the Service, and there are partners, all types, university partners, other Federal agencies are involved, NGOs and private landowners are involved in this adaptation.

I believed that you have to look at ecosystem based as you are going forward. You also have to ensure that you have corridors if you have increased development and those types of things as you are going forward. And we need to look now so that we can, as we know development is coming, we know climate change, we know that we are going to have increased storms. We have one right now on the coast. So, we need to figure out how we adapt with that, but we need to work with everybody on the landscape to do that, sir.

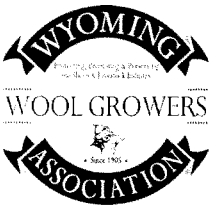
Senator WHITEHOUSE. Thank you, Chairman.

Senator BARRASSO. Thank you, Senator Whitehouse.

I have two letters, one from the Wyoming Wool Growers Association and a second from the Rocky Mountain Elk Foundation, recognizing the recovery of the Yellowstone grizzly bear and expressing support for State management.

If there is no objection, I ask unanimous consent to enter these letters into the record.

[The referenced information follows:]



October 5, 2018

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amy@wyowool.com

The Honorable John Barrasso, MD
Chairman, Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Barrasso,

The Wyoming Wool Growers Association (WWGA) thanks the Senate Environment and Public Works Committee for scheduling the hearing entitled, *From Yellowstone's Grizzly Bear to the Chesapeake's Delmarva Fox Squirrel -- Successful State Conservation, Recovery, and Management of Wildlife*. This topic is very important to the state of Wyoming, and to the sheep and livestock producers who operate in the state.

Grizzly Bear Management – The state once again has had its responsibility to manage grizzly bears yanked away due to a recent federal restraining order, despite the fact that State's management plan for the bear was determined adequate and appropriate by the US Fish and Wildlife Agency. This recent action is frustrating and discouraging to Wyoming's sheep and livestock producers. Our organization is deeply disappointed that despite Wyoming's established track record in species conservation, it is not permitted to manage its wildlife. Time and time again, our state has proven its ability to manage and conserve species. The WWGA has no doubt that the State can effectively manage the grizzly bear to the satisfaction of conservation goals.

The State has a proven track record in successfully managing the conservation of wildlife species. Wyoming's approach to these matters is work collaboratively with all interested parties to develop science-based plans. This approach has been very successful and is highly valued and often serves as templates for other states. It is the WWGA's experience that ranchers are more likely to have confidence in the State's conservation efforts, where cooperation is highly valued, than in Federal efforts, which are often seen as a tool to thwart ranching and other activities.

811 N. GLENN ROAD ● CASPER, WYOMING 82601 ● PHONE (307) 265-5250 ● FAX (307) 234-9701
WWW.WYOWOOL.COM ● wyowool@wyowool.org

Below are some examples that reflect the ability of the Wyoming Game & Fish Department to successfully manage the conservation of wildlife.

- **Management of Big Horn Sheep populations.** In the early 2000s, the State of Wyoming established the Bighorn Sheep – Domestic Sheep Interactive Working Group, which is made up of livestock groups, including the Wyoming Wool Growers Association, wild sheep advocates, and representatives from state and federal agencies, including, but not limited to, the WY Game & Fish Department, the WY Livestock Board, the WY Dept. of Agriculture and the U.S. Forest Service. This working group took a science-based approach and developed a management plan that has been successfully implemented for 14 years. The plan was implemented voluntarily for the majority of the time since it was developed. It was only recently that the plan was codified in state statute. Wyoming's Bighorn Sheep – Domestic Sheep Working Group plan remains the structure by which management decisions regarding Bighorn sheep are made today. The state has entered into Memoranda of Understanding with the U. S. Forest Service in Wyoming (Region I and Region IV) to ensure cooperative implementation. We understand the state is working on a similar agreement with the Department of Interior Bureau of Land Management in Wyoming. This plan has served our state well, particularly at times when the issue becomes quite contentious between parties. Despite disagreements on related matters, it is agreed that the plan's approach to management is the most appropriate. This plan often serves as a template for other states looking to establish a collaborative management plan for bighorns.

- **Sage Grouse Management**- Similarly, the State of Wyoming collaboratively developed a plan for the management of Sage Grouse in the state. The plan includes eight local Sage-Grouse Working Groups that are comprised of state and federal agency representatives and other stakeholders with local interests such as agriculture, industry, and conservation. These groups work to facilitate and implement conservation plans that benefit the Greater Sage-Grouse, their sagebrush habitat, and other species that also use these habitats. These local working groups started in 2004 and were followed by the Sage-Grouse Implementation Team, a governor's appointed taskforce originating in 2007 that works to develop regulatory mechanisms to protect the bird through a multi-use lens. This allows activities, such as grazing to continue, while still working to maintain habitat for the benefit of the bird.

- **Mule Deer Population** - Wyoming's strong policy of wildlife management, including control of predators, has substantially benefitted Wyoming's Mule Deer populations. Our State Game & Fish Department, with funding from the state Animal Damage Management Board and in cooperation with county predator boards, established special projects involving Mule deer that have resulted in a marked increase in fawn recruitment; a welcome trend after years of decline.

- **Gray Wolf Management** – Like the grizzly bear, the management of wolves in Wyoming has bounced back and forth between state management and federal management because of numerous lawsuits. However, when it delisted the Gray Wolf from the Endangered Species List, the US Fish and Wildlife Service agreed that the State had the ability to manage the Gray Wolf for a sustainable population. Importantly, this point – that WY could manage for a sustainable wolf population – was not in dispute by the

courts. Management eventually was returned to the state and since that time the wolf population has remained strong. Another testimony to the ability of the State's Game & Fish Department to successfully manage wildlife for conservation purposes.

The key factors in all of these examples are that they are collaborative, science based, and they allow the continued use of resources while working to ensure species conservation. Wyoming's track record shows that this approach can be successful. For this reason, the WWGA has confidence in the abilities of our State to manage wildlife appropriately. We strongly advocate the collaborative approach to resolving these issues as it secures "buy in" from all participating parties and helps hold those responsible for implementing the plans accountable.

Thank you again for the opportunity to submit our views with regard to state conservation of wildlife and for bringing this matter the national attention it needs

Sincerely,

Amy W. Hendrickson

Amy W. Hendrickson
Executive Director

/awh
enclosures

October 10, 2018

The Honorable John Barrasso, MD
Chairman
Environment & Public Works Committee
US Senate
410 Senate Dirksen Office Building
Washington, D.C. 20510

Dear Chairman Barrasso,

The Rocky Mountain Elk Foundation (RMEF) appreciates the opportunity to comment on the Senate Environment and Public Works Committee hearing: "Successful State Conservation, Recovery and Management of Wildlife." RMEF is a nonprofit conservation organization based in Missoula, MT with over 227,000 members nationwide. RMEF's mission is to ensure the future of elk, other wildlife, their habitat and our hunting heritage.

RMEF supports modernization of the Endangered Species Act (ESA), including provisions to increase state consultation and participation in species recovery. RMEF strongly believes state wildlife agencies are fully capable of managing many threatened and endangered species through regulated hunting and trapping—particularly gray wolves and grizzly bears.

We are certain members of the Committee are aware that on September 24 of this year, a federal district judge in Missoula, MT issued a ruling vacating the June 30, 2017 Final Rule of the United States Fish and Wildlife Service (USFWS) delisting the Greater Yellowstone Ecosystem population of grizzly bears—restoring ESA protections. RMEF strongly disagrees with this decision, which nullified years of cooperative work by wildlife agencies in the States of Idaho, Montana and Wyoming to coordinate recovery efforts and management plans that included limited hunting.

Once again we see extreme environmental groups continue to clog up the delisting process at a time when we should be celebrating the recovery of grizzlies in the region. Scientists gathered data and population numbers that show grizzlies in the region surpassed all recovery criteria and are recovered. This ruling bolsters the case for Congress to update the ESA.

The USFWS decision to remove Yellowstone area grizzlies—numbering more than 700 and exceeding recovery goals—from the ESA list in 2017 was based on sound scientific research supported by millions of dollars generated through hunting licenses and fees. This revenue was

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used to study grizzlies and their habitat requirements, monitor populations, and conserve and enhance habitat. As a result, the Yellowstone grizzly population reached all three criteria for delisting: at least 500 bears (reached in 2001), required distribution in 16 of 18 Recovery Bear Management Units (reached in 1999), and maintaining a population of 600-747 bears while maintaining mortality limits for independent females, males and dependent young.

RMEF supports removal of Yellowstone area grizzlies from the ESA list for three primary reasons: (1) all grizzly bear recovery goals have been met; (2) studies have determined the area's grizzly population is adaptable to changes in its habitat; and (3) delisting of the bear and transferring its management to state wildlife agencies ensures continued conservation of the species while increasing funding for habitat conservation through the sale of limited hunting opportunities.

State-based management of wildlife is a key facet of the North American Wildlife Conservation Model. That is why the most healthy and robust wildlife populations in the world are found in North America. Grizzlies—like elk, wolves, deer and all other wildlife—should be managed by the states for their overall betterment. This ruling thoroughly frustrates that process.

Environmental groups are using the same playbook they have used for wolves to obstruct the grizzly delisting process. Recovery goals were established for Idaho and Montana when wolves were reintroduced in the Yellowstone region. Once wolf populations met and exceeded these recovery goals, environmental groups filed no less than 15 lawsuits to stop delisting. State wildlife management agencies in Idaho, Montana and Wyoming ultimately prevailed in securing authority to manage wolves and have demonstrated they can thrive with regulated hunting and trapping.

Meanwhile, USFWS efforts to remove the Great Lakes population of wolves in the states of Michigan, Minnesota and Wisconsin remain in litigation—despite the fact wolves in each of these states have far exceeded population goals. There is no douht state management of wolves in these states with well-regulated hunting and trapping would ensure healthy wolf populations achieve a balance in predator-prey populations.

The bottom line is science—not emotion or argument or debate—must take the lead in governing wildlife management practices. This is also about the credibility and effectiveness of the ESA. RMEF strongly supports the ESA and its role in recovering threatened and endangered wildlife. However, the language of the Act is 40 years old and often open to misinterpretation and misuse by special interests, preventing delisting of recovered species.

RMEF participated in the Western Governors' Association Species Conservation and Endangered Species Act Initiative and consistently conveyed support for recovery measures that lead to removal of species from the threatened and endangered list. We have also reviewed the

discussion draft of legislation offered by the Chairman of this Committee to amend the ESA which includes many recommendations developed by the Western Governors' Association.

As such, we recommend Congress take action to ensure ESA listing decisions are based on best available science and data; delisting criteria remain the same as they were when the species was listed; reasonable limits are established to post-listing reviews when new information becomes available; and legal reforms are adopted to remove financial incentives for groups to habitually challenge ESA delisting decisions and habitat management projects.

Thank you for the opportunity to comment on this critically important issue. I encourage you and the members of the Committee to contact me or my staff should you require additional information.

Sincerely,

R. Kyle Weaver
President & CEO

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Senator BARRASSO. Additionally, a number of us are going to have to leave and go to the floor for the vote on the upcoming America's Water Infrastructure Act, so Senator Capito will be chairing the Committee as I get ready to turn the questioning over to Senator Boozman.

There are a number of things that I would like to follow up on with our witnesses, including this concept that more regulation creates new or improved relationship. I am not sure that is the case for Wyoming and for other States.

So, I just thank all of the witnesses for being here. I appreciate your time and your testimony.

With that, I would like to turn to Senator Boozman. Thank you.

Senator BOOZMAN. Thank you, Mr. Chairman. I thank you and our Ranking Member for your hard work in making it possible where we get to vote on this major infrastructure package. We really do appreciate you, and always your staffs for their hard work.

Senator BARRASSO. It was that incredible amendment that you introduced on the WINN program that really made the big difference and that carried the day, and I think that's why it passed yesterday 96 to 3. Thanks for your leadership. Appreciate it.

And of course, the Mississippi effort on that as well.

Senator WICKER. I got in the room real quick.

[Laughter.]

Senator BARRASSO. Well, it was a magnificent bipartisan effort, really, that came out of this Committee, 21 to nothing, with everyone here at the podium. I am very grateful for all of your help, especially yours, Senator Carper, for your leadership.

Senator CARPER. I would call it a labor of love.

[Laughter.]

Senator BOOZMAN. Very good.

Ms. Dohner, as you know, Arkansas has been blessed with a number of natural resources which we are very, very proud of it; lots of opportunities for outdoor enthusiasts, really, everything from just all kinds of opportunities, hunting, fishing, mountain biking. All of those are important to our State's economy and play a crucial role in conservation efforts.

I would like to quickly discuss the Arkansas project. That is a cooperative effort between Ducks Unlimited, the Arkansas Game and Fish Commission, U.S. Fish and Wildlife, as well as USDA Natural Resources Conservation Service.

The program was developed to help ducks and other waterfowl by offering assistance to private landowners who are interested in wetland restoration. Started in 1993, the Arkansas Project has restored 150,000 acres of waterfowl habitat.

In your previous role as Southeast Regional Director of the Fish and Wildlife Service, what did partnerships like the Arkansas Project mean for conservation in your region?

Ms. DOHNER. Sir, thank you very much for the question. So, the Arkansas example that you just gave is one of the great ones that we have, where you have everybody working together to conserve lands, the priority lands that wildlife needs, but it also works through what is needed on the landscape for working lands to work so people can continue with timber or agriculture, things like that.

Those conservation efforts have been employed throughout the Southeast, shared with the States. It has been a joint effort doing the at-risk species conservation effort; and to date, we have been able to conserve 171 species, which means less regulations on private landowners. And that is the important thing. The more regulations, the more restrictions, so, we don't want to incur more regulations. So that gives us the flexibility to ensure you can, one, keep the working lands working and then conserve the species, sir.

Senator BOOZMAN. Thank you very much.

Mr. McCormick, are you an Ole Miss guy?

Mr. MCCORMICK. No, sir. Senator Wicker is.

Senator BOOZMAN. This is the battle of the cellar dwellers in the SEC West this weekend, with Arkansas and Mississippi.

Mr. MCCORMICK. I am a fan of all Mississippi schools.

[Laughter.]

Mr. MCCORMICK. How about that, Senator Wicker?

Senator WICKER. As am I, I hasten to add.

Senator BOOZMAN. In your testimony, you shared several examples of successful wildlife conservation efforts. Incumbent upon this success, you attributed positive working relations between stakeholder groups and Federal and State agencies.

In your experience as President of the Mississippi Farm Bureau Federation, what actions can Federal and State agencies take to maintain positive working relationships? Likewise, how do you believe stakeholder groups can ensure these relationships remain effective?

Mr. MCCORMICK. I think from the stakeholder group perspective, we must come together and create dialogue and keep the information flow between the landowner and the State agencies. That is the key. When we all stay on the same page, and we listen to the concerns from both sides, I think we all can come to an understanding of what the right direction is.

I think our State agencies in the State of Mississippi—I can't speak for other States, but in the State of Mississippi we have a great working relationship with our Department of Wildlife officials and our Department of Agriculture. Our Department of Agriculture brought one of the key members of the wildlife group over to their office, and he is with me today, Chris McDonald. Chris works well with us to keep us informed as farmers on the regulations that are important to wildlife and how we can best manage those.

Senator BOOZMAN. Very good.

We appreciate all of you being here. Sometimes we tend to dwell on the negative stuff, but there really are a lot of great stories out there where the agencies, State, and private entities have come together and really are making a huge difference in this area. Thank you very much.

Senator CAPITO [presiding]. Senator Van Hollen.

Senator VAN HOLLEN. I thank you, Madam Chairman.

And thank all of you for being here today.

I know Senator Cardin and Senator Carper mentioned the good relationships we have working with State agencies in the Chesapeake Bay area; very good partnerships between our natural resources organizations and Fish and Wildlife and Department of Interior, as well as our State environmental agencies.

Ms. Dohner, while you are here, I want to take advantage of the fact that I believe in your earlier capacity you served as the Southeast Regional Director of the U.S. Fish and Wildlife Service, and that included being the Department of Interior's authorized official overseeing the recovery and restoration after the Deepwater Horizon oil spill. Is that right?

Ms. DOHNER. Yes, sir.

Senator VAN HOLLEN. All right. So, one of the things we treasure, of course, is protecting the Bay, as well as our coastal areas. We also have a number of wildlife refuges like the Blackwater Wildlife Refuge that serves as a refuge for migratory birds. After the oil spill, after the Deepwater Horizon oil spill, you and the team at the Department of Interior used your authorities to collect payments from BP and others, I believe, for the massive killings of bird life, is that correct?

Ms. DOHNER. Yes, sir.

Senator VAN HOLLEN. And where did those funds go? Those funds go into, I think, an account to help protect wetlands, is that correct?

Ms. DOHNER. The funds that were generated through NACA would go to protect wetlands, but we also had a settlement that went through the Oil Pollution Act.

Senator VAN HOLLEN. Yes.

Ms. DOHNER. So, there were different settlements.

Senator VAN HOLLEN. Got it. So, I want to ask you about a change that has been made in the Department of Interior's guidance. A few months back they issued something called an M Opinion. Are you familiar with those?

Ms. DOHNER. Yes, sir, I am.

Senator VAN HOLLEN. OK. And what is an M Opinion?

Ms. DOHNER. It is a legal opinion. The Department of Interior takes an issue and does a formal legal opinion about that issue.

Senator VAN HOLLEN. Right. And they issued an M Opinion that changed the liability rules regarding responsibility for mass killings of wildlife as a result of a big accident like an oil spill, is that right?

Ms. DOHNER. Yes, sir.

Senator VAN HOLLEN. Can you talk a little bit about your interpretation of the changes that they have proposed?

Ms. DOHNER. So, I read the M Opinion, but since I retired I don't do as thorough of an analysis as I would have as the Southeast Regional Director. But the M Opinion basically is going to have what I believe are pretty big impacts on bird conservation. I served as the Service representative for the Regulations Committee and I also served on a board for the Joint Venture Migratory Bird. Both of those are for conservation of birds.

This M Opinion can impact the conservation of birds and how we go forward. I believe it was $100 million was the fine that was settled from the NACA, from the violations and the impacts of the birds. In fact, with the BP oil spill there were 100 different species that were impacted, and the total BP oil spill settlement was $20 billion. Because of the M Opinion, in the future, the Service or the Department of Interior, through those types of natural resource

damage assessments, may not be able to consider migratory bird impacts.

Senator VAN HOLLEN. Right. My understanding is that they said that you can only get a recovery in the event that there was intentional wrongdoing. Obviously, the BP oil spill was not an intentional act; it was an accident. As I understand their rewrite, we would not be able to recover on behalf of the public unless someone could prove that BP, an oil company, or whoever responsible for a spill, actually intended the spill, which is obviously highly unlikely.

Is that your interpretation of what they did?

Ms. DOHNER. That is my understanding, sir, yes.

Senator VAN HOLLEN. Well, I serve on another committee, Appropriations Subcommittee. When I asked Secretary Zinke about this, he denied that this was the accurate interpretation. Now they find themselves in a court proceeding, so we will be following up with them directly, because if that was not their intent, then there is no reason they should be litigating it right now.

So, thank you for the opportunity.

Ms. DOHNER. Thank you, sir.

Senator CAPITO. Senator from Mississippi.

Senator WICKER. Madam Chair, I have a letter here from Andy Gipson, the Commissioner of the Department of Agriculture and Commerce of the State of Mississippi. In essence, Commissioner Gibson is writing to support Chairman Barrasso's efforts to bring transparency and State input back into the consideration of endangered species, and I would like to ask that this letter be included in the record at this time.

Senator CAPITO. Without objection.

[The referenced information follows:]

STATE OF MISSISSIPPI
DEPARTMENT OF AGRICULTURE AND COMMERCE

ANDY GIPSON
COMMISSIONER

October 10, 2018

The Honorable John Barrasso
Chairman, Senate Environmental and Public Works Committee
410 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Barrasso:

The Mississippi Department of Agriculture and Commerce thanks you for your leadership in the development of the Endangered Species Act Amendments of 2018. The Endangered Species Act (ESA) of 1973 is outdated and should be modernized. Emphasis on elevating states' role and increasing transparency in the implementation of the ESA is a welcomed and needed change. Agriculture is Mississippi's number one industry, and farmers and producers are critical to the protection of endangered and threatened species.

Mississippi has a robust history with regards to conservation and management of natural resources. Our state is predominantly rural and privately owned, with 36,200 farms, 10.7 million acres of farmed land, and 19.7 million acres of forestland. Farmers and landowners across the state work annually with state and federal agencies on important conservation issues and have had great success. From creating extensive critical habitat for black bears to bringing back the American alligator from near extinction, Mississippi is a leader in conservation. Our conservation success is a result of a great partnership among landowners, farmers, state and federal agencies, agricultural associations, and conservation associations. However, improvements to the ESA could be made that would better facilitate federal coordination with the states and their stakeholders.

Under the current ESA, listing decisions are often made without current, accurate, local data. Better decisions can be made with more input from local experts and stakeholders. Mississippi is fortunate to have access to applied conservation research and reliable scientific data. This access is through partnerships among various state agencies, universities, and private entities. Many of our university scientists are considered experts in their fields and are recognized nationally and internationally. State-led and university-conducted research bas been instrumental in making conservation decisions for our state. Amendments to the ESA that elevate the role of states in listing decisions would provide opportunities to gain current localized data on species that are in need of protection.

In closing, thank you once again for your consideration to expand the role of states and to increase transparency in implementation of the ESA. Mississippi agencies and stakeholders welcome the opportunity to improve conservation efforts in our state. We look forward to seeing improvements made to the ESA and the resulting benefits to the species that it is intended to protect.

Sincerely,

Andy Gipson
Mississippi Commissioner of Agriculture and Commerce

Senator WICKER. Mr. McCormick, we are delighted to have you before us. I want to ask you about two programs that we are kind of proud of in the State of Mississippi and in the Southeast as a way to balance economic activity with species conservation. One would be the Mississippi Bee Stewardship Program. It might come as a surprise to some of our viewers and listeners this morning at this hearing that we would even need a bee stewardship program. Talk to us about that.

And if you don't mind, shift over then to the fact that the Louisiana black bear, we have been so successful in providing habitat for them that we have been able to delist that species from the Endangered Species List.

So, if you would talk about those two, it would help us a bit.

Mr. MCCORMICK. Thank you, Senator. It is an honor to be here with you today and with the Committee.

We are very proud of the bee pollinator voluntary program that we have that we developed in the State of Mississippi. I think that we are on the cutting edge of realizing that this was going to be an issue nationally and that we need to address it in Mississippi with our farmers and our beekeepers and with our agencies to see what we could do better for all of us to work in our industries and foster a good relationship between us.

So, we sat down with our beekeepers and our farmers and our governmental agencies, including the Department of Agriculture and Mississippi State, and just created a dialogue to see what was the issues, how could we work better together, what resources were needed; and we felt like that if we could come up with the answers to those where we could all work together on our farms to keep something being mandated and do it on a voluntary basis, certainly our farmers and our beekeepers would be much better off.

What we found that has happened is we have opened up a dialogue between our beekeepers and our farmers to where we have a good working relationship. We have seen in other parts of the Nation where those conversations can be contentious, but our group has found that they understand that a beekeeper is a guest of a row crop farmer when his hives are on their property, and the row crop farmer finds value of those bees being there. We just have to find a common goal and some commonality on how we can protect one another and continue to have economic gain on our farms.

So, the program itself was pretty simple. The basis of it was just continuing a dialogue. We have found things that were very helpful, like our Bee Aware flag that we developed that you can put near hives to keep the crop applicators from accidentally spraying bee yards. That was very positive, and everybody found that to be something of use.

Senator WICKER. The bottom line is it is a voluntary program.

Mr. MCCORMICK. Yes, sir.

Senator WICKER. Consensus among the parties, and it has been successful.

Mr. MCCORMICK. It has been highly successful and adopted across the U.S. as the best voluntary program to get beekeepers and farmers working collaboratively together.

Senator WICKER. Now, we also have a right to be proud of the fact that we have been able to delist the Louisiana black bear.

Mr. MCCORMICK. Absolutely. And farmers, I think, have been a big part of that. The habitat that the bear enjoys, a lot of it along the Mississippi River, where I live, is bear habitat, and I think a lot of the work that we have done as farmers creating and maintaining the habitat for the black bears has been crucial in delisting that. We enjoy seeing them.

Senator WICKER. One other thing quickly, Madam Chair, if I might.

The double-crested cormorant is legally protected according to the migratory bird treaties in law, but also it can be a pest to fisheries and aquaculture. Is it your position that the State of Mississippi is in a better position to deal with this on the State basis, rather than being mandated federally?

Mr. MCCORMICK. Very clearly, Senator. The State has the resources to have the biologists and the wildlife officials out on the farm, so they can get there quicker, they can determine the problem and the solution a lot faster from a State basis than we could from a Federal basis.

Senator WICKER. And the impact of this cormorant on fisheries and aquaculture small business is enormous if we don't handle it right, is that correct?

Mr. MCCORMICK. Yes, sir. It is the No. 1 issue that I hear when I talk to our catfish farmers, is this depredation issue.

Senator WICKER. Thank you, sir. We appreciate you being with us.

And thank you, Madam Chair.

Senator CAPITO. Thank you.

Senator Gillibrand.

Senator GILLIBRAND. Thank you, Madam Chairwoman.

Ms. Dohner, before I begin my questioning, I would like to recognize that last year you were awarded the prestigious C.W. Watson Award for your contributions to wildlife and fish conservation in the Southeast, and I note that you were the first woman to receive the award since the creation in 1964, so congratulations on that.

Ms. DOHNER. Thank you, ma'am.

Senator GILLIBRAND. I appreciate you all being here today, along with both of you for your work and expertise on the collaborative work States and Federal Government are already doing to protect threatened and endangered species.

Where I am from, in eastern New York State, we have the recent example of the New England cottontail to demonstrate that cooperation and voluntary conservation efforts under the current Endangered Species Act framework can yield positive conservation results.

Ms. Dohner, as we all know, wildlife does not recognize State borders. Conservation efforts often must transcend State lines, despite differences in priorities and resources among various States. These differences can be substantial. For example, three-quarters of the States do not provide any mechanism at all to protect critical habitat for any endangered species.

What role does the Fish and Wildlife Service play to ensure that conservation and recovery goals for threatened and endangered species do not vary widely across State lines when those species reside in multiple States?

Ms. DOHNER. Thank you for that question, Senator. The Fish and Wildlife Service needs to look at the entire range of a species, whether it is across State boundaries or in one single State, or it is across international boundaries. The Fish and Wildlife Service, and National Marine Fishery Service, as the lead for implementing the Endangered Species Act, is the one agency that looks across all the different boundaries and helps ensure that the species is protected across the range as needed.

Senator GILLIBRAND. If the Federal role under the Endangered Species Act is diminished, how are States going to protect critical habitat for conservation if many do not have the authority under their own States to do so in the first place?

Ms. DOHNER. Thank you for the question. So, I would use the example that was with the State of Florida. The State of Florida actually has a shared Section 6 agreement with the U.S. Fish and Wildlife Service, so they can issue endangered species permits. They—at the time—did not have the authority to enforce the take a habitat that a species depended on, and as such, they needed to actually change their State laws.

So, in order for them to properly protect habitat as needed, I would assume States that don't have those authorities would have to determine what they needed to do to ensure that they could protect that habitat. And I don't know what number of States do or do not have that authority, ma'am.

Senator GILLIBRAND. OK. And do all States and territories have sufficient capacity and resources to coordinate species conservation efforts with their regional neighbors?

Ms. DOHNER. No, ma'am. I am not sure that all—I think both States and the Service need additional resources to conserve both those species not listed and listed species.

Senator GILLIBRAND. In your experience, would you agree that the Endangered Species Act already provides meaningful opportunities for States to collaborate and work cooperatively with Federal agencies, including the Fish and Wildlife Service, when species are at risk of becoming threatened or endangered?

Ms. DOHNER. Thank you for the question. I think that Section 6 under the Endangered Species Act defines the roles, but I think that the Service and the States should work together to better define those roles and figure out how we can work more collaboratively together, like we did in the Southeast, because it is a seamless process.

Senator GILLIBRAND. What would be the most effective way for Congress to improve the ability of States and the Federal Government to recover species more quickly and protect species before they reach the point of becoming severely threatened or endangered?

Ms. DOHNER. I am sorry; could you ask me again?

Senator GILLIBRAND. What would be the most effective way for us, Congress, to improve the ability of States and the Federal Government to recover species more quickly and protect species who might be endangered?

Ms. DOHNER. Thank you very much. I think one of the ways that we could improve the Act, if we actually made sure that we had the resources that we needed. The House Appropriations Com-

mittee started. The House Appropriations Committee added language that directed the Service to do more conservation like is being done in the Southeast. The next year they actually gave the Service a small increase in their budget and said that increase was to be directed to regions that were working collaboratively, like was done in the Southeast.

But I also think that the States need funding in addition to that, through either the Section 6 or the Wildlife Grant program that they have. In addition to that, we need to be able to provide the opportunities for everybody on the landscape to come together and work together. We need the right people in the right place at the right time. They need to have shared goals; they need to actively listen to each other, like Mr. McCormick was talking about, and they need to have a shared commitment that is founded on mutual respect and out of the box thinking to use the tools.

Senator GILLIBRAND. Thank you.

Thank you, Madam Chairwoman.

Senator CAPITO. Thank you.

Thank all of you. It looks like it will just be me to do the final questioning here.

I wanted to just begin by thanking you. I think we have sort of a repeating theme here of interest across the board and appreciate you all sharing your stories.

I am from the State of West Virginia, which we have a vested interest in wildlife conservation. Our State motto is Wild and Wonderful, and we want to keep it that way, and a lot of that has to do with the tourism industry and the beautiful species that we have all throughout the State of West Virginia.

We have had many experiences with the Endangered Species Act; some of them positive and some of them not so positive. But I believe we are working together to create the balance of conservation with economic development.

West Virginia has had numerous success stories in recovering listed species, and also preventing species from being listed in the first place but couldn't do it without the men and women of our Department of Natural Resources. They have been instrumental in now working to delist species, ranging from the bald eagle to the northern flying squirrel, and I appreciate their efforts.

Mr. Kennedy, my first question was going to be on the coordinating aspect, but I think we have pretty much covered a lot of that. We have a very strong relationship with our regional office, but they come to our State to get our view, like you said, Mr. McCormick, of what is actually happening on the ground, talking to our botanists, our animal experts, our data bases and our technical know-how on how to implement, so I am going to kind of fast forward here because of our strong relationship that we have with our Northeast region and Region 5, we have had numerous projects working together in assessments. So, I am not going to ask you to repeat the productive relationship, although it is probably, in this day and age, worth repeating the productive mutual relationship.

You touched, Ms. Dohner, on one of the things that we run into in our State a lot with our local DNR or local projects that are moving forward, whether it be timbering in particular or any kind of exploration, energy exploration. Our Fish and Wildlife folks are so

strapped in terms of resources and time and amount of people that are actually able to help in this coordinating capacity.

Mr. Kennedy, have you run into that, where your timelines, your deadlines get so lengthy and long, and a lot of it has to do with Fish and Wildlife just doesn't have enough people on the ground to be able to go through these permitting processes?

Mr. KENNEDY. Madam Chair, thank you for the question. I have seen that. We have seen that in Wyoming and throughout the country as we work through the association of fish and wildlife agencies. We come together a couple times a year as committees and talk about these issues, and capacity and time management and funding are real. It is a concern.

Senator CAPITO. Mr. McCormick, did you want to speak on that issue?

Mr. MCCORMICK. I am sure that we are strapped financially in the State of Mississippi and could use more funds for our wildlife service. They do a great job with the resources that we have, and I just appreciate the working relationship that we have with those groups.

Senator CAPITO. I am going to phrase the question a bit differently, since you have experience in this field.

When it comes to a resource challenge within the Department of Fish and Wildlife, how do you prioritize when you do have these strapped resources? Are you going to something that has maybe a seasonal impact, if we can't timber past November or December, so we need this decision before that? How do you figure that out when you have difficulty meeting all the challenges?

Ms. DOHNER. Thank you for the question. Some of it relates to the way you raised the question as far as do we have actions that are going to happen and impact a bird before it nests. So, we could possibly expedite those so that we ensure that the actions are completed, and then the bird can successfully nest. You also have to look across the board as far as what the priorities are and how you are impacting those on the lands.

For the manatee example that I gave, I knew that that was a priority because we basically shut down a lot of businesses. Nobody could build docks; nobody could go out in certain areas to go boating; no recreational opportunities. We knew we had to focus on that, and we knew we had to figure out a way to do it.

So, you look at different things when you are prioritizing, ma'am.

Senator CAPITO. Right.

Well, I thank you all very much. I think this concludes our hearing.

If there are no more questions for today, members may also submit follow up questions for the record. The hearing record will remain open for 2 weeks.

I want to thank the witnesses for your time and testimony, and this hearing is adjourned. Thank you.

Ms. DOHNER. Thank you.

[Whereupon, at 11:38 a.m. the Committee was adjourned.]

[Additional material submitted for the record follows:]

June 26, 2014

The Honorable Dan Ashe
Director
U.S. Fish and Wildlife Service
1849 C Street, NW
Washington, D.C. 20240

Dear Director Ashe,

We are writing to discuss the future status of the grizzly bear under the Endangered Species Act. While we recognize that the Fish and Wildlife Service has made great progress in conserving the grizzly bear, we believe that there are several significant challenges the Service must address before it moves to delist the grizzly bear in the Greater Yellowstone Ecosystem (GYE) or other parts of the species' range.[1]

We are deeply concerned about the consequences for grizzly bears in the remainder of their range in the lower 48 states if the Service moves to designate and delist a GYE Distinct Population Segment (DPS) from the larger grizzly bear listed entity. Last year, when the Service proposed to delist the gray wolf nationwide, it did so in large part because it concluded that the original 1978 gray wolf listing no longer represented a valid entity under the ESA. In other words, the designation and delisting of the Northern Rocky Mountains DPS and the Western Great Lakes DPS had, in the Service's opinion, invalidated the rest of the original listing. We believe that the designation and delisting of a GYE DPS, as well as the Northern Continental Divide Ecosystem DPS for grizzly bears, could have the same effect — the Service would be left with a remnant population of grizzly bears that it considers invalid for listing under the ESA. And in so doing, the Service would jeopardize the recovery of grizzly bears in other key parts of the species' historic range including the Cabinet-Yaak, Selkirk, North Cascades, Selway-Bitterroot and San Juan mountains.

There is a way to move forward with grizzly bear delisting that does not jeopardize the larger listed entity; the Service can undertake a range-wide review and reclassification of the grizzly bear listing that in addition to designating — and if appropriate delisting the GYE — clarifies the status of the remainder of the species in the lower 48. This could be done by either clarifying that the remainder of the grizzly bear's range in the lower 48 does qualify for recognition as a DPS, or by creating additional DPS units.

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[1] On May 23, the spring unified regulatory agenda was published on the OIRA website and contained a proposed delisting rule for the Greater Yellowstone DPS. *See Removing the Grizzly Bear in the Greater Yellowstone Area From the List of Endangered and Threatened Wildlife*, RIN 1018-BA41, http://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201404&RIN=1018-BA41 (last visited June 23, 2014).

Doing so is fully consistent with the Service's past practice. The Service reclassified the original range-wide Columbian white tailed deer into two DPS units prior to delisting the recovered DPS unit, while leaving the other DPS unit as endangered. Likewise, the National Marine Fisheries Service reclassified the original range-wide Steller sea lion listing into two DPS units, and most recently reclassified the range-wide loggerhead sea turtle into nine DPS units. We are aware that NMFS is currently pursuing similar reclassifications for the green sea turtle and humpback whale.

Undertaking such a reclassification would unquestionably take more work and time for the Service to complete, but could still be accomplished before the end of 2016. We would hope that the Service would be transparent with such a process, provide notice to the public of its intent to pursue such a strategy, and solicit input from stakeholders across the grizzly bear's historic range. This would allow the Service to make an informed decision about the future of this species, not only in the GYE but elsewhere across its range.

Furthermore, if the Service undertakes such a process, it would provide valuable time to resolve key scientific disputes regarding the status and trend of the grizzly bear within the GYE. Research published by Doak and Cutler (2013) and Higgs et al. (2013) has raised significant concerns about the status of bears in the GYE.[2] The conclusions of Higgs et al. (2013) indicate that the grizzly bear population in the GYE has potentially been declining since 2008. Doak and Cutler (2013) identified critical methodological errors that may have resulted in the Service overestimating the current size of the grizzly bear population in the GYE as well as the trend of that population. Other data suggests human-related mortality of bears is on the increase in the GYE.

Finally, doing a comprehensive reclassification would allow the Service to take the time to improve any potential delisting rule in the GYE or elsewhere such that it is adequately protective to ensure grizzly bears maintain their recovered status over the long-term. This includes ensuring (1) that all post-delisting regulatory mechanisms are adequate such that a status review will be triggered in the event that the GYE population declines significantly; (2) that the post-delisting monitoring period (PDM) is biologically meaningful; for example an extended PDM similar to the Peregrine Falcon PDM which occurs over three generations of grizzly bears; (3) and that habitat and linkage zones are properly maintained to allow connectivity between grizzly bear populations.

Ever since 2011, when then-Secretary Salazar promised to delist the grizzly bear in 2014, the Service has been on an accelerated time-line to complete delisting of the GYE by this arbitrary deadline. Taking the extra time to fully address these concerns would make any final decision more defensible and consistent with the legal requirements of the ESA. Moving

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[2] Doak, D.F. and K. Cutler. 2013. *Re-Evaluating Evidence for Past Population Trends and Predicted Dynamics of Yellowstone Grizzly Bears*, Conservation Letters; Higgs, M.D., et al. 2013. *Insights Into the Latent Multinomial Model Through Mark-Resight Data on Female Grizzly Bears With Cubs-of-the-Year*, Journal of Agricultural, Biological, and Environmental Statistics, 18:556–577

forward with grizzly bears the right way would be something that the entire environmental community could potentially support and celebrate. Thank you for your consideration.

Sincerely,

Kierán Suckling
Executive Director
Center for Biological Diversity

Travis Bruner
Executive Director
Western Watersheds Project

John Horning
Executive Director
WildEarth Guardians

Tehri Parker
Executive Director
Rocky Mountain Wild

Joseph Vaile
Executive Director
Klamath-Siskiyou Wildlands Center

Gary Macfarlane
Ecosystem Defense Director
Friends of the Clearwater

Nick Cady
Legal Director
Cascadia Wildlands

Brad Smith
Conservation Associate
Idaho Conservation League

May 18, 2018

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

Re: Please intervene to stop Wyoming's grizzly bear hunt

Dear Governor Mead:

We, the undersigned wildlife photographers, strongly oppose the Wyoming Department of Game and Fish's plans to open up a sport hunt on grizzly bears (*Ursus arctos*) in the Greater Yellowstone Ecosystem (GYE). These bears were listed as *threatened* under the U.S. Endangered Species Act (ESA) until last June. Yet Wyoming wildlife officials, with their newly-allocated management authority, immediately proposed to allow trophy hunters to kill up to 24 bears as part of an overly aggressive hunt that will, according to several experts, roll back decades of grizzly bear conservation efforts in just one season.

Fundamentally, this hunt permits a few to trample upon if not to suppress the rights of the majority. That is, apparently, the Wyoming way. The Wyoming Game Commission has an unfortunate track record of zero accountablity to the people of Wyoming, much less to the millions of American and international tourists who come to Wyoming annually to enjoy wildlife as watchers. Therefore, we ask you to intervene to conserve grizzly bears for those millions of people who come to Wyoming to spend their money - **$3.2 billion in 2016** – many of whom come to view and photograph bears. According to a 2017 economic report, travel spending in Wyoming amounted to $8.9 million dollars *per day* ($3.2 billion) in 2016; has increased annually by 4.3 percent since 2000; visitors support 32,000 Wyoming jobs and generated $894 million in salaries in the travel industry; $171 million in 2016 in state and local taxes.[1] As a video featuring local businesses on the Wyoming office of Tourism website indicates that tourists are vital to local economies. One business owner stated, "Tourism helps small communities thrive."[2]

As wildlife photographers with a deep love and admiration for Wyoming's wildlife, we want to underscore one thing. Grizzly bears are an iconic species, and the majority of Americans do not support killing them just so a very few can obtain a bearskin rug or a full body specimen. Hundreds of people can photograph a bear year-after-year, but not if she or he has been shot as a trophy.

Today, less than 2,000 individual bears remain in the lower 48 states, and only about 700 grizzly bears in the GYE. The Wyoming population is special, one of the most storied, beloved and photographed bear populations in the world.

Grizzly bears cannot weather aggressive human hunting. Bears are large-bodied carnivores who sparsely populate across vast areas. They produce only a few cubs but provide extended parental care to their young. It takes a mother bear a decade to replace herself.

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[1] Dean Runyan Associates, "The Economic Impact of Travel on Wyoming," *https://www.travelwyoming.com/sites/default/site-files/files/uploads/industry/State%20and%20County%20Travel%20Impacts%202016.pdf* (April 2017).
[2] See: Wyoming Office of Tourism, "Tourism Matters": https://www.travelwyoming.com/industry/tourism-matters

Over the past three years, record numbers of GYE grizzly bears have died, a substantial portion of the estimated population of the slowest-reproducing mammal in North America. Meanwhile, more than half of grizzly bears killed by humans go unreported, because they were either killed by poachers or from vehicle collisions.

Added to those woes, Yellowstone-area grizzly bears' two primary staple foods, whitebark pine and cutthroat trout, have been decimated. And snow pack, which grizzly bears require in order to successfully hibernate is diminishing. This should signal to wildlife managers that grizzly bear conservation efforts should not be stripped away at the very time when they need more protections, not less.

For all of these reasons, we urgently ask you to intercede to stop the hunt on Yellowstone's grizzly bears before it is too late. Stopping the grizzly bear hunt is the right thing to do for Wyoming.

Sincerely,

Tom Mangelsen
Images of Nature
Jackson Hole, Wyoming
http://mangelsen.com/

Josh Able
Bobs Creek Photography
Gardiner, Montana
https://www.bobscreekphotos.com/

Theo Allofs
Theo Allofs Photography
Galisteo, New Mexico
www.theoallofs.com

Julie Argyle
Julie Argyle Wildlife Photography
Ogden, Utah
https://julie-argyle.pixels.com/

Sirachai Arunrugstichai
Sirachai Arunrugstichai Photography
Bangkok, Thailand
www.shinsphoto.com

Tanya Austin-Cameron
T&S Photography
West Point, Utah
https://www.facebook.com/t&sphotography

Aaron Baggenstos
Aaron's Photo Tours
https://www.aaronstours.com/

Greg Balvin
Peak Photography
Alpine, Wyoming

Amy M. Barker
Amy M. Barker Photography
Island Park, Idaho
http://www.amybarkerphotography.com/about/

Linda Barnes
Barnes Consulting Group
Prosper, Texas
www.barnesconsulting.biz

Jack Bayles
Jack Bayles Photography
Jackson Hole, Wyoming
jack@jackbaylesphoto.com

Connie Bransilver
Connie Bransilver Photography
Los Ranchos, New Mexico
conniebransilver.com
GuardiansoftheEverglades.com

Drew Burdick
Drew Bird Creative Story Telling
Oakland, CA
www.drewbirdphoto.com

Jonathan Byers
Mountains Rivers Media
Missoula, Montana
www.jonathanbyers.com

Peter Cairns
Peter Cairns Photography
Scotland, United Kingdom
petercairnsphotography.com

Susan E. Cedarholm
Watercolor Diary / Inspired Wild Designs
Jackson, Wyoming
www.watercolordiary.com
www.inspiredwildesigns.com

Dr. Katherine M. Feng
Wen Zhen Photography
Durango, Colorado

Carolyn Fox
Carolyn Fox Photos
West Yellowstone, Montana
http://carolynfoxphotos.com/

Jonathan Deitch
Belgrade, Montana

Deby Dixon
Running Wolf Nature Photography
Gardiner, Montana
http://runningwolfnaturephotographybydebydixon.zenfolio.com/blog/2014/3/welcome-to-running-wolf-photography

Rob Daugherty
Rob's Wildlife Photography
North Salt Lake, UT
Robswildlife.com

Ronan Donovan
Ronan Donovan Photo and Film
Bozeman, Montana
www.ronandonovan.com

Amy Gerber
Cub Creek Photography
Cody, Wyoming
http://www.openrangeimages.com/amy-gerber.html

Donald Getty
Don Getty Wildlife Photography
Wapiti, Wyoming
http://dongettywildlifephotography.com/

Daisy Gilardini
Daisy Gilardini Photography
Vancouver - British Columbia - Canada
www.daisygilardini.com

Carolyn Golba
Evergreen, Colorado
http://yourshot.nationalgeographic.com/profile/1672093/#b/

Melissa Groo
Melissa Groo Photography
Ithaca, New York
https://www.melissagroo.com/

Steve Hinch
Steve Hinch Photography
West Yellowstone, Montana
http://www.stevehinchphotography.com/

Trip Jennings
Director/Filmmaker
BalanceMedia.TV
Portland, Oregon
http://www.balancemedia.tv/

Tom Knauss
Jackson Hole Photography Studio
Jackson, Wyoming
https://www.jacksonholephotographystudio.com/about/

Brian Johns
Brian Johns Adventure Photography
Wrentham, Massachusetts
https://brianjohnsadventure.smugmug.com/

Louise Johns
Louise Johns Photography
Bozeman, Montana
http://www.louisejohnsphoto.com/

Beverly Joubert
Beverly Joubert Fine Art Photography
Maun, Botswana
http://beverlyjoubert.com

Wendy Keefover
Broomfield, Colorado

Bill Keeting
Fine Art America
Miami Beach, Florida

Eugene Kiedrowski
Pine Creek, Montana
https://www.facebook.com/northrangephotos/

Marc Kleinman
Wildlife & Nature Photography
Moran, Wyoming
http://www.marckleinman.com/

Roger Hayden
Roger Hayden Photography
Jackson Hole, Wyoming
http://rogerhaydenphotography.com

Will Hopkins
Jackson, Wyoming
https://m.facebook.com/profile.php?id=100000049842268&ref=content_filter

Joseph McDonald
McDonald Wildlife Photography, Inc.
McClure Pennsylvania
www.hoothollowcom

Mary Ann McDonald
McDonald Wildlife Photography, Inc.
McClure Pennsylvania
www.hoothollowcom

Steve Mattheis
Steve Mattheis Photography
Jackson Hole, Wyoming
http://www.sgm.photography/

Sandy Mell
Peak Photography
Alpine, Wyoming

Laura Menefee
Sleeping Fox Photography
PeriWinkle Moon Farm
Sturgeon Bay, Wisconsin
www.periwinklemoonfarm.org

Cristina Mittermeier
Vision Lead and Co-Founder SeaLegacy
Cristina Mittermeier Photography
https://www.cristinamittermeier.com/
British Columbia, Canada

Carol Morrison
Kingman, Arizona

Jack Morrison
Kingman, Arizona

Paul Nicklen
Expedition Lead and Co-Founder, SeaLegacy
Paul Nicklen Photography
British Columbia, Canada
www.paulnicklen.com

Brad Orsted
Horsefeathers Photography
Gardiner, Montana
http://horsefeathersphotography.com/

Jim Osterhout
Swan Valley Photo
Irwin, Idaho
https://www.swanvalleyphoto.com/

Christine Paige
Ravenworks Ecology
Driggs, Idaho

Denis Palanque
Denis Palanque Photography
Montcarra, France
www.denispalanque.com

Sam Parks
Sam Parks - Wild Ecosystem Images
Dubois, Wyominig
http://samparksphotography.com/

Karen Perry
Karen Perry Images
Walnut Creek, California
www.karenperryimages.com

Ray Rafiti
Wild Faces Wild Places
Fort Collins, Colorado
https://www.facebook.com/wildfaceswildplaces/

Scott Read
SERphotography
Syracuse, Utah
www.serphotography.com

Jim Richardson
Richardson Photography
Lindsborg, Kansas
jimrichardsonphotography.com

Jim Robertson
AnimalsInTheWild.com
Twisp, Washington
http://www.all-creatures.org/aw/

David Rohm
Wild Excellence Films
Pittsburgh, Pennsylvania
http://www.wildexcellencefilms.com/

Melissa Rohm
Wild Excellence Films
Pittsburgh, Pennsylvania
http://www.wildexcellencefilms.com/

Gary Rowe
Gary Rowe Photography
Laramie, Wyoming
http://www.garyrowephotography.com/

Bernie Scates
Jackson, Wyoming

Ashleigh Scully
2017 Youth Nature Photographer of the Year
Morristown, New Jersey
Wilson, Wyoming
http://www.ashleighscullyphotography.com

Dave Showalter
Dave Showalter Nature Photography
Arvada, Colorado
www.daveshowalter.com

Sandy Sisti
Wild at Heart Images
Wapiti, Wyoming
https://wildatheartimages.photoshelter.com/index

Trent Sizemore
Trent Sizemore Photography Workshops
West Yellowstone, Montana
www.trentsizemore.com

Linda R. Skeen
Grizzly Ridge Photography
Cody, Wyoming

Ricardo Small
Albany, Oregon

Shari Sommerfeld
Shari Sommerfeld Images
City Lake Stevens, Washington
https://shari-sommerfeld.pixels.com

Richard Spratley
Mountain Meadow Photography
Images by Richard Spratley
Boulder, Colorado
https://richardspratley.smugmug.com/

Gloria Straube
Alone in Yellowstone
St. Louis, Missouri
https://www.facebook.com/Alone-in-Yellowstone-327553567672344/

Brett Swain
Montana Wildlife Images
Marion, Montana
www.montanawildlifeimages.com

Jamie Tarris
Jami Tarris Photography
Santa Fe, New Mexico
www.jamitarris.com

Larry Tibbet
Holland, Michigan

Roy Toft
Toft Photo Safaris
Ramona, California
www.Toftphoto.com

David Treick
Sorrell Butte Photography
Cody, Wyoming
http://treick.zenfolio.com/

Pamela Underhill Karaz
Kindred Spirit Studios
Remsen, New York
www.pamelakaraz.com

Ami Vitale
Ami Vitale Films and Photography
Missoula, MT
www.amivitale.com

Jed Weingarten
Jed Weingarten Photography
Bozeman, Montana
www.jedweingarten.com

John Whedon
John Whedon Photography
Franklin, New Hampshire
http://www.johnwhedonphotography.com/

Jack Wills
Jack Wills Nature Photography
Vida, Oregon
http://jackwillsphotography.zenfolio.com/

Steve Winter
National Geographic
Hoboken, New Jersey
stevewinterphoto@mac.com

Robert Winslow
Robert Winslow Photo
Durango, Colorado
www.robertwinslowphoto.com

Art Wolfe
Art Wolfe, Inc.
Seattle, Washington
www.artwolfe.com

James L Yule
James Yule Photography
Worland, Wyoming
http://www.yulephotography.com/f1003510971

Sandy Zelasko
Sandra Lee Photography
Valley Center, California
http://www.sandralee-photography.com/

Codie Wyers
Codie Lynnn Wyers Photography
Bozeman, MT

Laura Cowen
Performance Horse Photography
Brighton, Colorado
www.performancehorsephotography.com

Linda Barnes
https://www.instagram.com/lindabarnesphotos/
Prosper, Texas

David Mackenzie
David Mackenzie Photography
Ascot, Queensland, Australia
www.davidmackenziephotos.net

Mac McMillen
Mac McMillen Photography
Manhattan, Montana

Leine Stikkel
Stikkel Photography
Jackson, Wyoming
www.stikkel.com

Jutta Maue Kay
www.mauekay.org
https://www.instagram.com/juttamaue/
https://www.flickr.com/photos/alicebear/
Montecito, CA

Karine Aigner
Karine Aigner Photography
Grand Prize winner Por El Planeta, Finalist WildLife Photogapher of the Year 2016
www.karineaigner.com
Washington, DC

Kevin FitzPatrick
All Species Photography
www.allspeciesphotography.com
Highlands NC

Denis Palanque
Wildlife and Conservation Photographer
www.denispalanque.com
Montcarra, France

Morgan Heim
Wildlife Photojournalist and Filmmaker
Senior Fellow, International League of Conservation Photographers
https://morganheim.com/
Astoria, OR

Jeff Vanuga
Vanuga Photography
www.JeffVanuga.com
Dubois, Wyoming

Michael Ready
Photographer
International League of Conservation Photographers
www.michaelready.com
San Diego, CA

Jim Richardson
Small World Gallery
www.jimrichardsonphotography.com
Lindsborg, Kansas

Dave Showalter
Conservation Photographer
International League of Conservation Photographers
www.daveshowalter.com
Arvada, CO

Tim Laman
Wildlife Photojournalist
National Geographic
Wildlife Photographer of the Year 2016
www.timlaman.com
Lexington, MA

Clay Bolt
Natural History Photographer
www.claybolt.com
Bozeman, MT

Sandy Zelasko
Sandra Lee Photography
www.InvestInNature.org
Valley Center, CA

Daniel Beltra
Photographer
International League of Conservation Photographers
Wildlife Photographer of the Year 2011
www.danielbeltra.com
Seattle, WA

Alison M Jones
Director & Lead Photographer for No Water No Life, LLC
www.nowater-nolife.org
New York, NY

Luciano Candisani
Photographer
www.lucianocandisani.com
Ilhabela, Brazil

Protecting Water for Western Irrigated Agriculture
P.O. Box 216
Klamath Falls, Oregon 97601
www.familyfarmalliance.org

October 24, 2018

The Honorable John Barrasso, Chairman
The Honorable Tom Carper, Ranking Member
Committee on Environment and Public Works
United States Senate
410 Dirksen Senate Office Building
Washington, DC 20510-6175

Re: October 10, 2018 Oversight Hearing - "Successful State Conservation, Recovery, and Management of Wildlife"

Dear Chairman Barrasso and Ranking Member Carper:

On behalf of the Family Farm Alliance (Alliance), we respectfully request that you include this written testimony in the public record associated with your October 10, 2018 oversight hearing entitled, " "*From Yellowstone's Grizzly Bear to the Chesapeake's Delmarva Fox Squirrel -- Successful State Conservation, Recovery, and Management of Wildlife.*" Thank you for your Committee's hosting of this hearing, which provided useful testimony regarding successful state work to conserve, recover, and manage wildlife, in partnership with federal agencies, landowners and stakeholders. This testimony has been prepared to supplement the hearing record with additional examples of challenges associated with state and local species efforts to recover species and tackle challenges associated with invasive species in parts of the American West.

The Alliance is a grassroots organization of family farmers, ranchers, irrigation districts, and allied industries in 16 Western states. The Alliance is focused on one mission: To ensure the availability of reliable, affordable irrigation water supplies to Western farmers and ranchers. We are also committed to the fundamental proposition that Western irrigated agriculture must be preserved and protected for a host of economic, sociological, environmental, and national security reasons – many of which are often overlooked in the context of other national policy decisions.

Our organization is on record in strong support of improved state-federal consultation relating to conservation and recovery of wildlife and plant species in the Western U.S. We continue to believe that there is a way to encourage collaboration and consultation with states and private stakeholders as partners in meeting the objectives of the federal Endangered Species Act (ESA), while ensuring that

the law is applied consistently and without conflict of interest. Our membership includes ranchers, farmers and water managers who have dealt with challenges associated with species protected by the ESA across the West, from the Delta smelt in California and salmon in the Pacific Northwest, to the greater sage grouse in Wyoming and razorback sucker in the Colorado River. Invasive species proliferate the West, particularly in the estuary formed by San Francisco Bay and the confluence of the Sacramento and San Joaquin Rivers. The purpose of this testimony is to provide some positive examples of how states can conserve, recover, and manage wildlife, in partnership with federal agencies, landowners and local interests. It also serves to underscore the critical importance of addressing invasive species in California and other parts of the West.

ESA Success Stories in the West

Colorado River Basin Recovery Programs

The Colorado Basin States rely on the efficient and effective management of the Colorado River reservoirs to provide water to approximately 40 million people and 5.5 million acres of irrigated agriculture. The Colorado River system also produces more than 4,200 megawatts of hydroelectric power, and the Colorado River Storage Project (CRSP) power revenues provide funding for programs that allow water project development and operation while ensuring compliance with federal laws and regulations. Additionally, the funds support two endangered fish recovery programs that provide NEPA and ESA compliance for 2,500 water projects in the basin, including every Bureau of Reclamation project upstream of Lake Powell in Wyoming, Utah, New Mexico and Colorado. In both the Upper and Lower Basins of the Colorado River, water users have established successful, proactive programs to respond to ESA issues and environmental concerns.

The Lower Colorado River Multi-Species Conservation Program was created to balance the use of the Colorado River water resources with the conservation of native species and their habitats. The program works toward the recovery of species currently listed under the ESA. It also reduces the likelihood of additional species listings. Implemented over a 50-year period, the program accommodates current water diversions and power production, and will optimize opportunities for future water and power development by providing ESA compliance through the implementation of a Habitat Conservation Plan (HCP).

Partners of the Upper Colorado River Endangered Fish Recovery Program are recovering four species of endangered fish in the Colorado River and its tributaries in Colorado, Utah, and Wyoming while water use and development continues to meet human needs in compliance with interstate compacts and applicable federal and state laws (Family Farm Alliance, 2015). In March, the U.S. Fish and Wildlife Service (FWS) recommended changing the humpback chub from endangered to threatened, meaning it is still at risk of extinction, but the danger is no longer immediate. FWS earlier this month recommended reclassifying the razorback sucker from endangered to threatened (Elliott, 2018). Changing the two fish species from endangered to threatened will allow more flexibility in the way they are protected. Hundreds of thousands of razorbacks once thrived in the Colorado River and its tributaries. By the 1980s they had dwindled to about 100. Researchers blame non-native predator fish that attacked and ate the razorbacks and dams that disrupted their habitat. Their numbers have

bounced back to between 54,000 and 59,000 today, thanks to this multimillion-dollar recovery effort on the Colorado River.

Another important program – the San Juan River Basin Recovery Implementation Program (SJRIP), was established to recover the Colorado pikeminnow and the razorback sucker while allowing water development and management activities to continue in the San Juan River Basin. Basically modeled after the Upper Colorado program, it focuses more on water users in New Mexico and southwest Colorado, including all the diverted water to the Rio Grande.

The Colorado River programs embody effective cost shared partnerships among states, tribes, federal agencies, water users, CRSP power customers and environmental organizations throughout the basin, and they guarantee federal requirements are met while protecting water supplies for human needs. CRSP power revenues have been provided to the basin-wide programs consistently for more than two decades and have been supported by every administration since President Reagan.

On August 22, 2018, our organization joined the Colorado River Energy Distributors Association and The Nature Conservaney on a letter sent to Congressional appropriators emphasizing the importance of continued, reliable funding to support these endangered fish recovery programs on the Colorado River. We reiterate that message today.

Little Snake River Watershed

The Little Snake River watershed in south-central Wyoming is a portrait that weaves into it the environment and conservation, the community and its economy. It is a portrait that caught the attention of John C. Fremont, while traveling through the Little Snake Watershed in 1844, who wrote, "The country here appeared more variously stocked with game than any part of the Rocky Mountains we had visited: and its abundance is owing to the excellent pasturage and its dangerous character as a war ground".

The symbiotic relationship between food production and the environment lives on today. The Little Snake River Basin today is the permanent home to 21,000 mule deer, 9,000 elk, 25,000 pronghorn antelope, 2,500 Sage Grouse, 20,000 mother cows, 10,000 domestic sheep, and 800 people. Land ownership in the basin consists of 68% federal, 8% state, and 24% private lands.

For the last three decades the Little Snake Basin has clearly demonstrated that conservation and food production are compatible (Family Farm Alliance, 2016). This is achieved through strong local leadership working with a myriad of federal, state, and local agencies, nonprofit conservation organization, private landowners, and the interested public in a collaborative, goal-oriented "on-the-ground" approach to conservation and production. For the last two and half decades, the local conservation district has lead efforts with numerous partners to address resource issues while maintaining or enhancing agriculture production in the watershed.

In an era where new surface water storage projects face tremendous political and regulatory hurdles, Little Snake River residents led an innovative initiative that resulted in the construction of a multiple purpose reservoir in the headwater reaches of the watershed. While providing a reliable water supply to downstream ranching communities, the stored water released from High Savery Dam has contributed to the recovery of the Colorado River Cutthroat Trout, a candidate species for listing

under the ESA. The reservoir has a minimum inviolate pool which the Wyoming Game and Fish Department uses to support the largest brood population of Colorado River Cutthroat Trout in the entire Colorado River Basin. This "environmental pool" is tapped into by fisheries managers to provide much-needed cool freshwater flows for over 40 miles of downstream recreational fisheries.

In addition to providing supplemental water for fisheries from High Savery Reservoir, irrigators have worked with conservation partners like Trout Unlimited, the Wyoming Water Development Commission, Wyoming Wildlife and Natural Resource Trust Fund, and the U.S. Fish and Wildlife Service Partners program to modify every diversion structure on the Wyoming side of the watershed to allow for fish passage. Several low-head diversion structures employ natural channel design concepts to allow for three warm water sensitive fish species to successfully navigate the diversion structures. In the last seven years, fifteen irrigation diversion structures have been modified at a cost of over $8 million dollars. A decade ago, the aquatic habitat was highly fragmented and access by native fish may have been restricted to only a few miles of river. Today, the irrigation diversion structures have opened up the entire watershed, so that fish can now literally move from the lower basin to the Continental Divide, over 100 stream miles away.

ESA and Invasive Species Challenges in California's Bay-Delta

Much has been said and written about California's recent record-breaking drought and its drastic repercussions, including an unprecedented reduction in water for agricultural use (Keppen and Dutcher, 2015). The drought experienced by agricultural producers is, in part, an artificial drought created by regulations that reduce water deliveries to farms as a strategy for the recovery of populations of protected species in the rivers and San Francisco Bay-Delta system. Water use in the American West has always been an issue surrounded by competition and contention, which is exacerbated during times of drought creating frustration, uncertainty, and fear among the various user groups. A feeling of competition is particularly intense between agricultural water users and proponents of instream use for ecological services and protected fish populations.

With the record dry conditions experienced over the previous years, coupled with water supply reductions related to regulatory actions, water allocations for all use sectors were reduced with many agricultural water users receiving no allocations at all from the Central Valley Project (CVP). Settlement contractors, primarily agricultural water users, have water rights that predate the federal project. Even these priority rights on the system have seen reduced allocations due to regulatory actions. Resilience in food systems is inherently dependent on the water resources available to producers. The health of the San Francisco Bay-Delta ecosystem directly pertains to those water deliveries.

While dry conditions have certainly contributed to the water crisis in California, the application of environmental laws and policies has undermined one of the primary uses of the CVP, supplying water for agriculture, with little apparent benefit to the environment. A large portion of the water in the Sacramento and San Joaquin rivers is left in stream to flow to the ocean to provide specific conditions in the rivers for salmon and sturgeon, species protected by state and federal policies. The San Joaquin Valley farms and communities use fresh water pumped from the San Francisco Bay-Delta to supplement their needs; however, over the past several decades, exports via those delta pumps have

been reduced as a means to comply with water quality standards in the Bay-Delta and to address the decline in the delta smelt population, another protected species.

Presently, agriculture in California does not have a reliable supply of water, which undermines the ability to make long-term decisions to maintain the agricultural industry. The frustrating fact to agricultural producers is that the water cutbacks that have already occurred have not helped in increasing the populations of salmon and the delta smelt, the species listed for protection under the ESA. The National Research Council has suggested that reducing pumping for agricultural water does not significantly impact fish populations; whereas, other stressors along the systems, such as wastewater contaminants and nonnative aquatic species, do have a more significant impact on the health of the ecosystem and the populations it supports.

The Collaborative Science and Adaptive Management Program

Clearly, protected fish populations can be more effectively managed by focusing on other stressors to the Bay-Delta system while also providing a reliable water supply for agricultural use. Over a decade ago, when the Federal District Court in Fresno California rejected the Biological Opinions for Winter-Run Salmon and Delta Smelt as "arbitrary and capricious", a unique bond was formed among the combatants fighting over the Bay-Delta. All sides agreed to organize the Collaborative Science and Adaptive Management Program (CSAMP) to work together on improving the scientific foundation for the Court ordered remand and reconsultation. While the 9th Circuit subsequently overturned the ruling, the CSAMP has continued to function to this day (Peltier, 2018).

The participants at the policy level are the top regional leaders of the Bureau of Reclamation, FWS and the National Marine Fisheries Service (NMFS). From the State of California, the directors of the Department of Fish and Wildlife (CDFW) and the Department of Water Resources participate. Rounding out the CSAMP table are the general managers of several major public water agencies, including Westlands Water District, the Kern County Water Agency, the Metropolitan Water District of Southern California and several Non-Governmental Organizations including the Natural Resources Defense Council, the Coalition for a Sustainable Delta and the Pacific Coast Federation of Fishermen's Associations.

This collaborative science effort is supported by numerous technical working groups and truly reflects a new way of approaching the "Wicked Problems" of water system management and ecosystem management in the Sacramento-San Joaquin Delta. By identifying and focusing on the common scientific questions before them the CSAMP participants are finding common ground and are able to openly discuss their disagreements that have long occupied the policy ground of the Delta.

Invasive Species Challenges in the Bay-Delta

More broadly in the Delta, invasive species are a very significant problem for which too little is being done. It is widely known that the Delta is teeming with more than 185 invasive species, ranging from aquatic plants to sport fish to nasty beaver-like varmints known as Nutria. In fact, it is estimated that

at least 95 percent of the aquatic biomass in the estuary is non-native and these unwelcome guests continue to be among the most serious stressors on the ecosystem (Peltier, 2018).

"Taken together, the large number of exotic species, their dominance in many habitats, and the rapid and accelerating rate of invasion suggest that the San Francisco Bay and Delta may be the most invaded estuary and possibly the most invaded aquatic ecosystem in the world," wrote Andrew N. Cohen and James T. Carlton in "*Accelerating Invasion Rate in a Highly Invaded Estuary*".

Some of these non-native plants and animals are very destructive to the ecosystem and make managing for the recovery of five ESA-listed fish extremely complicated. For example, Asian Clams in the Delta can be found in concentrations of 40,000 per square meter. These filter feeders take out the bottom end of the food chain contributing to the fact that the Delta is "food short" for the listed species. The Delta has an excellent bass fishery, but these predators are known to consume 90% of the downstream migrating salmon. Water hyacinth and other aquatic plants which cover thousands of acres of Delta waterways also help predators, impair water management infrastructure, interfere with marinas and recreational boating and deplete oxygen from the system. In addition, hyacinth limits biological diversity of important organisms that are a vital food source for native endangered species (Peltier, 2018).

A more recent intruder, Nutria, has the potential to create catastrophic harm to the Delta levee system and damage the ecosystem. These 15-20-pound rodents are able to devour as much as a quarter of their body weight in vegetation each day, wasting and destroying as much as ten times that amount. These destructive feeding habits cause extensive damage to native plants and destroy marshlands resulting in further loss of critical habitat and wetlands, necessary for native species. Nutria are prolific breeders and are difficult to detect. The potential for breaching levees and the flooding of delta islands and resulting severe water supply disruptions for Bay Area and Southern California residents and Central Valley farms demands an aggressive eradication effort.

The State of California has an undersized nutria surveillance and trapping program in place. Agricultural interests, including the California Farm Bureau Federation, are urging the state to maximize resources to address this threat that is truly an emergency. CDFW wants to know about all potential nutria sightings, and is sending 7,000 letters to property owners along the San Joaquin River, requesting access to survey for nutria. The recently enacted 2018-19 state budget includes $400,000 allocated to the Department of Food and Agriculture to survey the extent of the problem and help CDFW with eradication efforts. California agricultural leaders are also appealing to Secretary of Agriculture Sonny Perdue to exercise his discretion in moving more teams from Wildlife Services into California and lead the eradication effort (Hecteman, 2018).

Of course, invasive species challenges are not limited to the Bay-Delta. Western water users also confront challenges associated with invasive salt cedar, tamarisk, quagga mussels, and cheatgrass, just to name a few. For example, tamarix species along riparian corridors or around desert springs can seriously reduce underground water tables and surface water availability, drying up wetlands, and reducing flows. Tamarix species can increase flooding in riparian areas by narrowing channel width. In addition, the plants are flammable and can introduce fire into wetland and riparian communities that are not adapted to periodic burning (DiTomaso and Kyser, 2013).

While millions of dollars have already been spent on efforts to reduce the impacts of these and other non-native pests, it hasn't been enough. And more invasive species will continue to arrive. Addressing the harmful impacts of invasive species must become a priority.

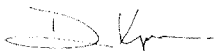
Conclusion

We are pleased to see the Committee re-assess the original intent of the ESA, which emphasized a paradigm where species conservation could be achieved in cooperation with state and local interests, including farmers and ranchers, instead of at the expense of agriculture, which is happening in several Western states under current interpretation of the Act.

The Family Farm Alliance for decades has worked to develop specific, practical changes to the ESA that we think will make it work effectively today. Application of the ESA today must be viewed through the prism of other human needs, including food production. To that end, management of our natural resources should be geared towards an approach that views the entire landscape - including invasive species - in a more holistic manner regarding its value for wildlife, food production, and other capacities. The flexibility built into the Act has the potential to yield net conservation benefits for imperiled species, as practitioners have recognized (Henson et al, 2018). While a regulatory approach may be necessary for species on the brink of extinction, such an approach should be employed sparingly, consistent with congressional intent and sound public policy. For threatened species, a partnership approach should be the guiding principal.

Thank you again for your strong leadership on this matter, and thanks also to you and your staff for working with us in this Congress. We appreciate the Committee's consideration of our views. If you have any further questions regarding our comments, please do not hesitate to contact me at (541)-892-6244, or dan@familyfarmalliance.org.

Sincerely,



Dan Keppen
Executive Director

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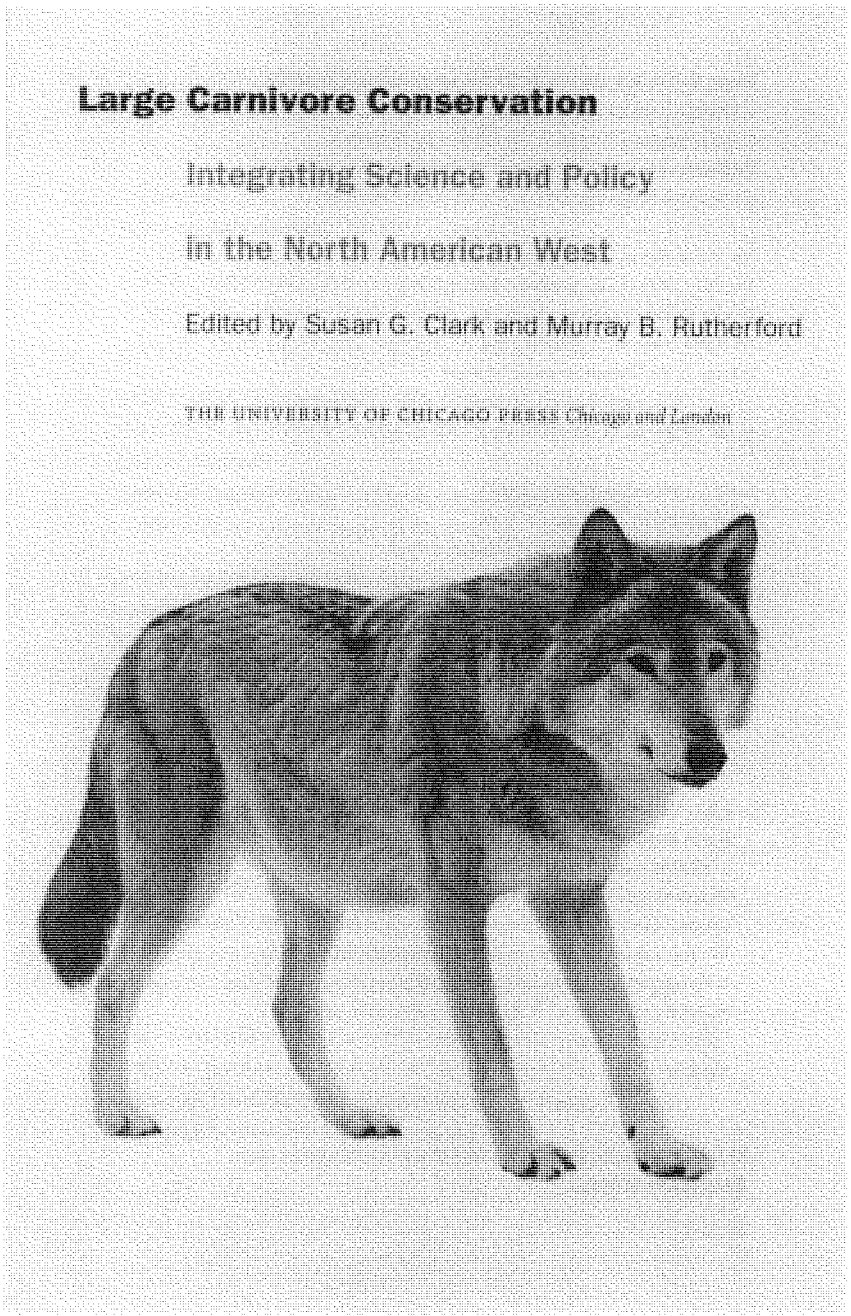
Large Carnivore Conservation
Integrating Science and Policy
in the North American West
Edited by Susan G. Clark and Murray B. Rutherford
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Susan G. Clark is the Joseph F. Cullman 3rd Adjunct Professor of Wildlife Ecology and Policy Sciences in the School of Forestry & Environmental Studies at Yale University. **Murray B. Rutherford** is associate professor in the School of Resource and Environmental Management at Simon Fraser University.

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6 Human–Grizzly Bear Coexistence in the Blackfoot River Watershed, Montana Getting Ahead of the Conflict Curve

SETH M. WILSON, GREGORY A. NEUDECKER, AND JAMES J. JONKEL

Introduction

When large carnivore populations overlap with humans, interactions can be problematic for people, but particularly acute for wildlife. In North America large carnivores are generally not well tolerated outside of protected areas (Mattson et al. 1996). When incidents or conflicts occur, carnivores are often trapped, relocated, or removed from populations. Such is the case when grizzly bears conflict with humans at the interface of public and private lands in places like southwest Alberta, southern British Columbia, Montana, and Wyoming (Woodruff and Ginsberg 1998; Wilson et al. 2006). Conflicts or incidents include bears killing livestock, destroying beehives, foraging for garbage close to homes, or in rare cases threatening human safety. Often private lands in valley bottoms and foothills adjacent to public lands are problematic zones, especially when available bear attractants coincide with occupied grizzly bear habitat. Repeated incidents typically lead to more severe conflict, habituation, and eventually to removal of the bear through trapping, relocation, or killing.

This chapter describes how a rural community joined with wildlife agencies and conservation groups to grapple with the complex challenge of learning to live with grizzly bears in the Blackfoot River watershed of west central Montana. This effort started in 2001 when Montana Fish, Wildlife and Parks (FWP) and the Blackfoot Challenge (BC), a grassroots watershed group in the Blackfoot valley, began meeting to discuss concerns among local residents

about increasing grizzly bear activity and conflicts in the region. Grizzly bears were reexpanding their range onto private lands, and there was a clear need to bring people together to determine exactly what the "problem" was and how best to address it. This chapter emphasizes how a collective decision-making process encouraged diverse local and national stakeholders to engage in a partnership where participatory efforts helped to reduce conflicts substantially for both bears and people.

Each author of this chapter has significant personal investment and professional capacity in the Blackfoot Challenge, a landowner-driven, nongovernmental organization that has worked since the 1990s to enhance, conserve, and protect the natural resources and rural lifestyle of the Blackfoot watershed. Its overarching goal is to provide a forum to support environmentally responsible resource stewardship through the cooperation of public and private interests. The BC promotes cooperative resource management of the Blackfoot River, its tributaries, and adjacent lands. Initially involved with grizzly bear management in 2000, the BC grizzly bear program was officially launched in 2002. As participants, we believed that building on the existing capacity of the BC was a sensible way to approach the problem of living with grizzly bears and that an inclusive and participatory approach to working with ranchers, landowners, conservation groups, and agencies would facilitate a more positive response to these animals. It was apparent to us that a single agency or individual would not be able to solve this challenge and that in order to make real progress, significant decision-making power would need to be in the hands of those landowners and ranchers who had to confront the daily reality of living with bears.

There were five general methodological phases in this effort. First, FWP met with the Blackfoot Challenge's executive committee to see if there was interest in creating a wildlife committee, that is, a community-driven sounding board for wildlife management. The BC agreed to form a committee with the understanding that the initial emphasis would involve grizzly bears. Second, the BC conducted a survey of thirty-five ranchers, outfitters, and small "hobby" ranch operators in 2002 and 2003 to get a better understanding of people's perspectives of grizzly bears and possible ways to coexist with them. Third, these data helped us to frame or define "problems" as perceived by residents whose livelihoods could be affected by grizzly bears. Fourth, we used geographic information systems (GIS) to map land-use practices, bear attractants, and other relevant features in the region (Wilson et al. 2005). FWP provided data on verified and reported grizzly bear conflicts and observations (1998 to 2004) that helped us to develop a GIS spatial dimension to bear ar-

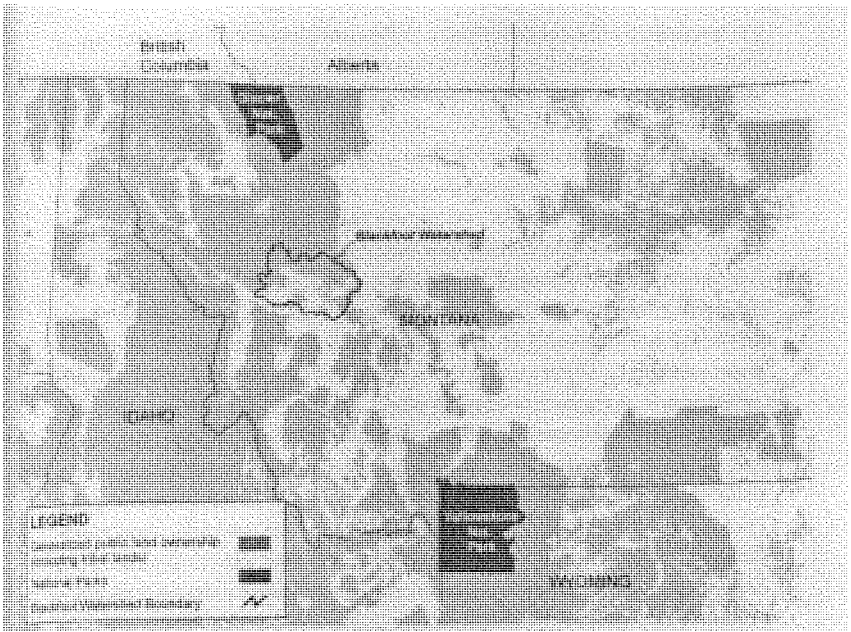

Figure 6.1. Location of the grizzly bear case study in the Blackfoot River watershed, Montana.

tivity and human-bear conflicts. From this, we determined the parts of the watershed where ranchers were experiencing the most bear problems, the areas where future problems were most likely, and the locations and types of conservation investments that should be made. Last, we brought this information back to the community and worked on the ground in diverse management activities to address problems over the ensuing years. Conflict reduction efforts have been focused on the middle portion of the Blackfoot watershed (fig. 6.1). Progress has been remarkable: a 96 percent reduction in reported and verified human–grizzly bear conflicts in the project area from 2003 to 2010 and a downward trend in known grizzly bear mortalities.

CONTEXT AND PROBLEM DEFINITION

The Blackfoot River watershed is about 1.5 million acres nestled just south of the Bob Marshall and Scapegoat Wilderness Areas and north of the Garnet Mountains (fig. 6.1). Land ownership in the watershed is approximately 49 percent federal, 3 percent state, 20 percent Plum Creek Timber Company,

and 24 percent other private owners. Public lands and significant portions of Plum Creek Timber Company lands generally make up the forested, mountainous areas, whereas other private lands comprise the lower foothills and valley bottoms.

Grizzly bears were historically found throughout much of western North America, ranging from Canada to northern Mexico. Prior to European settlement, possibly more than 50,000 grizzly bears lived in the western United States (US Fish and Wildlife Service 1993). With western expansion and development, grizzly bear populations declined dramatically by the turn of the nineteenth century. By 1975 the grizzly bear was listed as a threatened species under the Endangered Species Act (ESA; 16 U.S.C. 1531–1544), and protections were put into place to begin the process of recovery. A formal recovery program was instituted in 1981 (Servheen 1998), and since then bear numbers have gradually increased in both Glacier and Yellowstone National Parks and the surrounding ecosystems. By 2007 the US Fish and Wildlife Service declared the Yellowstone population recovered and removed the region's grizzlies from the Endangered Species List. This decision was legally challenged by several conservation groups, and by 2009 the US Ninth Circuit Court of Appeals reopened and vacated the delisting of the Yellowstone population. As of January 2013 all grizzly bear populations in the United States are considered threatened under the ESA, but population increases bode well for future viability. Unfortunately, increases in grizzly bear populations also mean increases in the potential for conflicts in places like the Blackfoot watershed.

ECOLOGICAL SETTING AND KEY STAKEHOLDERS

Ecological Setting

The landscape context of the Blackfoot watershed is unique. To the north are large wilderness areas that provide a source population of grizzly bears and to the south the Blackfoot Valley provides high-quality grizzly bear habitat. Grizzly bear activity and events associated with dispersal have been on the rise in the watershed since the early 2000s. The US Fish and Wildlife Service and Montana FWP have documented grizzly movements throughout the area (Jonkel 2002, 2006).

The Northern Continental Divide Ecosystem of Montana, an area that includes the Blackfoot watershed, shows grizzly bear population growth and expansion into formerly unoccupied habitat largely on private lands (Kendall et al. 2009). The state of Montana suggests that this grizzly population has grown at approximately 3 percent per year since population trend monitoring began in 2004. In 2004 the US Geological Survey's Northern Divide Grizzly

Bear Project identified a minimum of twenty nine grizzlies in their sampling area that overlaps with the Blackfoot watershed. The Blackfoot Valley is functioning as habitat for a resident population of grizzlies and as a linkage or "stepping stone" habitat for grizzly bears that disperse to the south.

The geologic and hydrologic characteristics of the Blackfoot watershed have produced a rich mix of habitats, particularly wetland features like glacial lakes and ponds, bogs, fens, spring creeks, riparian swamps, and extensive cottonwood forests. This diverse mosaic of upland foothills, glacial outwash plains, and extensive creek and river bottoms is ideal habitat for a wide array of wildlife, including grizzlies. The Blackfoot has remained largely undeveloped and is sparsely populated. Located at the southern end of the Northern Continental Divide Ecosystem, the watershed has been a natural location for grizzly bears to recolonize their former habitat. The ranching community has had to confront living with bears again since the early 2000s and continues to deal with the associated costs of conflicts.

Key Stakeholders

Stakeholders in this case include ranchers, newer nonranching residents, the state and federal governments, and conservation groups. There are approximately 2,500 households in seven small communities in the watershed. The dominant land use is agriculture, primarily family-owned cow-calf ranching operations and some small-scale forestry. Cow-calf operations have cows and bulls used for breeding stock, and calves are sold annually at six to eight months of age for beef production. Landowners in the Blackfoot value their rural way of life and have worked together since at least the mid-1990s to preserve their agricultural traditions and livelihoods. The first conservation easements established in the state of Montana were in the Blackfoot. The ranching community is characterized by a desire to be independent, yet maintain strong neighborly relationships. Ranchers tend to believe in the sanctity of private property rights, and they emphasize their need to maintain economically viable operations. It was not initially easy for the ranching community to adapt to the return of grizzly bears. Bears were perceived as unwelcome visitors that threatened livelihoods and human safety, and bear conservation efforts challenged notions about private property rights and the rights of ranchers to protect their livestock.

While ranching is still a dominant land use in the Blackfoot and the cultural norms of ranchers have permeated the overall character of the valley, new residents have increasingly been moving to the region over the past two decades. In many cases these new residents are "amenity migrants," who

have been drawn to the Blackfoot for its quality of life, solitude, and outstanding recreational and wildlife resources. These new residents are typically quite tolerant of grizzly bears and wolves, but may not have had much experience in actually living with these animals. However, new residents have been willing and in certain cases enthusiastic about participating in the grizzly bear projects of the BC.

Montana FWP plays the main formal role in grizzly bear management in the Blackfoot watershed. FWP is responsible for day-to-day management of grizzlies (conflict responses, monitoring, etc.) in consultation with the US Fish and Wildlife Service under the Interagency Grizzly Bear Committee guidelines (IGBC 1986). FWP has actively embraced the collaborative nature of the BC partnership concerning grizzly bear management, has shown respect for traditional ranching livelihoods, and actively supports projects that help maintain rural ranching through economic incentives and technical support.

The US Forest Service, US Bureau of Land Management, and Montana Department of Natural Resources and Conservation play minor consultative roles in bear and habitat management and have taken part in the BC efforts on an as-needed, project-by-project basis, since the bulk of the BC work on grizzly bear problems has focused on private lands.

Conservation groups have also been active participants in the efforts of the BC partnership (e.g., the Nature Conservancy, Defenders of Wildlife, Brown Bear Resources, the Great Bear Foundation, and the Living with Wildlife Foundation). The Nature Conservancy has played a major role in habitat conservation in the Blackfoot watershed by procuring conservation easements and has recently undertaken a significant project with Plum Creek Timber Company and the BC that will protect nearly 88,000 acres of land, much of which is critical grizzly bear habitat.

UNDERSTANDING CONFLICTS BETWEEN HUMANS AND BEARS IN THE BLACKFOOT

Conflicts with grizzly bears are partly a technical biological problem, but these conflicts are also very much grounded in what people do in a given landscape. People's behaviors and practices often cause or contribute to conflicts with bears, and the level of conflict can be severe when bear populations grow, individual bears disperse to reoccupy former habitats, and human communities are confronted with the challenges of living with these large carnivores.

As bear activity has increased in the Blackfoot watershed, so have human–grizzly bear conflicts and livestock losses. By the mid to late 1990s several ranches in the Blackfoot had experienced confirmed losses of cattle or sheep to grizzlies. This became a focal point for other livestock producers in the watershed, although they actually may have had few if any incidents with grizzlies on their own properties. Unfortunately, a human fatality occurred during a hunting outing in 2001, which was a tipping point that galvanized the community. This fatality and the general increase in grizzly bear observations and reported and verified conflicts on private lands stimulated strong concern among residents.

Not surprisingly, there were multiple perspectives or definitions of what exactly the "problem" was. For example, some people felt that there were simply too many bears, some celebrated the new grizzly bear activity, some defined the problem as primarily one of risk to human safety, and still others viewed the problem symbolically, linking the recolonization of bears to an erosion of personal rights and freedoms exacerbated by the regulatory burdens of the Endangered Species Act. It was clear that these competing perceptions of the problem, rooted in differing beliefs, attitudes, and values concerning grizzly bears, would make it difficult to set coherent goals. Grizzly bears presented both an ideological and material perturbation to an agrarian-based system of traditional Western values, largely centered on utilitarianism and a dominionistic view of grizzlies as predators. Nonetheless, we saw an opportunity to improve the situation for both people and bears by organizing an effective and inclusive decision-making process focused on empowering local community members, finding solutions for people, and reducing conflicts with bears.

Grizzly Bear Management Decision Process

Grizzly bear management, like other decision-making processes, is mainly about people: what we value, how we interact, how we make choices, and how we set up and carry out our day-to-day practices. Essentially, we are making decisions about how we manage ourselves as well as how we deal with bears. This includes understanding and possibly changing our behaviors and actions that can lead to problems with bears. Outcomes of this decision process affect what happens to bears, people, and the land. Ideally, a sound decision process should be open, factual, fair, and it should produce results that work.

DECISION-MAKING FUNCTIONS

Any complete decision-making process includes a set of distinct functional activities or stages. First are the activities that lead up to a decision. This includes the gathering, processing, and dissemination of information about the issue at hand (the *intelligence* activity), and the development and debate of alternatives designed to address the issue (the *promotion* activity). These pre-decision activities are followed by a decision, such as committing to a plan of action, law, regulation, policy, or program (the *prescription* activity). Prescriptions must be specific and realistic enough to work in practice and ideally should have enough support from those affected, or be backed by enough authority to be carried out and enforced. Once a decision has been made resulting in a prescription, several post-decision activities typically take place. First, the prescription must be initially instituted (the *invocation* activity) and then further interpreted and enforced (the *application* activity). Invocation and application are often referred to together as implementation, which must come to grips with all the realities of the actual situation on the ground as well as the administrative and other actions needed to put in place the selected prescription. The next step is to monitor and evaluate implementation of the decision and its outcomes (the *appraisal* activity). Good appraisals go beyond just evaluating outcomes to examine the processes through which decisions are made. If corrections are needed based on the results of appraisal, they can be made by changing course and partially or completely ending the previous policy or program (the *termination* activity). Taken together, these seven activities make up any complete decision process. Each activity, as well as the overall decision process, has standards that can be used to evaluate actual cases. In the rest of this section we examine each decision function and associated standards to evaluate the BC grizzly bear management decision-making process, with attention given to conditions before and after formalization and engagement of the BC partnership.

Gathering Relevant Information (Intelligence)

The intelligence gathering activity should be dependable, comprehensive, selective, creative, and open (Lasswell 1971; Clark 2002). The BC grizzly bear program included six main strategies to improve the intelligence activity: initial engagement between Montana FWP and the BC, which led to the formation of the BC Wildlife Committee; a survey of community members' perspectives; meetings with community members to share information and explore understandings of the problem; participatory spatial mapping of conflicts and potential attractants; regular reporting of grizzly bear activ-

ity and management actions; and working together to identify shared goals, which directed all of our initiatives and eventually provided the foundation for a formalized sub-basin management plan.

Initial Engagement and Formation of the Wildlife Committee

In 2000 the Region 2 Supervisor and bear manager for Montana FWP met with the Executive Committee of the BC to discuss the possibility of cooperating on grizzly bear management issues. Both organizations were concerned about the increase in grizzly bear conflicts in the Blackfoot Valley and were interested in exploring the possibility of a new approach to the problem. After lengthy discussions the Executive Committee agreed to work with FWP on a trial basis and then in 2002 established a formal committee of the BC to oversee issues involving grizzly bears.

Survey of Perspectives on Grizzly Bears and Grizzly Bear Management

Informal meetings in 2001 and 2002 organized by local community members and Montana FWP regarding the presence of grizzly bears in the Blackfoot watershed were characterized by strongly negative reactions to grizzlies. We saw an opportunity to improve the *dependability* and *comprehensiveness* of the intelligence activity by learning more about people's attitudes, values, and beliefs about bears and bear management. During 2002 and 2003 we conducted a survey of thirty-five active ranchers, outfitters, and small "hobby" ranch operations (appendix 6.1). Perceptions of grizzly bears were varied and complex. Of those who agreed that private landowners had a responsibility for protecting grizzly bears (42 percent), some respondents explained that grizzly bears were "part of the territory" and that it made common sense to take responsibility for running an efficient ranch that would not attract grizzly bears. Others suggested that bears played a role in the ecosystem and thus it was prudent to maintain those functions (e.g., regulation of prey populations). Of those who disagreed that private landowners had a responsibility for protecting grizzly bears (58 percent), there were three main explanations that emerged. First, some respondents felt that responsibility for grizzly bear management was clearly the role of wildlife management agencies, not landowners. Second, other respondents explained that bears should be geographically separated from humans and should not need to use private lands. Third, some respondents believed that environmentalists were a large part of the problem since the protective and legalistic actions of environmentalists on behalf of grizzly bears had contributed to population increases and had led to unnecessary problems for ranchers.

When respondents were asked about whether the Blackfoot would be a better place to live without grizzly bears on private lands, 52 percent agreed and two themes emerged: (1) fear for personal and family safety and (2) risk to livelihoods and property. Of the 48 percent who disagreed with the statement that the Blackfoot would be a better place to live if there were no grizzly bears on private lands, explanations fell into three themes: (1) the biodiversity theme was consistent with earlier sentiments suggesting that bears play a role in the system that should be valued; (2) the place and lifestyle theme was characterized by the notion that grizzly bears help make the Blackfoot a special and unique place and that grizzly bears help to define the rural lifestyle; and (3) the biocentric theme involved the recognition that humans are one species among many, all of which have value, including grizzly bears.

Fifty-eight percent of respondents agreed with the statement that people shouldn't have to change their habits to accommodate grizzly bears that use private lands. Three overarching themes emerged: (1) the loss of freedom theme was characterized by the concern that use of private lands by grizzly bears was limiting personal management authority and the ability to run an efficient ranching operation; (2) this was accompanied by fear and anxiety about potential injury by bears, particularly in situations where ranchers might have to contend with grizzlies during fence repair, irrigation set-up, livestock monitoring in remote settings, or during the calving season (particularly during night work); and (3) the perception that grizzlies could impact livelihoods and destroy private property was reiterated here in the context of ranchers not wanting to change their habits to accommodate bears because they perceived this as meaning that they would have to change their traditional rural lifestyles and practices.

One finding from the survey that was particularly important for the development of the BC grizzly bear program was that 90 percent of respondents agreed that private landowners should take precautions to reduce conflicts with grizzly bears. At the same time 90 percent of respondents disagreed with the proposition that grizzly bears should remain off limits to hunting. Finally, respondents were split over the statement that "grizzly bears are a serious threat to my livestock," with 45 percent in agreement and 55 percent in disagreement.

The survey concluded by asking about the most important issues that needed to be addressed so that grizzly bears and people might coexist in the area. Responses fell into two broad categories representing solutions that emphasized changing human behaviors versus those that emphasized

changing grizzly bear numbers and bear behaviors. This breakdown of responses was a simple yet effective way to gain insights about how local residents thought about the problem and what they offered as possible solutions (appendix 6.2).

Meetings with Community Members

The survey responses and other discussions with community members revealed a need for a more open and creative intelligence gathering process for decision making about grizzly bears in the Blackfoot. It was apparent that local residents sought to develop strategies, understand the system, and receive valid information from wildlife managers. It was also clear that many locals recognized that human-based changes could occur to reduce conflicts with grizzlies. These types of solutions were more likely to be identified and brought into practice if there was an organized venue in which to share information, discuss creative alternatives, and make decisions.

To meet this need, the BC partnership organized a series of meetings and discussions with private ranchers, residents, Montana FWP, the US Fish and Wildlife Service, conservation groups, and Allied Waste Services (western Montana's largest waste hauler). These early meetings allowed the BC group to further explore the ways people defined the problem and to identify shared perspectives. The BC agreed to develop a formal Wildlife Committee to serve as a forum to continue to bring participants together for regular communication, information sharing, and decision making.

A key task at this point was to make sense of the problem. Based on the survey results and discussions in group meetings, we could see that there were multiple and complex perceptions of just what the problem was as local residents confronted the reality of an expanding grizzly bear presence. It was important for all of us to understand that competing definitions of the problem fell into ideological and symbolic realms. For example, the notions that grizzly bears should be completely geographically separated from human activities, or that there were simply too many bears, or that environmentalists were largely to blame for the situation, posed serious barriers to constructive discussions about how best to respond, since there were no feasible solutions available if the problem was characterized in these ways. There were other problem definitions apparent, however, that were quite practical in nature. These reflected concerns about human safety, property, and livelihood interests—all areas that theoretically could be addressed by understanding the problem as one of risk management. This provided an avenue for productive discussion during initial goal setting.

Participatory Spatial Mapping

The fourth initiative to improve the intelligence activity was to bring a spatial dimension to the collective understanding of the problem of grizzly bears on private lands in the Blackfoot. We organized mapping workshops to demonstrate how Geographic Information Systems (GIS) could help to understand the problem of human–grizzly bear conflicts from a spatial perspective. Using GIS, it was possible to display grizzly bear activity and conflict locations visually and demonstrate that human-bear interactions were occurring across ownerships comprising more than 650,000 acres. This illustrated that potential solutions might require a community-level response to match the scale of grizzly bear home ranges and conflict locations.

From experience in previous research conducted in Montana's Rocky Mountain Front it was evident that asking ranchers to talk about their ranching operations and to map their livestock pasture arrangements digitally was a powerful way to collect meaningful data in a nonthreatening manner that also helped invest ranchers in the process of data generation (Wilson et al. 2006). The mapping workshops in the Blackfeet demonstrated the participatory nature of GIS mapping and showed how locations of agricultural and other human-related attractants could be compared with known conflict locations and grizzly bear observations collected by Montana FWP. The hope was that by opening up the intelligence process and selectively focusing on conflict locations, attractants, and preventive techniques, we could diminish the polarization and symbolic rhetoric often associated with the presence of grizzly bears in ranching country and work on tractable and feasible solutions to reduce conflicts. The objective was to get a better understanding of where regular conflicts were occurring (current conditions), share this with the community, then jointly discuss trends and projections, and offer some possible solutions. At these early workshops, local FWP bear managers discussed preventive techniques, including the electric fencing of calving areas and other proven tools that they had used over several decades of experience. Collectively, ranchers and residents showed an interest in building on the existing proactive efforts of FWP and using GIS data to guide and augment these efforts.

The participatory and interactive nature of mapping as proposed to the ranching community was important for stimulating people's interest and asking for their direct involvement in solving the problem. Mapping reverses the traditional flow of information in practical problem solving, so that rather than flowing from the "experts" to the local people, information flows from the local people to the experts. Further, this approach created

the opportunity for mutual learning. This is distinctly different from traditional approaches to land and wildlife management, where, for example, rural people have endured heavy handed regulation or have resented being told what to do (Brick and Cawley 1996).

With the aid of maps participants were able to explain their management practices readily. When ranchers located calving or lambing areas they often explained why they had chosen specific pastures for their livestock or why they had selected a portion of their ranch for livestock carcass disposal. For example, during the calving season, ranchers lose some calves to natural causes. Since the calving process is labor intensive and requires constant management, it is typical for "boneyards" or "dead piles" to be located near calving and lambing areas. This saves labor in disposing of dead animals, but also increases the risk that scavenging grizzly bears could come into conflict situations. Mapping produced spatial data sets that included the underlying explanations that ranchers helped generate, led to other insights regarding management practices, and, perhaps most importantly, developed trust and credibility. The integration of livestock management practices and known locations of grizzly bear observations and conflicts allowed us to produce maps of conflict hotspots using a variety of geospatial analysis techniques (Wilson et al. 2005; Wilson et al. 2006). This enabled us to prioritize specific locations in the landscape to focus on in possible management and conservation actions with landowners.

Reporting of Grizzly Bear Activity and Management Actions

The fifth intelligence oriented initiative of the BC project was to make dependable information on grizzly bear behavior and management actions more available. In addition to the GIS mapping and risk assessment work, the formation of the Wildlife Committee offered a powerful means for the Montana FWP grizzly bear management specialist to provide a factual accounting of grizzly bear activity and management actions on a regular basis. This was a critically important step that allowed landowners to have regular contact with a wildlife manager and to learn about grizzly bear foraging activity, when to expect emergence of grizzly bears from their dens, what travel routes were preferred by bears, and other insights on bear behavior and life history needs.

Regular communication with FWP also provided landowners with detailed information about grizzly bear management activities. For example, seasonal updates were provided on the causes of human-bear conflicts, the number of grizzlies outfitted with radio telemetry, the numbers of grizzlies trapped because of conflicts, and the locations to which these bears were

moved. These data from FWP helped to minimize the likelihood of false information being disseminated into the community and maximized opportunities for FWP to provide factual and comprehensive information about grizzly bear activity. This information included FWP's finding that in the period from 1998 to 2004 about 50 percent of conflicts in the Blackfoot area (known as Region 2) resulted from poorly contained residential and agricultural attractants and that more than a third of known human-caused grizzly bear mortality in the region arose from attractant-related incidents and repeated livestock depredations (Jonkel 2006).

Setting Goals

By integrating expert and local knowledge through regular meetings about the social and ecological factors contributing to human–grizzly bear conflicts, the BC program opened up the intelligence activity and provided an atmosphere that was more conducive to generating shared goals. The group eventually settled on the following goals: to formalize community-supported management of human–wildlife interactions in the Blackfoot and to address human–grizzly bear conflicts and grizzly bear–livestock conflicts by emphasizing preventive techniques, protecting human safety, and helping to maintain rural livelihoods by reducing risk of livestock losses. These goals generated within the community complement national goals of grizzly bear recovery by focusing on reducing bear mortalities by reducing conflicts. Moreover, these goals were powerful in that their development and linguistic framing supported rather than threatened the personal identities of local people involved in understanding the problem and ways to confront it. The process of clarifying a shared sense of the problem and developing community-supported goals was time consuming, costly, and required a great deal of patience. However, this process helped to develop trusting relationships for sharing information and a shared sense of responsibility for working toward viable, common sense solutions that benefit both people and bears.

One ongoing difficulty with the intelligence activity for the BC grizzly bear program is that, despite concerted efforts to have open and inclusive meetings, a small group of Blackfoot ranchers have elected not to take part actively.

Developing Support for Action (Promotion)

In addition to its involvement in the intelligence activity, the Wildlife Committee of the BC has been actively engaged in the promotion activity. Ide-

ally, promotion should be rational, integrative, and comprehensive (Lasswell 1970; Clark 2002). The Wildlife Committee was structured to encourage the involvement of a wide range of values and interests in its decision-making activities. Afternoon meetings of the full group are held quarterly and are supplemented by quarterly meetings of an evening work group called the Landowner Advisory Group. Together, the Wildlife Committee and the Landowner Advisory Group represent both communities of interest and communities of place, thereby contributing to more comprehensive and integrative development and debate of alternative strategies for action. For example, meetings of the full Wildlife Committee are heavily attended by both state and federal agency personnel and several prominent, national-level conservation groups like Defenders of Wildlife. One factor that contributes to attendance by these groups at these daytime meetings is that many agency interests or conservation groups have the ability to meet during the day and are, in effect, paid to do so. These agencies and organizations broadly represent larger, national-level communities of interest regarding threatened and endangered species conservation, and they hold values that may not be shared by many local residents. Conversely, the Landowner Advisory Group allows for broad local geographic representation from key opinion leaders, business owners, and respected ranchers throughout the Blackfoot watershed, who represent a community of place. Coordinating, balancing, and including the sometimes competing value demands that participants bring to discussions about grizzly bears through these multiple decision-making forums has been challenging, but it is critical for mutual learning, developing shared goals, and promoting strategies that are rational—in that they advance shared goals—and effective in achieving on-the-ground successes.

Our experience in the BC provides further evidence that inclusiveness is absolutely fundamental to progress in contested conservation settings. The Wildlife Committee and the Landowner Advisory Work Group offer multiple opportunities for broad representation of different value systems and perspectives. In an ideal world there might be one overall committee coordinating all the various interests (all of the other BC committees operate in this way). However, if certain individuals such as ranchers prefer a small group setting and can only attend meetings during the evening because they are working during the day, then it is important to attend to these details. Open and frequent communication through multiple means for all participants is a key factor for managing competing value demands and finding ways to arrive at solutions that serve the common interest.

Although having these two sets of meetings has been critical to ensure

broad participation in the BC grizzly bear program, there are also some drawbacks. The process is time consuming and delicate in terms of maintaining a neutral stance. Ideally, one forum would simplify the task of managing and integrating competing values and would bring more efficiency to the decision-making process. However, it appears that members of the Wildlife Committee are satisfied with the current structure and appreciate the role of the Landowner Advisory Group. Regular dissemination of information to all stakeholders and annual field tours highlighting different projects have been critical for integrating multiple values.

The Wildlife Committee was also involved in a community-wide, sub-regional planning process led by the BC and the Nature Conservancy to develop an overall conservation plan for the watershed. The Wildlife Committee focused on developing a set of conservation targets for grizzly bear habitat conditions, conflict, and mortality thresholds along with a strategy for achieving those targets. This effort brought additional community members into the decision-making process and helped to document formally the Wildlife Committee's place and strategy for long-term grizzly bear conservation under the larger, sub-regional plan for the watershed.

Making Decisions (Prescriptions)

The Wildlife Committee and the Landowner Advisory Work Group fostered civil discourse and rational discussion of various programs (prescriptions) for ameliorating human-grizzly bear conflicts in the Blackfoot. The two groups looked for prescriptions that were pragmatic, nonthreatening, and participatory. They selected four: electric fencing, livestock carcass removal, a neighbor-to-neighbor communication network, and a waste management program. These initiatives used tools that had been proven to work in other settings, provided ranchers with a central role in making decisions, and involved cost sharing among ranchers, beekeepers, and residents.

Standards for the prescription activity include effectiveness, rationality, and comprehensiveness (Lasswell 1971; Clark 2002). The BC partnership intentionally focused on modifying management practices and human behaviors rather than killing bears or attempting to change value systems. As a result, decisions have been highly effective, that is, they have met the expectations of all partners and have been supported by all partners. For example, small changes in ranching practices like shifting from traditional barbed wire to electric fences around calving areas, or eliminating dead cows and calves from a ranch during the calving season, are concrete ways to prevent and reduce conflicts with bears and avoid livestock depredations. Although the

reasonably of recognizing the livelihood interests of ranchers and honey producers may seem obvious, close attention was paid in the BC to making programs and practices more comprehensive by tailoring them so that, in addition to the direct benefits of capital investments in nonlethal deterrence of bears and other predators, there were indirect economic benefits to ranchers. For example, several of the fences built around calving areas also keep elk away from haystacks, thus helping ranchers to maintain adequate supplies of winter feed for their cattle. Many of the electric fences installed in the Blackfoot also protect grain storage facilities, household garbage, pet foods, and other attractants associated with ranch operations.

Some of the risks of ranching, such as disease, fire, land use change, weather related calf mortality, or global market fluctuations in cattle prices, are largely beyond the control of livestock producers. However, providing incentives to modify existing land-use practices is a nonthreatening way to help ranchers manage risk better, without demanding that they give up control over their operations. Initially, some ranchers in the Blackfoot were reluctant to adopt new practices like electric fencing or livestock carcass removal because these innovations challenged traditional norms. However, the results of our initial trials encouraged broader participation. For example, once some of the first fencing projects successfully deterred grizzly bears from calving areas and greatly reduced bear activity, many ranchers began to openly acknowledge the benefits of the fencing.

Implementation (Invoking and Applying Decisions)

Implementation consists of invoking (initially instituting) and applying (further interpreting and enforcing) decisions. Implementation should be timely, dependable, rational, nonprovocative (nonthreatening), realistic, and uniform (Lasswell 1971; Clark 2000). As just discussed, the programs implemented by the BC partnership included electric fencing, livestock carcass removal, a neighbor to neighbor communication network, and a waste management program. All of these efforts were directly related to the original goals of addressing human–grizzly bear conflicts through preventive techniques, protecting human safety, and reducing impacts to rural ranching livelihoods.

First, during 2003 to 2010, 82,000 linear feet of electric fences were constructed around fourteen calving areas, a rural livestock transfer site, a composting facility for dead livestock and deer, and sixteen apiaries. Electric fences nonlethally deter grizzly bears from attractants like calves, garbage, or beehives. All projects were paid for using funds from public and private

foundations, which provided ranchers and beekeepers with substantial cost savings on the capital investments. Ranchers and beekeepers helped share the total costs by providing in-kind donations of labor to prepare sites and remove old fences.

Our early experience with the electric fencing project serves as a good illustration of how the implementation of a new program can be perceived as threatening. At first, some ranchers were concerned that electric fences would require excessive maintenance or would be susceptible to ungulate damage. In some cases, ranchers were unfamiliar with the technical aspects of electric fencing, and the adoption of this new technology challenged norms such as their pride in self-reliance regarding routine work like fixing barbed wire fences. We have worked closely with ranchers to monitor and maintain electric fences so that they are functional and inexpensive to ranchers.

Second, the livestock carcass pick-up program was designed to remove the cows, calves, ewes, and other livestock that naturally die during the calving and lambing season (mid-February through mid-May), so that carcasses would not be found by foraging grizzly bears and other predators. Cow-calf ranches in this area are characterised by winter feeding, centralised and spatially fixed operations, irrigated hay production, and docile breeds of cattle (Dale 1980; Jordan 1993). The calving season typically overlaps with the emergence of grizzly bears from their dens in the early spring. Bears routinely visit calving areas, and the traditional practice of dumping dead livestock into spatially fixed boneyards (carcass dumps) can lead to chronic livestock-grizzly bear conflicts. Grizzlies that are drawn to a ranch because of livestock carcasses may be tempted to kill live calves or lambs or find other foods, like grain, protein licks, pet foods, or bird seed. The BC grizzly bear program has been responsible for the removal of more than 1,200 livestock carcasses from our project area since 2003.

Our initial efforts to remove livestock carcasses generated considerable concern as ranchers did not want to have the numbers of livestock deaths on their ranches disclosed to neighbors for fear of being stigmatized for poor animal husbandry. This concern was addressed by establishing centralized drop-off locations where ranchers could bring carcasses for pick up. Since 2007, composting of livestock carcasses has proven to be a highly effective disposal method and has been widely applauded by the ranching community as a more appealing method of disposal than past practices of depositing carcasses at landfills on their properties.

Third, the "neighbor network" initiative of the BC partnership connects

local residents so they can help each other to reduce and prevent human-bear conflicts. The network consists of over 120 residents who work together: (1) to minimize the availability of human-related attractants, (2) to communicate among neighbors about grizzly bear and wolf activity using phone trees and e-mail alerts, and (3) to report to a designated area coordinator any incidents or observations of bear or wolf behavior that may pose problems. The goal of this program is to improve communication among neighbors and with Montana FWP in order to prevent conflicts with carnivores before they occur. Nine networks have been set up in the project area, each with a coordinator, to help facilitate communication among neighbors and to FWP when there is grizzly bear or wolf activity. A free check out program allows residents to borrow bear-resistant trash cans, portable electric fencing, electrified bird feeders, and other nonlethal deterrent tools that help residents reduce conflicts.

Fourth, the BC program also focuses on common sense management of waste and household garbage for all residents of the Blackfoot. Waste haulers and residents use bear-resistant garbage cans or take simple precautions to keep garbage secure from scavengers. These efforts are integrated with the neighbor network.

Participants in the BC have worked extremely hard to deliver all of these projects in an efficient, *dependable*, and *timely* manner. Demonstrations and one-to-one discussions with ranchers have helped to overcome fears and suspicions about innovative projects, making implementation less *problematic*. Moreover, our efforts have been open and available to anyone in the Blackfoot, including ranchers, landowners, and new residents, thus providing uniformity. One key to effective implementation has been to have a representative of the BC program available on short notice to respond and deal with questions or problems as they arise. We have made extensive efforts to be highly responsive to landowners and their needs. Often a telephone call or personal visit is used to assess the situation and take necessary steps to alleviate any issues. As a result of all these factors, participants appear to be satisfied that program delivery is *rational* in that it serves the broader common interest in the Blackfoot watershed and nationally.

Although the BC partnership has made good progress with implementation of its grizzly bear projects, we anticipate future challenges with funding. Initial funding was provided for virtually all projects from public and private foundations, which provided a strong economic incentive for ranchers to participate. To date, there has been fairly limited direct financial contribution to ongoing projects by ranchers, although they have made in-kind

contributions of labor. Programs like livestock carcass removal are clearly valued by ranchers as an important service, but the long-term sustainability of these benefits is not secure, considering the small, annual contributions of actual funds (less than $2,000 in total) by ranchers to a program that costs approximately $14,000 per year.

Monitoring and Evaluating Decision-Making Processes and Outcomes (Appraisal)

Criteria for the appraisal activity include dependability, rationality, comprehensiveness, selectiveness, independence, and continuity (Lasswell, 1971; Clark 2002). Thus far, evaluation of the BC grizzly bear effort has been informal and internal, without the involvement of an independent third party. Although the present chapter rationally evaluates the decision-making processes of the BC partnership using explicit criteria (summarized in appendix 6.1), this is still an internal evaluation because the authors are all involved in the program. Nonetheless, the Wildlife Committee and the Landowner Advisory Group of the BC were structured to be as inclusive as possible and to provide opportunities for broad community representation, so the self-appraisal that has taken place incorporates a variety of perspectives (contributing to *dependability* and *rationality*). Although appraisal has not been continuous, the BC program does regularly assess its projects and look for opportunities for improvement. These informal appraisals typically focus *selectively* on specific projects, in contrast to this chapter, which is a more comprehensive evaluation of the program as a whole.

Participants are justifiably proud of the outcomes of the BC grizzly bear program. From 2003 to 2010 there was a 96 percent reduction in reported and verified human–grizzly bear conflicts in the BC project area. There has also been a downward trend in known grizzly bear mortalities in the Blackfoot watershed. In 2003 there were five grizzly mortalities in the watershed, and in 2004 there were three known mortalities, one resulting from a hunter-related incident, one from an illegal kill, and one from a vehicle collision. In 2005 there was one road kill mortality of a sub-adult grizzly of unknown sex. In the same year, no grizzly bears were trapped in the Blackfoot for conflict management purposes, nor were there any management-related conflicts or mortalities in 2006. In 2007 human-bear conflicts continued to decline with fewer than five conflicts reported. There were two hunter-caused mortalities (one adult male, one adult female) in backcountry settings outside the project area and one adult male grizzly killed by a vehicle collision outside

the project area. In 2008 there were no grizzly bear mortalities and twelve minor, attractant-related conflicts. In 2009 only five reported conflicts occurred and there were no grizzly bear mortalities. In 2010 there were only three conflicts in the project area but several grizzly bear mortalities on the outside edges of the project area as a result of garbage-related attractants.

Recent population analysis by the US Geological Survey, which used DNA hair-snare methods, reported approximately twenty-nine individual grizzlies in the Blackfoot area in 2004, and population estimates by FWP suggest that the Northern Continental Divide Ecosystem population is growing at about 3 percent per year. We recognize that the downward trend in conflicts may partly be a result of there being fewer "problem" bears, or changes in bear foraging behaviors, or the heightened awareness by local residents, who may report conflicts less often. However, the combination of targeted prevention efforts—electric fencing, carcass removal, improved decision making, and citizen-based monitoring—are clearly helping to reduce conflicts between humans and grizzly bears. Ongoing FWP monitoring of grizzly bear activity, conflicts, and bear mortality will help to evaluate the long-term outcomes of this initiative.

Ending or Changing Programmatic Direction (Termination)

The grizzly bear conflict work of the BC grizzly bear program is now entering a monitoring and maintenance phase. The past five years have resulted in the development of several successful initiatives and dozens of on-the-ground projects. Monitoring and maintaining the investment in a coexistence infrastructure in the Blackfoot watershed is the next task ahead. While the grizzly bear work is certainly not completed, new projects will be initiated as needed and overall direction will be guided by the grizzly bear strategy in the subregional plan.

The BC partnership is now shifting energy, skills, and resources to the challenging issue of wolf-livestock conflicts, with the hope that the decision-making systems put in place for grizzly bear management will enable a proactive response to the emerging and contentious issue of wolves. Initial efforts suggest that the BC will again have to contend with widely differing definitions of the problem, including differing perceptions regarding wolf numbers, management authority, direct and indirect impacts of wolves on livestock, impacts on ungulate numbers and hunter opportunity, and levels of lethal control. The BC has elected not to take an advocacy position on wolf

management or the status of wolves under the Endangered Species Act, and a small number of individuals have formally withdrawn from the BC partnership over this issue.

Moving Forward: Lessons and Recommendations

The success of the BC grizzly bear program shows that a community-based initiative that attends to principles of good decision making can be effective in building social capacity and reducing conflicts with carnivores. By opening up the intelligence and promotion activities, developing more reliable information about important social and biological trends, and selectively focusing on practical ways of managing attractants and reducing conflicts, the BC has helped to promote coexistence between grizzlies and humans in the Blackfoot Valley. In this section we identify field-based lessons for managers from our experiences and then discuss general recommendations for designing and improving decision-making processes in this and other complex conservation programs.

LESSONS FOR MANAGERS

Our field-based lessons for managers are not meant to be an exhaustive inventory, but merely an attempt to share some of the most important and useful lessons reflecting our collective experience with the BC. These lessons are summarized in the following sub-sections.

Build on Existing Institutional Capacity

When this effort started it was clear that it would be foolish to ignore the existing institutional capacity of the BC. The long-term commitment that ranchers, residents, and other landowners in the Blackfoot have made to preserve rural ways of life has resulted in strong working relationships within the community and across multiple natural resource agencies and other government entities. This history of collaboration has generated and maintained a stock of social capital, which has been drawn on successfully from time to time to confront complex issues like drought, invasive plants, and landscape-scale habitat conservation (Putnam 2000). It made sense that if the BC was willing to work on the grizzly bear issue we should build on and expand this existing institutional capacity.

Take a Proactive Approach

While it is not always possible to take a proactive and precautionary approach to natural resource issues, we did so in this case. A few human–grizzly

Box 6.1
Emerging Lessons for Managers from the Bloodfood Valley Case

- If possible, integrate desired management and conservation actions with existing institutional capacity to accelerate all decision-making functions and generate strong local support for efforts.
- Strive to take a future-oriented or proactive approach to the current problem and avoid reactive approaches when possible.
- Develop a holistic understanding of how people's perceptions of the problem are connected. Typically, this is a function of historic and current ecological, social, and political conditions.
- Do not rush decision-making processes in rural contexts. Recognize that developing trust and support takes time and that participation by most stakeholders is contingent on satisfying their livelihood interests first.
- Recognize that highly attuned listening skills are necessary; important information is often delivered in subtle or discreet ways.
- Share decision-making authority and intellectual ownership of the issue with engaged participants to improve creative problem solving and fully supported outcomes.
- Understand the biological scale of key processes to be addressed and match human responses accordingly.

bear conflicts and livestock losses to grizzlies had already occurred when the BC grizzly bear program began in the early 2000s, but it is likely that without a collective preventive response at that point the intensity and frequency of grizzly bear conflicts would have increased substantially. The use of GIS analysis helped us to predict and target areas that were at greatest risk for conflicts in the future, thereby avoiding the need to "bear proof" the entire landscape. If the expansion of grizzly bear activity and their population continues on private lands in this area, it is hoped that these proactive efforts will enable the community to stay well ahead of the problem.

Develop a Broad Understanding of "the Problem"

Considerable time and research was invested in understanding how the problem was perceived by key stakeholders and how these perceptions were grounded in the local context. The spatial and biological dimensions of

grizzly bear activities and the opportunities for managing attractants were important considerations that the group learned about collectively. Care was taken to be holistic and to understand that a long-term solution to the problems associated with grizzly bears would depend on finding common ground across multiple stakeholders.

Be Patient and Listen

While it may appear obvious that patience is an important skill to bring to collaborative efforts, this skill is critical in rural, agrarian contexts. Participatory efforts are time intensive and costly, but developing inclusive and meaningful decision-making processes greatly increases the likelihood of achieving desired outcomes. The process can be as important as the end product. Well-developed listening skills are also essential. We have found that people involved in our efforts have different ways of communicating important information. Some are direct, others more subtle. For example, it is common for a rancher to refer to himself in the third person (e.g., "a guy could do such and such" to describe what he himself might be willing to do). This may serve as a way to deliver positions in a thoughtful and nonthreatening manner and may have origins in agrarian needs for neighborly communications. Indeed, the word "neighbor" is sometimes used as a verb, as in "he knows how to neighbor well." There are unique complexities in the ways people in different settings communicate, and being attuned to this by being a good listener is essential to comprehending the situation and being effective.

Share Power

Power-sharing arrangements can be difficult to create and manage. Nonetheless, our experience with the BC partnership demonstrates that power sharing among stakeholders, specifically in making decisions on both a tactical level (project-based) and strategic level (management and conservation approach) are beneficial. The willingness of Montana FWP and other agencies to invest in the BC effort and actually give and take direction from landowners, ranchers, and residents shows that the BC developed a high degree of trust among stakeholders. This has resulted in stakeholders who are willing to participate on a long-term basis and who know that their values are being incorporated into decisions. The BC partnership will need to work to maintain this level of trust as it tackles the highly divisive issue of wolf management.

Scale Matters

One likely explanation for the downward trend in conflicts between bears and humans is that our programs were designed to match the biological scale of grizzly bear activity. For example, the carcass pick-up and removal program covers ranches across nearly 650,000 acres, a scale commensurate with grizzly bear home ranges and their twenty-four- to forty-eight-hour foraging bouts. By having dozens of ranchers participating in this program, there is a collective benefit realized from individual participation. If only a handful of ranchers had taken part in the program, grizzlies would likely have found and exploited carcasses on the ranches of nonparticipants, eventually creating spillover conflicts across our project area.

RECOMMENDATIONS

In addition to these lessons for managers, there are three main recommendations that emerge from this case study for designing and improving community-based approaches to large carnivore conservation and other complex natural resource cases: build and maintain partnerships, communicate effectively, and strive for long-term sustainable outcomes.

Build Partnerships

Beginning with the intelligence activity and continuing through all the decision-making activities of the BC program, at the core of our success has been a strong partnership. This has enabled us to bring a diverse group of stakeholders together to capitalize on our collective knowledge, skills, and financial resources. Integrating local and expert knowledge in the intelligence and promotion activities was a powerful means to develop a holistic understanding of the problem of coexisting with grizzly bears. The people involved in our efforts have multiple skill sets—from bear monitoring to interpersonal communication, fund raising, facilitating meetings, and ranch management. These skills, and many more, constitute a "skill network" that can be readily tapped on a project by project or issue by issue basis to advance the goals of the partnership. In addition, funding institutions (both public and private) are often interested in supporting partnerships, which has helped the BC partnership to garner substantial financial resources to implement key programs.

Communicate Effectively

Effective communication is critical to carnivore conservation programs in both formal and informal settings. The formal communication structure that

we put in place using the Wildlife Committee and the Landowner Advisory Group gave all invested stakeholders a voice to share information and exchange ideas. This opened up the intelligence and promotion activities, giving participants access to better data about social as well as biological trends and helping them to settle on a tractable definition of the problem. Both communities of place and of national interest were given representation and encouraged to communicate with each other to make decisions. The ability for national-level conservation groups to understand the local reality of living with bears has been particularly helpful in crafting approaches that are locally supported and practical but also benefit the national goal of conserving grizzly bears.

At the informal level, the network of partners that organized under the IC has helped to provide options for communication in decision making based on trusting relationships. For example, certain individuals in this partnership have known some of the ranchers in the Blackfoot for more than three decades, which makes it possible to present new ideas or grapple with sensitive subjects initially in one-on-one informal settings. Being able to broach sensitive issues at the individual level prior to group settings can be an important way to probe or test out new ideas in a nonthreatening manner. In these types of cases, testing or prototyping a new innovation, such as fencing, is possible and presents a low-risk way to try new approaches.

Additionally, we recommend that communication be based on nonthreatening language choices and a nonadvocacy approach to discussing the issues, and that, at least in the Blackfoot watershed, the communication flow be largely upward from the grassroots. Being highly attuned to the values and needs of landowners and ranchers through regular communication and being willing to "listen from the ground up" have been important ways to frame communication strategies.

Strive for Long-Term Sustainable Outcomes

Sustainable coexistence with large carnivores like grizzly bears in the long term will ultimately depend on local people's tolerance for these animals and their willingness to exert a degree of ownership, in the sense that there is shared responsibility for wildlife management rather than the traditional model in which people rely wholly on agency action. Ideally, living with carnivores will become part of cultural expectations in these regions. Over the past ten years of our work, people in the Blackfoot have increasingly developed a sense of responsibility for their actions with respect to coexisting with grizzly bears. Our neighbor network is a prime example of residents

taking an active and participatory role in peer education and reversing the flow of information about grizzly bear activity to Montana FWP. Ranchers are developing their own portable electric fencing systems to deter bears and wolves nonlethally, and across the community the general level of "bear awareness" has increased dramatically.

Appendix 6.4 depicts a continuum of local involvement in grizzly bear conservation and indicates the implications for sustainable outcomes. We recognize that in the BC program technical assistance and financial resources were provided to ranchers for many of our programs and that we have not yet reached the far end of the continuum in terms of local ownership of grizzly bear conservation. However, the improved decision-making process developed in the Blackfoot is a critical step in reaching this long-term and most sustainable outcome. We also believe that the long-term support that this partnership has enjoyed from the ranching community is largely a result of having developed communication forums where local values, needs, and concerns were regularly articulated and met in a meaningful way. The future outlook of the effort appears to be sustainable. The state and federal agencies involved recognize that sharing power in decision making has invested local people in the long-term success of this effort. However, long-term financial sustainability to maintain core programs may require more cost sharing by ranchers, more investment by local landowners who can act as donors, and continued and diversified support from private foundations. It may also be desirable to develop new legislation that could direct congressional appropriations to support proven tools and techniques as described in this effort.

Conclusions

Much of the success of the BC grizzly bear program can be attributed to understanding and communicating effectively with people. In too many cases of natural resource management, undue attention and emphasis are placed on observing, studying, and analyzing biological processes or problems. We have found that people's interactions, communications, and decision making are the key areas on which to focus attention. We did not ignore important biological data relevant to reducing grizzly bear conflicts, but we found that focusing our efforts on building nonthreatening forums for understanding how the problem was perceived and cooperatively generating shared goals and solutions has been well worth the investment.

At the beginning of this effort it was expected that the issue of grizzly bears would be perceived differently among interested stakeholders, that there would be multiple and competing value demands made by stakehold-

ers, and that an organized approach was needed to work through this complexity. Doing nothing would clearly have been a poor choice for people and grizzly bears. The BC partnership focused on changing people's practices and behaviors, not changing their value systems, and it gave people who had to live with grizzly bears the means to develop coherent goals of reducing and preventing human–grizzly bear conflicts. While not all ranchers and landowners have been involved in the effort, there has been enough core support to make the programs a success. The inclusive and multiple forums to guide decision making relied on participatory projects and had the support of wildlife managers who were willing to invest in this collaborative effort. This has produced a strong partnership and enhanced communication and trust among participants, thereby opening up opportunities for innovation and on-the-ground success.

Appendix 6.1

Likert-Scaled Statements Regarding Perceptions of Grizzly Bear Activity and Appropriate Landowner/Resident Behaviors in the Blackfoot Watershed, Montana

1. Grizzly bears that use private land are a threat to human safety.
   71 percent agree
   29 percent disagree
2. I do not feel safe when I am outside on my property because of grizzly bears.
   45 percent agree
   55 percent disagree
3. There are too many grizzly bears using private lands in this area (Blackfoot).
   71 percent agree
   29 percent disagree
4. I am comfortable with the current level of grizzly bear activity in this area (Blackfoot).
   32 percent agree
   68 percent disagree
5. Private landowners have a responsibility for protecting grizzly bears.
   42 percent agree
   58 percent disagree

6. This would be a better place to live if there were no grizzly bears on private lands.
   52 percent agree
   48 percent disagree
7. People shouldn't have to change their habits to accommodate grizzly bears that use their private land.
   58 percent agree
   42 percent disagree
8. Private landowners should take precautions to reduce conflicts with grizzly bears.
   90 percent agree
   10 percent disagree
9. Grizzly bears should remain off-limits to hunting.
   10 percent agree
   90 percent disagree
10. Grizzly bears are a serious threat to my livestock.
    45 percent agree
    55 percent disagree

Appendix 6.2
The Relative Difficulty of Important Issues for Improving Human–Grizzly Bear Coexistence

Aggregated responses of respondents when asked about the most important issues that should be addressed to improve human–grizzly bear coexistence and the relative difficulty of addressing issues.

ISSUES CHARACTERIZED BY MANAGING HUMAN BEHAVIORS

Less Difficult

Develop a strategy.
Focus on protecting garbage, grain, bird feeders, etc.
"Keep a clean camp."
Better communication.
Truthful communication from wildlife managers.
Better education on how to live with bears.
Protect human safety.
Improve cooperation among landowners and managers.

More Difficult

Stop developments in bear habitat.

ISSUES CHARACTERIZED BY MANAGING BEAR BEHAVIORS AND NUMBERS

Less Difficult

Manage "problem" bears more aggressively.

Improve bear monitoring.

More Difficult

Know where "problem" bears are.

Know what the bear population is doing.

Reduce the bear population.

Institute a hunting season on bears.

Have a legal right to protect livestock from bears.

Increase bear relocation distances.

Appendix 6.3

Decision Activities, Standards, and Effectiveness for Grizzly Bear Management in the Blackfoot River Watershed, Montana

An overview and appraisal of the grizzly bear management decision process in the Blackfoot River watershed, Montana (standards adapted from Lasswell 1971; Clark 2002).

INTELLIGENCE

Recognizing the problem and gathering information.

Dependable

Comprehensive

Selective

Creative

Open

Pre-engagement (1997–2001)

FWP data on bear numbers and activity were perceived with some skepticism by the community and viewed as *undependable*. Bears were perceived as great threats to human safety and livelihoods. Data were needed to integrate land-use practices, attractants, and conflict location data to create a *comprehensive* and integrated understanding of the problem while *select-*

ing or targeting key practices (e.g., calving areas, livestock carcass management) that would influence conflict probability. Information gathering was traditional and limited in scope (emphasis on monitoring movements of a small number of collared bears) or *uncreative* and was not widely available or *open* to the community.

Engagement (2002–Present)

Analysis and clarification of the "problem" of having grizzly bears return to private lands helped to show that ideological and symbolic problem definitions would be difficult to solve, and they led to general support by the community and a focus on understanding what human behaviors and practices would reduce the risk of conflict. A spatially explicit and more *comprehensive* understanding of conflict was generated with the support of FWP and ranchers through data sharing and valuing local knowledge. The process of data collection, *open* dissemination of information, and regular communication with FWP and ranchers helped to create trust in data (*dependability*) and opened opportunities to find solutions that respected ranchers' exclusive interest in property while attending to inclusive national interests of reducing grizzly bear-human conflicts and bear mortality.

Key Challenges

The process of clarifying problem definitions is time consuming and costly. Power sharing and generating the trust and support of FWP was a time consuming and delicate process that required patience. A small vocal minority of ranchers have refused to take part in any information generation or sharing activities since 2002.

PROMOTION

Open debate, in which various groups advocate for their interests or preferred policies.

Rational

Integrative

Comprehensive

Pre-engagement (1997–2001)

Forums for *rational* and open discussion and debate were limited. Disparate values were simultaneously promoted and dismissed by various stakeholders with little or no *integration* or synthesis. Special interests were largely dominating informal discussions at the community level.

Engagement (2002–Present)

The BC provided structure to elevate the discussion and debate to a more *rational* and *comprehensive* level that *integrated* place-based and interest-based values through multiple communication forums.

Key Challenges

Multiple communication forums require intensive coordination (time-consuming). Ideally, the BC would have a single committee to debate and discuss grizzly bear management.

PRESCRIPTION

Setting the policy, rules, or guidelines.

Effective (stable expectations)

Rational

Comprehensive

Pre-engagement (1997–2001)

Ranchers and landowners were concerned that state and federal management actions would trump or ignore local decision making and limit property rights. FWP was understaffed and underbudgeted.

Engagement (2002–Present)

Committing to specific decisions was carried out in a collaborative manner with cogeneration of voluntary plans deemed *rational* or balanced by ranchers. The *expectations* of ranchers that they should have a central role in decision making were met, helped build support of existing FWP management plans, and led to new voluntary projects (characterized by economic incentives and risk-reducing practices), furthering a *comprehensive* and proactive approach to the problem. Funding and personnel were acquired to expedite project delivery.

Key Challenges

Initially, ranchers were skeptical about the efficacy of certain proposed actions such as electric fencing and livestock carcass removal since adoption of these practices challenged traditional cultural norms.

INVOCATION AND APPLICATION

Implementation, enforcement, and dispute resolution.

Timely

Dependable

Rational
Nonprovocative (nonthreatening)
Realistic
Uniform

Pre-engagement (1997–2001)

Efforts by FWP existed to manage grizzly bears efficiently, but funding and personnel shortages made progress slow. Efforts were not systematically organized.

Engagement (2002–Present)

The existing institutional capacity and ability of the BC were used to catalyze new partnerships and synchronize state, federal, and NGO involvement, leverage significant funds, and deliver results on projects efficiently (*timely*), *dependably*, and *nonprovocatively*. Widespread support of the ranching community for the project ensued. Efficient and reliable project implementation may have resonated with the work ethic of ranchers, whose survival is dependent on a problem-solving and solution-oriented practice. The institutional capacity of the BC to implement projects efficiently has created efficiency and rationality in program efforts that are perceived as a favorable private-sector solution that served common interests (*rational*).

Key Challenges

The use of economic incentives that have resulted in relatively low-to-no-cost projects may have created expectations of conservation subsidies and could jeopardize the ability to sustain core programs in the long term if some proportions of costs are not borne by the ranching community.

APPRAISAL

Review and evaluation of the activities so far.

Dependable
Rational
Comprehensive
Selective
Continuing
Independent

Pre-engagement (1997–2002)

Initial efforts by FWP to address the grizzly bear issue were largely based on traditional, expert-driven wildlife management and self-appraisal with limited engagement of the local community in decision making.

Engagement (2002–Present)

Although the appraisal process presented here is informal (no external third party has yet evaluated this effort), systematic, regular, and coordinated communication among all stakeholders has helped create a *dependable* and *rational* process that appears to be generally supported by those invested in the issue. The comprehensive approach to identifying and properly *selecting* and removing/securing attractants has helped reduce conflicts with grizzly bears by 91 percent from 2003 to 2009. A downward trend in grizzly bear mortality has been observed in the project area and no known livestock kills have been attributed to grizzly bears since 2004, while FWP reports a slowly expanding (1 to 3 percent per year) grizzly bear population in the Northern Continental Divide Ecosystem. FWP monitoring of grizzly bear activity, conflicts, and bear mortality will help evaluate the long-term success or failure of programs. *Independent* appraisal might generate new ideas for improvements.

Key Challenges

Recolonization of wolves in the Blackfoot watershed beginning in 2009 has generated widespread concern among the community, not unlike the negative perceptions of grizzly bears described earlier in this chapter that were common in the late 1990s and early 2000s. However, the widely differing problem definitions among stakeholders in the Blackfoot watershed regarding wolf numbers, management authority, direct and indirect impacts to livestock, purported impacts to ungulate numbers and hunter opportunity, levels of lethal control, and the BC's nonadvocacy position on wolf management or status under the Endangered Species Act have led a small number of individuals to withdraw formally from BC activities.

TERMINATION/SUCCESSION

Ending or moving on.

Timely

Comprehensive

Dependable

Balanced
Ameliorative

Pre-engagement (1997–2001)

Previous land-use practices (e.g., livestock carcass management, unprotected calving areas) led to increased conflicts.

Engagement (2002–Present):

Previous practices that led to conflicts were abandoned in favor of new practices that helped *ameliorate* conflicts in a *timely* manner. The process of stopping specific practices and shifting to alternatives was collaborative and sought out *balanced* and *comprehensive* solutions. With a strong downward trend in conflicts and bear mortalities observed in the project area, specific programs like electric fencing of calving areas and beehives have been terminated since the bulk of the high-risk areas are now secure. Livestock carcass removal requires long-term maintenance. Overall, the grizzly bear management approach is now characterized by monitoring and maintenance, and additional projects will be implemented as needed.

Key Challenges

Maintaining funding to sustain the annual costs of livestock carcass removal may be difficult.

OVERALL STANDARDS

Honest
Economical
Technically efficient
Loyal and skilled personnel
Complementary and effective impacts
Differentiated structures
Flexible and realistic in adjusting to change
Deliberate
Responsible

Throughout all decision making, *honesty* and trust have been hallmarks of this effort. Regular communication among wildlife managers, researchers, landowners, and ranchers has generated trusting relationships among key stakeholders. The use of *economic* incentives facilitated adoption of

new land-use practices, yet the long-term financial sustainability of core programs and willingness of ranchers to defray future costs will remain a challenge. The partnership that was created by the BC relies on diverse *skill* sets of *technically* trained personnel who can rely on one another to address diverse problems as they arise. This group of stakeholders has come to a place where *loyalty* and *responsibility* are largely invested in the decision process itself, not situated at individual agency or institutional levels, which has helped to prevent any one individual or organization from attempting to appropriate success of the effort.

Appendix 6.4
A Continuum of Local Involvement in Grizzly Conservation

A continuum of local involvement in grizzly conservation and implications for sustainability of carnivore populations and conservation programs (adapted from Wilson, Primm, and Dood 2007).

Least Sustainable

"You're on your own."

Outcome—People eliminate large carnivores.

"Tell them how."

Outcome—People slowly eliminate large carnivores.

"Do it for them" (expert dependency model).

Outcome—Program may be successful in the short term but costly and likely unsustainable.

"Show them how" (technology transfer).

Outcome—More sustainable.

Ownership: Peer educators

Outcome—Coexistence becomes part of local culture.

Most Sustainable

NOTES

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Timothy J. Preso
Joshua R. Purtle
Earthjustice
313 East Main Street
Bozeman, MT 59715
(406) 586-9699 | Phone
(406) 586-9695 | Fax
tpreso@earthjustice.org
jpurtle@earthjustice.org

Counsel for Plaintiffs Sierra Club, Center for Biological Diversity, and National Parks Conservation Association and Local Counsel for Plaintiff Northern Cheyenne Tribe

Joshua Osborne-Klein
Ziontz Chestnut
2101 Fourth Avenue, Suite 1230
Seattle, WA 98121
(206) 448-1230 | Phone
(206) 448-0962 | Fax
joshok@ziontzchestnut.com

Counsel for Plaintiff Northern Cheyenne Tribe

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MONTANA
MISSOULA DIVISION

CROW INDIAN TRIBE, et al., Plaintiffs, v. UNITED STATES OF AMERICA, et al., Federal Defendants, and STATE OF WYOMING, et al. Defendant-Intervenors.	Case No. CV 17-89-M-DLC (consolidated with Case Nos. CV 17-117-M-DLC, CV 17-118-M-DLC, CV 17-119-M-DLC, and CV 17-123-M-DLC) **DECLARATION OF THOMAS MANGELSEN**

DECLARATION OF THOMAS MANGELSEN

I, Thomas Mangelsen, declare as follows:

1. I am a resident of Moose, Wyoming.

2. I am also a member of the Sierra Club.

3. I have worked since the early 1970s as a professional nature photographer. I operate eight "Mangelsen – Images of Nature" galleries in the West and Midwest. I have exhibited photos internationally and have had my work published in National Geographic, BBC Wildlife, Life, Audubon, American Photo, National Wildlife, Smithsonian, Natural History, and Newsweek, among others. I have authored six books of my photographic images, including "Polar Dance: Born of the North Wind" and "The Last Great Wild Places." My work has taken me to numerous locations around the globe to photograph wildlife species including bald eagles, polar bears, Bengal tigers, and African lions. But of all the wildlife in my portfolio—which consists of hundreds of species encompassing millions of images—I have felt the strongest connection to the grizzly bears near my own home in the Jackson Hole valley of northwest Wyoming, and especially to one extraordinary bear identified as 399 and her family.

4. I moved to Jackson Hole 40 years ago. At that time, there were no grizzly bears in this area; they had been killed off by ranchers and trophy hunters many years earlier. That began to change in the early 2000s. I had my first experience with a grizzly bear in the Tetons one early morning in 2005 when I woke up because my dog was barking and saw a grizzly bear standing on the porch of my house near the small community of Moose.

5. In the spring of 2006, friends began to tell me about a female grizzly with triplets that had been observed in Grand Teton National Park east of the Teton Mountains. In September of that year, I caught my first glimpse of this bear—identified by government biologists as 399—

while she and her cubs were feeding on a moose carcass on the shore of the Oxbow Bend of the Snake River. I was intrigued by the presence of this mother grizzly and her cubs in Grand Teton National Park after such a lengthy absence of grizzlies from Jackson Hole. In the spring of 2007, I began following 399 daily and photographing her.

6. I spent several weeks in 2007 rising at dawn every morning and staying out past dusk watching 399 and her cubs. Three of my photographs of 399 that have been popular with the public, images called "Snow Mittens," "Grizzly Comfort," and "Spring Bouquet Along Pilgrim Creek," date from this period. They are attached to this declaration, respectively, as Exhibits 1, 2, and 3. They accurately depict what I saw when I photographed them.

7. One particularly memorable observation of 399 and her cubs that year occurred in the area of Willow Flats near Jackson Lake Lodge in Grand Teton National Park. In the late spring, cow elk often graze in the open meadows of Willow Flats and use the protective cover of the extensive willow stands in that area as a safe place to give birth to their calves. One evening in 2007, I watched from the hotel patio at Jackson Lake Lodge—along with hundreds of other onlookers—as 399 and her cubs hunted the willows below the lodge in search of recently born elk calves. To have a beautiful sow and three cubs so visible doing the things that wild grizzlies are supposed to do, and with the Tetons rising above them as a backdrop, that is as dramatic a setting as you're ever going to find. One of my images of 399 and her cubs hunting elk calves in the Willow Flats near Jackson Lake Lodge is attached as Exhibit 4. It accurately depicts what I saw when I photographed it.

8. Another significant incident involving 399 also happened in 2007. Based on reports that I received, I understand that in June of that year a guest at the Jackson Lake Lodge inadvertently walked up to within a few yards of 399 and her cubs while they were standing over

a dead elk calf. As a result, 399 charged the man, knocked him down, and bit him on the back and rump—and then she left him alone. News of this encounter went viral on social media and public interest in 399 and her cubs skyrocketed overnight.

9. In the weeks following this incident, 399 and her cubs were highly visible at locations in Grand Teton National Park including the Oxbow Bend and Willow Flats and also Pacific and Pilgrim Creeks and Colter Bay. People began to flock to the park to see them and crowds would gather where they were sighted—30 to 50 people at first but then growing into "bear jams" of cars on park roads sometimes involving hundreds of people. These situations had the potential to be dangerous for both bears and people, so Grand Teton National Park formed a volunteer "Wildlife Brigade" to direct traffic and clear a space for bears to cross the road when such incidents occurred. To my mind, it was a miracle in those early years that 399 stayed alive, that she kept her cool and did not feel threatened as she and the cubs moved around cars and people. She showed herself to be a very intelligent bear, oftentimes stopping to look both ways for traffic before leading her small cubs across a busy highway. One of my images of 399 and her cubs navigating a throng of human onlookers in Grand Teton National Park is attached as Exhibit 5. It accurately depicts what I saw when I photographed it.

10. One of these "bear jam" incidents led to another of my remarkable experiences observing 399 and her cubs. One day 399 was feeding in tall sage near Colter Bay. She was somewhat far away from her yearling cubs and they could not see her because of the intervening vegetation. While they were separated in this way, the cubs ran across the park road that runs through the area. Immediately they were spotted by people driving by, who stopped their vehicles to view the bears. The resulting "bear jam" ended up further separating the cubs from their mother as traffic backed up on the highway that separated 399 from her offspring. The cubs

and 399 began bawling in an effort to locate each other, but the noise emanating from the "bear jam"—which at this point included a couple of large diesel trucks—was too loud for them to hear each other's calls. As this went on, 399 became increasingly frantic in her search for her cubs. Finally, after an extended separation, they caught up with each other and 399 immediately began nursing her cubs. To my eye, this appeared to be nothing less than a loving reunion. In my experience, when you see something like that, you start looking at bears differently—not as monsters but as sentient, emotional, intelligent beings.

11. Over the ensuing years, 399 has become the matriarch of an extended grizzly family in Grand Teton. In 2011, one of her cubs from that 2006 litter—a bear that researchers identified as 610—emerged from her winter den with her own set of twin cubs. That same year, 399 emerged with her second brood of triplets. This was frosting on the cake. The presence of the two grizzlies, mother and daughter, both with cubs drew even more onlookers to Grand Teton National Park and made national and international news. An Associated Press story about this phenomenon ran in over 225 different media outlets that summer. One day I received an email from the eminent primatologist Dr. Jane Goodall, whom I had met when she visited Jackson Hole to deliver a speech, telling me that she had seen a story and photos about these bears in the London Daily Mail. Remarkably, during the course of that summer one of 399's cubs was adopted by her daughter, 610, leaving 399 with twins and abruptly vesting 610 with triplets. 399 had her third set of triplets in 2013, while 610 had a single cub in 2014 that did not survive and her second set of twins in 2015. In all, 399 is known to have birthed 13 cubs between 2004 and 2017.

12. In the intervals between weaning one set of cubs and birthing another, 399 has ranged by herself, sometimes consorting with big male grizzly bears nicknamed Brutus and

Bruno. I have continued to watch and photograph 399 during these periods. She was without any cubs for two years and the years that she did have cubs, when they were approximately 2 ½ years old, she would "kick" them out to be on their own, usually in late May. She would then be without cubs during summer, fall and winter. The point being there were many fall seasons during her life that a hunter would have no idea whether she was a female or a male, or a female that was pregnant. I have seen literally thousands of grizzlies from Alaska, Canada and the Greater Yellowstone that unless they had cubs with them I could not sex them positively. One October day in 2010, I was ready with my camera when, shortly before sunrise a bear, who I believed to be 399, emerged from the willows just north of Oxbow Bend and forded the Snake River. The resulting picture, "First Light—Grizzly Bear," became the cover image for my 2014 book, "The Last Great Wild Places." This image is attached to this declaration as Exhibit 6. It accurately depicts what I saw when I photographed it.

13. I have continued to rise at dawn to seek out and photograph 399 or one of her descendants—or any of the other grizzlies that have reclaimed their historic territory in Jackson Hole. In 2016, writer Todd Wilkinson and I collaborated on a book about 399 and her family called "Grizzlies of Pilgrim Creek." The book features many of my photographs of 399 and other grizzlies in Jackson Hole, Yellowstone and nearby areas.

14. This past spring of 2017, 399—who is now believed to be 21 years old—emerged from her winter den with yet another set of cubs, this time twins. Every spring I breathe a sigh of relief when I first see her or hear of her return. The crowds still gather to see her and the other grizzlies. In fact, today they are larger than ever. Earlier this spring, I was out viewing 399 with approximately 125 other people in Grand Teton National Park. I met a teacher and science class

of 48 kids from Olathe, Kansas. They had traveled from Kansas to Grand Teton some of whom came with the specific goal of seeing 399.

15. In the past few years I have begun making and distributing stickers for the onlookers in these crowds. The stickers say "I Saw Grizzly 399" and people tell me they have seen them on vehicles from all over the country.

16. I intend to continue to venture into Grand Teton National Park and surrounding areas for the purpose of viewing and photographing 399 and her progeny, along with other grizzly bears, for as long as I am able. I have specific plans to continue to document these iconic bears and to fight for their protection as a threatened species under the endangered species act.

17. I understand that the U.S. Fish and Wildlife Service issued a decision to remove the Yellowstone-area grizzly bear population from the list of threatened species under the Endangered Species Act on June 30, 2017. I am concerned that this decision reduces legal protections for grizzly bears in areas that I frequent, including reducing protections for grizzly habitat. In addition, the transfer of jurisdiction over grizzlies from the federal Fish and Wildlife Service to state agencies opens up a new threat that grizzlies—including 399 and other specific individual grizzlies that I seek to observe, experience, and photograph—will be recreationally hunted for trophies.

18. I am particularly concerned about this threat because 399, 610, and other grizzlies living in Jackson Hole and the Teton Range do not spend all of their denning or non-denning period in the refuge of Grand Teton National Park. In particular, 399 and 610 are documented to travel out of the park up Pacific Creek and Pilgrim Creek into the Bridger-Teton National Forest. I have also frequently observed these bears in the fall consuming gut piles and other remains of elk left by hunters, which is a food source that draws grizzlies out of the park and into the

surrounding national forest and the proximity of hunters. I have personally viewed 399's winter denning area in the high reaches of the upper Pilgrim Creek drainage, which is also outside the park. These transboundary grizzlies have no idea where they are in relation to the administrative boundaries of the national park or hunting authorizations. Also, these bears are very tolerant of people from their many years of exposure to crowds in Grand Teton, therefore, they will be easily approached by grizzly hunters. Each of these factors threatens to subject these bears to killing due to state-sponsored hunting that is now contemplated in Wyoming. There are agency plans to not only have a fall but a springtime grizzly bear hunt if they are delisted.

19. The fact that state-sponsored hunting is not intended to target female bears does not negate this threat. It will be difficult for any hunter to discern the difference between 399 or 610 and a male bear during those years when these females do not have any cubs, or at any time when they are observed away from their cubs as I have frequently seen them. In those situations, the threat is very real that 399, 610, or other female grizzly bears will be shot regardless of any state limitations on hunting of females.

20. In my experience, the world is already very dangerous for these grizzly bears. While 399 and her line of cubs have remarkably added 18, and counting, new grizzlies to the Greater Yellowstone population, half of them are documented dead, an unknown number are also likely dead. Those documented dead are due to instances ranging from conflicts with deer and elk hunters, management removals and auto strikes. The above figures point out the importance of each female grizzly in the ecosystem. I fear that state-sponsored hunting will simply add to these already substantial losses.

21. For the record – I grew up in Nebraska on the Platte River in a family of avid hunters and fishermen. My father taught me a great deal about sportsmanship and fair chase in

the act of pursuing our quarry. Our whole lives centered around hunting and fishing. We always treated what we hunted with respect and dignity and ate everything we killed. Killing for killings sake was never part of my upbringing. We built blinds and made our own duck and goose decoys. My father taught me how to call ducks and geese so well that I won the World's Goose Calling Championship twice, the youngest to do so at the time. My father would roll over in his grave at the thought of shooting a species like grizzly bears, wolves or cougars purely for fun. I no longer hunt with a gun only with my camera. I have no problem with hunters that are ethical and hunt for food.

22. If 399 were killed in a state-sponsored hunting season, the effect for me of losing this individual bear that I have known for 10 years would be like losing a family member. It is a joy for me to see her and her progeny every spring year after year. Maybe once in a lifetime an animal like this appears and her mere presence seems to galvanize everything. An icon of motherhood. An emblem of wildness. A sentient creature who has taught us new ways to think about others of her kind. The loss of 399 or 610 to state-sponsored hunting would also represent a great loss for my interest in grizzly conservation. These bears are ambassadors for the most popular wildland destination in the lower 48. They have learned to navigate the front country of one of our nation's busiest national parks with little conflict with humans and human activity, and they have taught their cubs that skill as well. It would be a great blow to me and my interest in grizzlies for someone to come in here and take a beloved asset, so synonymous with all of the good things Jackson Hole stands for, kill it, and cart it away like a stack of cordwood in the back of a pickup.

23. In short, if the Yellowstone grizzly delisting stands with the result that 399 and other grizzlies are subjected to the threats posed by state-authorized hunting, my interests in

grizzly bears and grizzly conservation will be irreparably harmed. The loss to millions of Americans and people around the world who come specifically for the opportunity to get a glimpse of bears in the Greater Yellowstone is unimaginable.

I declare under penalty of perjury that the foregoing is true and correct. Executed on September 1, 2017 in Moose, Wyoming.

Thomas Mangelsen

State of WYOMING County of TETON
Subscribed and sworn before me on 9/1/17
(Date)

(Notary Signature)

R. DAVISON - NOTARY PUBLIC
County of Teton
State of Wyoming
My Commission Expires September 23, 2017

Exhibit 1

to Declaration of Thomas Mangelsen

Exhibit 2

to Declaration of Thomas Mangelsen

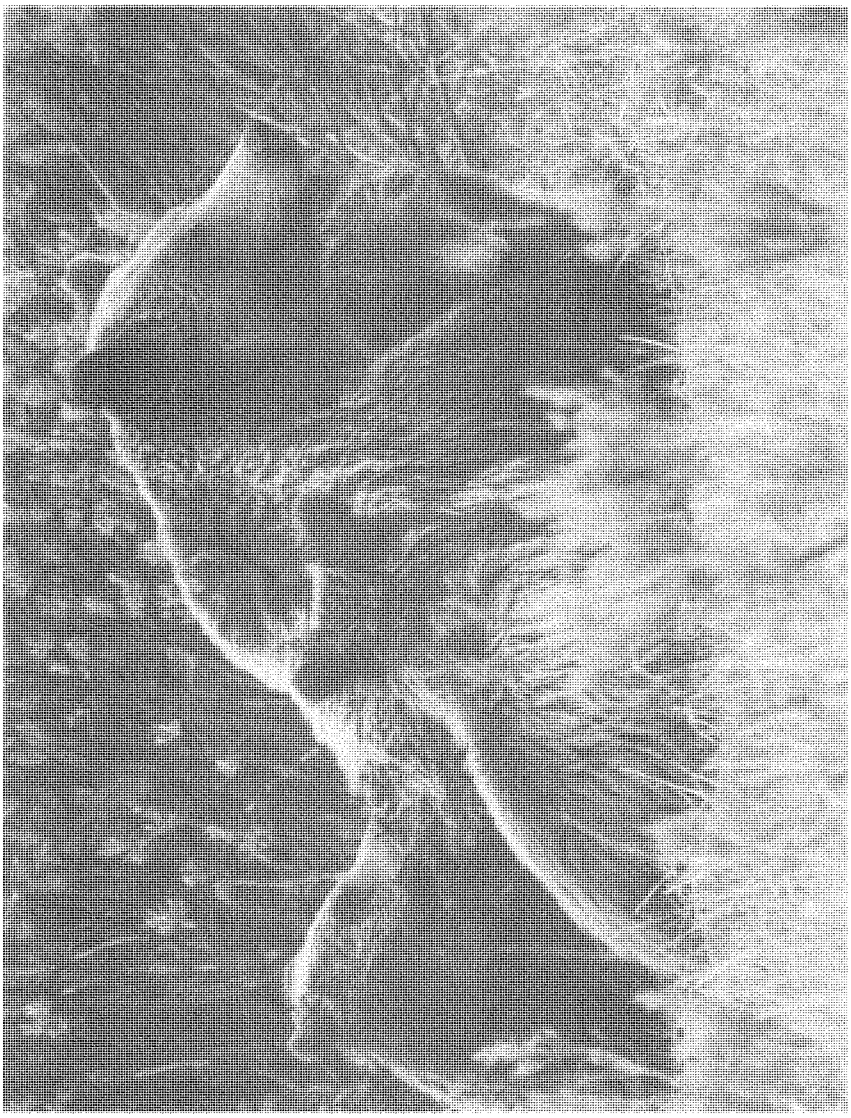

Exhibit 3

to Declaration of Thomas Mangelsen

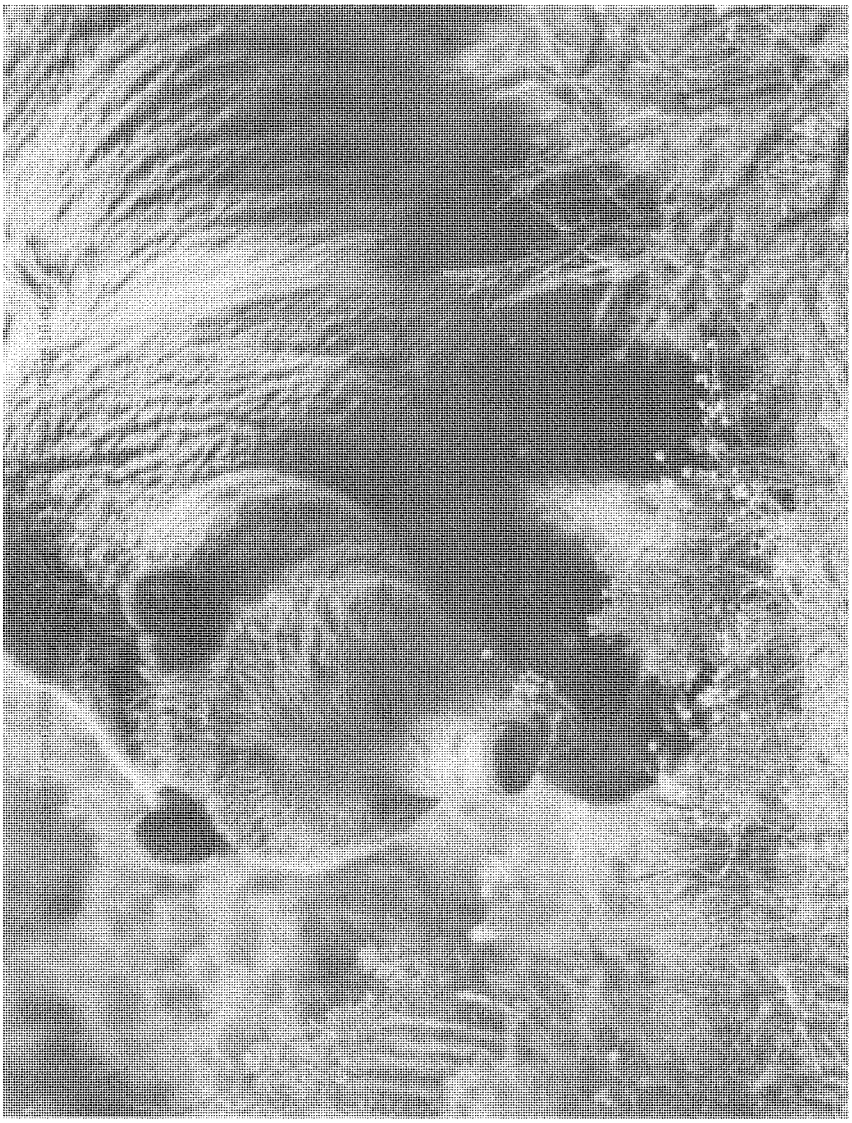

Exhibit 4

to Declaration of Thomas Mangelsen

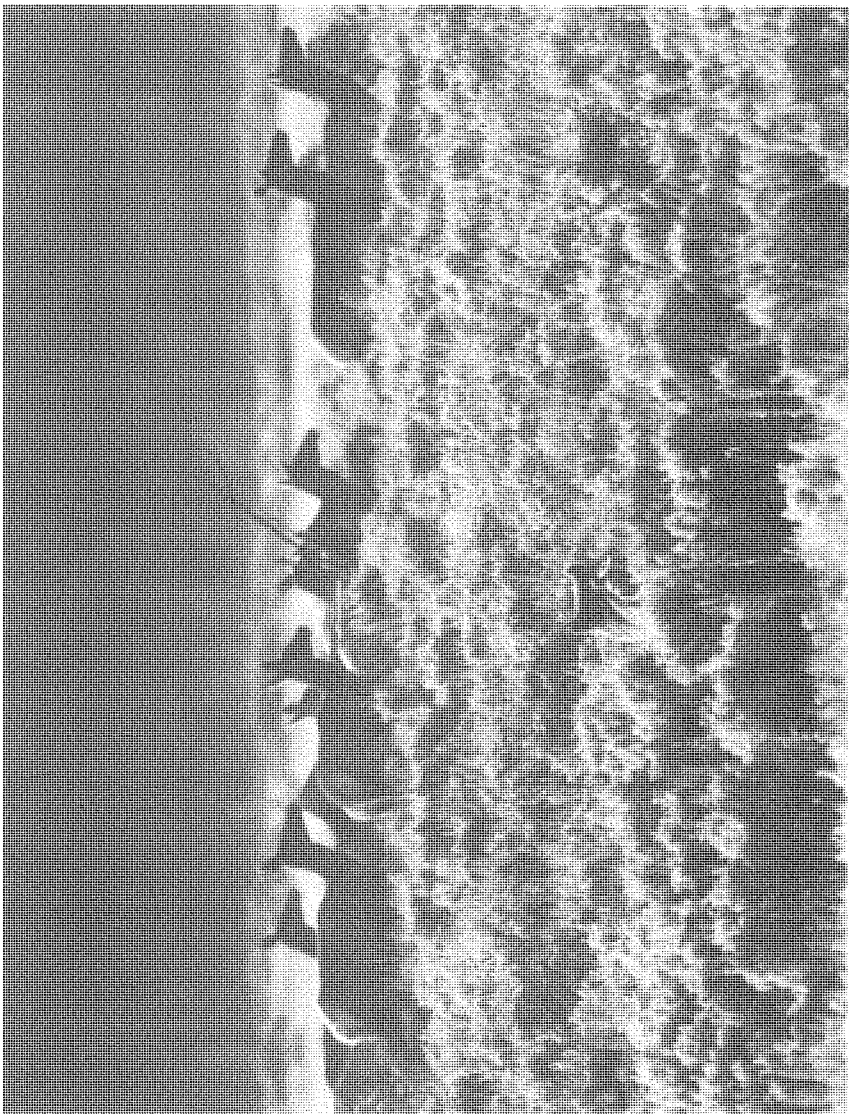

Exhibit 5

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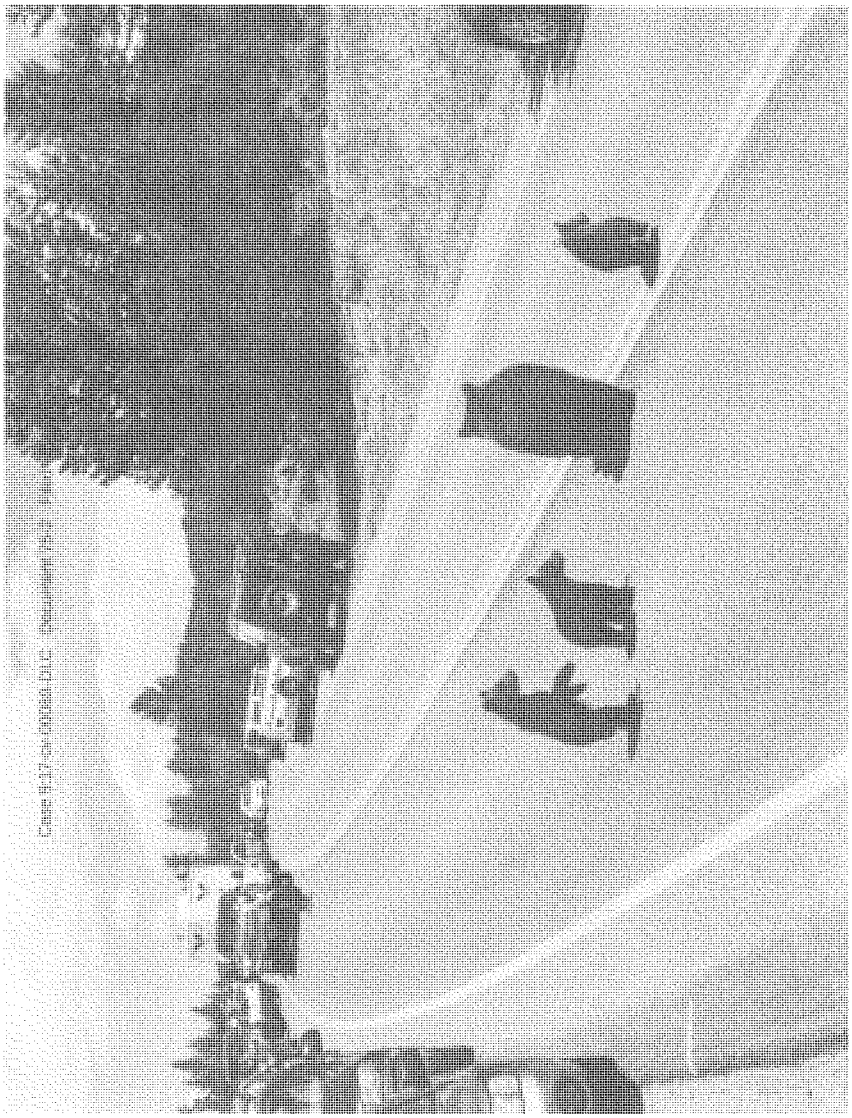
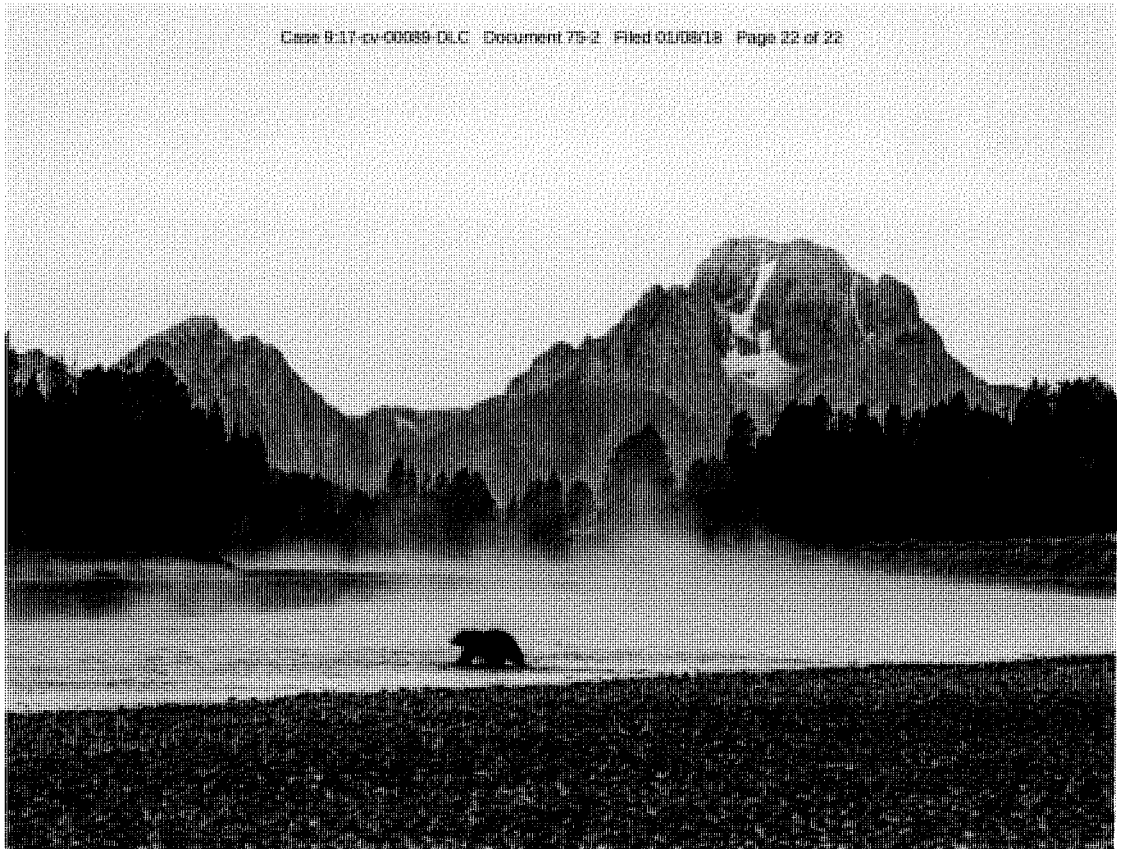


Exhibit 6

to Declaration of Thomas Mangelsen



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.

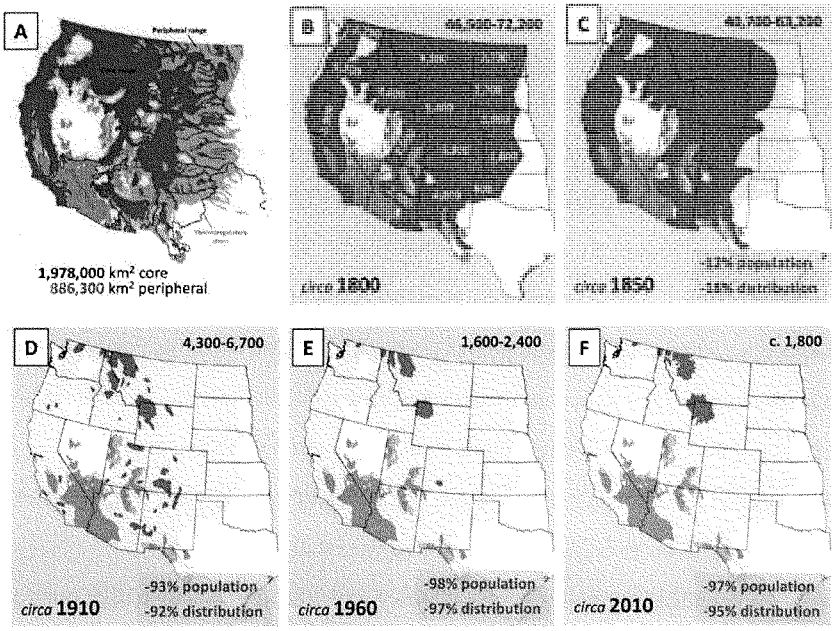


Figure 1. Losses of grizzly bear numbers and distributions in the western contiguous United States between 1800 and 1960 (Panels B, C, D, and E) along with the extent of gains since roughly 1970 (Panel F), largely under ESA protection. The extent of grizzly bear distributions at each time step are shown 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 4[1]) 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 phylogenetisists 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 auxliaris*), 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

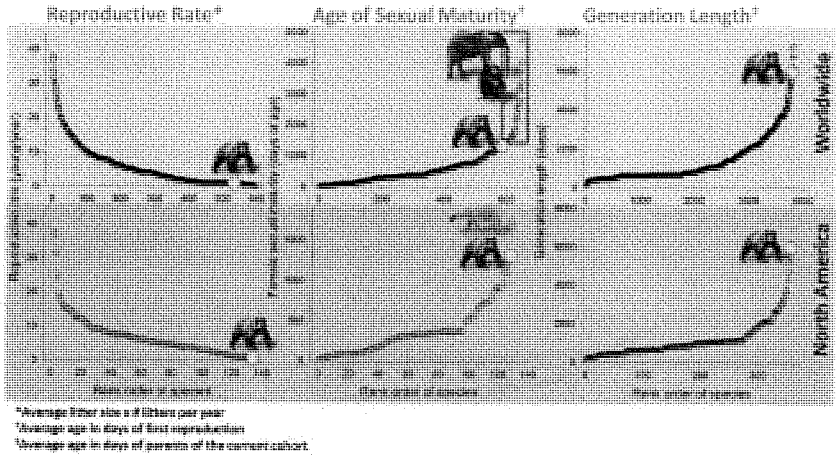


Figure 2. Signifiers of population productivity for grizzly bears (large yellow dots) relative to all other terrestrial mammals, worldwide (top) and in North America (bottom). Sources: Ernest, S. K. (2003). Life history characteristics of placental nonvolant mammals. Ecology, 84(12), 3402-3402. https://doi.org/10.6084/m9.figshare.c.3297992.v1; 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 philopatry[2] 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 (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.

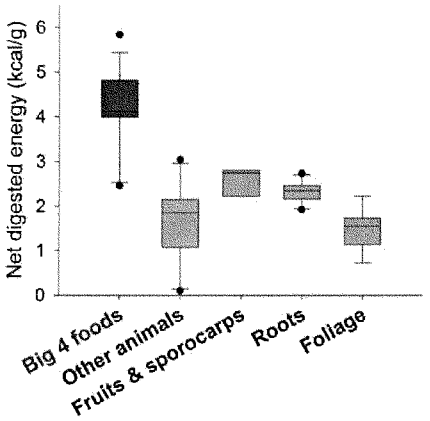


Figure 3. Median net digested energy available from the "Big 4" bears foods (whitebark pine seeds, army cutworm moths, meat from bison and elk, and cutthroat trout) versus all other known, alternate, foods in the GYE.

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.

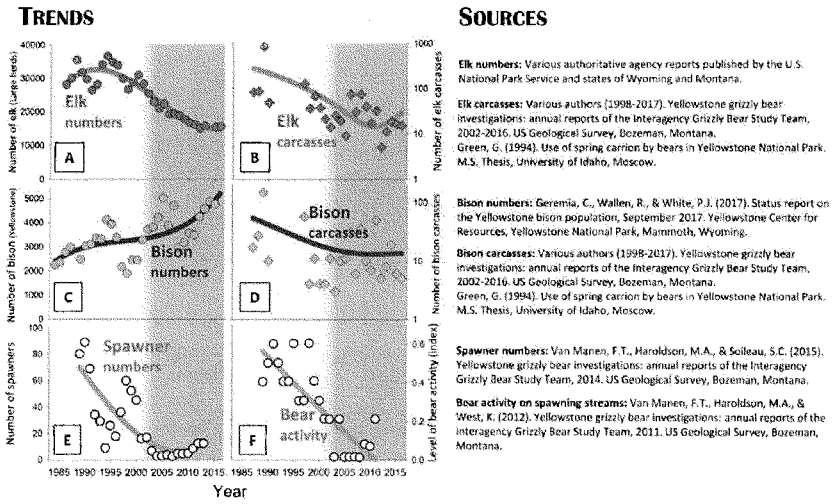


Figure 4. Summary of trends in availability of three important Greater Yellowstone Ecosystem grizzly bear foods, including: (A) size of the Northern Yellowstone and Jackson elk herds; (B) numbers of elk carcasses counted along fixed transects in Yellowstone National Park; (C) size of the Northern and 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).

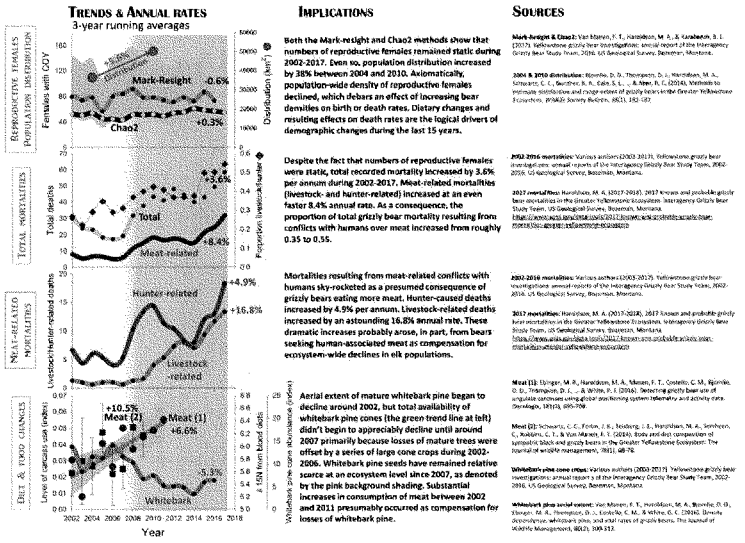


Figure 5. Synopsis of population, mortality, and dietary trends of Greater Yellowstone Ecosystem grizzly bears relevant to dynamics unfolding from 2002 to 2017. Sources for each data time series are provided farthest right, with a brief discussion of implications provided in the middle column. The pink-shaded 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, invariate 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

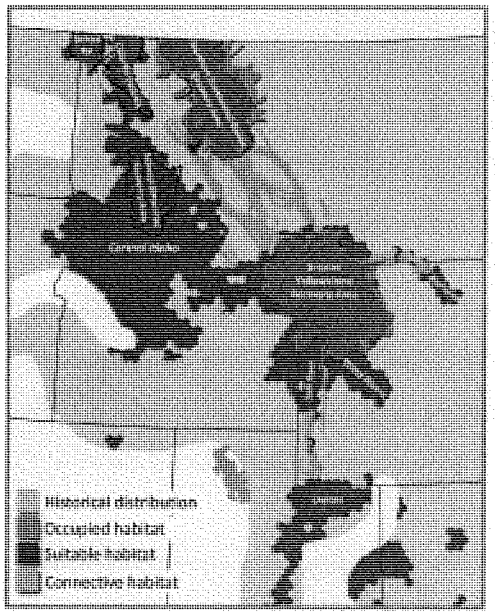
burden of deaths caused by sport hunting.

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:

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Suitable habitat:

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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.

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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.

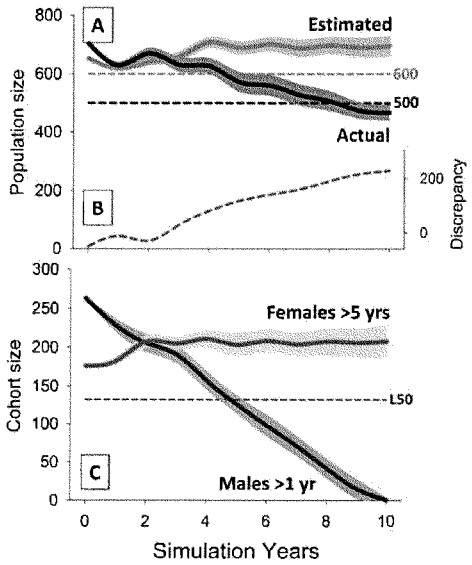

Figure 7. 10-year population projections simulating implementation of MOA protocols for management of grizzly bears inside the Yellowstone DMA. Estimated population size increasingly exceeds real population size over time (A), with over-estimates reaching near 200 bears by 10 years out (B), largely because 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

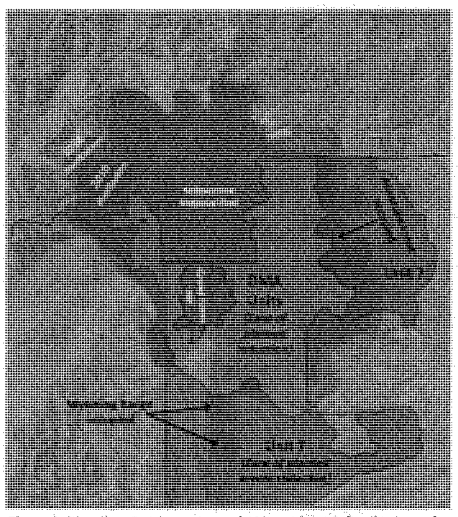

Figure 8. Map showing the estimated 2010 and 2016 distributions of the Greater Yellowstone grizzly bear population overlain by Wyoming and Idaho hunting units within which grizzlies will be sport hunted beginning September 1, 2018. Hunting units within the Demographic Monitoring Area (DMA) are differentiated 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.

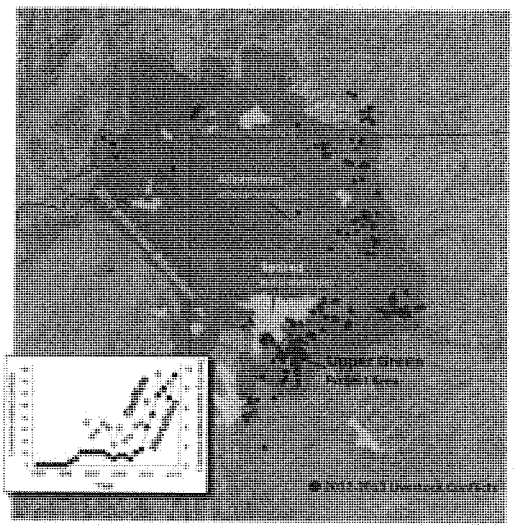

Figure 9. Distribution of grizzly bear depredation on livestock and related conflicts in the GYE during 2012-2013 (dark red dots) along with *circa* 2010 grizzly bear distribution (green), recently retired public land grazing allotments (yellow) and active allotments identified as having chronic conflicts.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

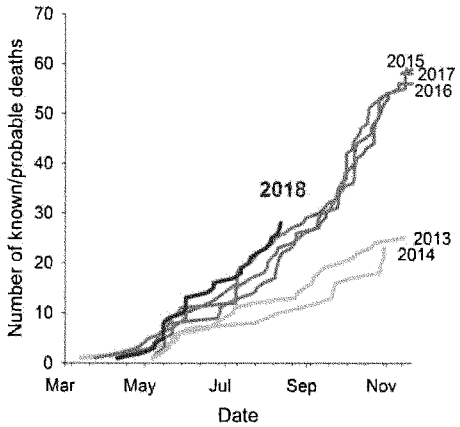

Figure 10. Annual accumulation curves for known and probable grizzly bear deaths in the GYE during 2013-2018. Deaths are attributable to all causes both inside and out of the DMA. The accumulation curve for 2017 in includes four deaths that occurred late in 2017 but were not detected until spring 2018. 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), Robbinson 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 depensatory effects on birth and death rates (Stringham 1980, Swenson et al. 1997, Wielgus et al. 2013, Gosselin et al. 2015, Frank et al. 2017, Bishof 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; Bishof 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 depensatory 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 depensatory,

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.

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 eougars: 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 form 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 Tuner 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 dynamies 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 JJ1*, submitted to *Human Dimensions of Wildlife*, Yale School of Forestry & Environmental Studies, New Haven, CT, 2007-2008.

17. Reader for Taijs van Maasakkers, *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 form 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 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. Käre 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 assistanee 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 seientist'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-Escalanate 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. Sweanor. (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, Corvalis, 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**)

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.

(18) BIBLIOGRAPHY

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.

89. Hart, J., **D. Mattson** & T. Arundel (2007). Background and methods for investigating mountain lions in the Flagstaff Uplands. Pages 6-16 *in* D. Mattson, editor. *Mountain Lions of the Flagstaff Uplands: 2003-2006 Progress Report*. USGS Open-File Report 2007-1062.

88. Arundel, T., **D. Mattson** & J. Hart (2007). Movements and habitat selection by mountain lions in the Flagstaff Uplands. Pages 17-30 *in* D. Mattson, editor. *Mountain Lions of the Flagstaff Uplands: 2003-2006 Progress Report*. USGS Open-File Report 2007-1062.

87. Wilson, S.M., M.J. Madel, **D.J. Mattson**, J.M. Graham, & T. Merrill (2006). Landscape conditions predisposing grizzly bears to conflicts on private agricultural lands in the western USA. *Biological Conservation* 130: 47-59.

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.

85. Wilson, S.M., M.J. Madel, **D.J. Mattson**, J.M. Graham, J.A. Burchfield, & J.M. Belsky (2005). Natural landscape features, human-related attractants, and conflict hotspots: A spatial analysis of human-grizzly bear conflicts. *Ursus* 16: 117-129.

84. Van Riper, C., III, & **D.J. Mattson**, editors (2005). *The Colorado Plateau II: Biophysical, Socioeconomic and Cultural Research.* University of Arizona Press, Tucson, AZ.

83. **Mattson, D.J.**, S.R. Podruzny, & M.A. Haroldson (2005). Consumption of pondweed rhizomes by Yellowstone grizzly bears. *Ursus* 16: 41-46.

82. **Mattson, D.J.**, S. Herrero & T. Merrill (2005). Are black bears a factor in the restoration of North American grizzly bear populations? *Ursus* 16: 11-30.

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.

80. **Mattson, D.J.** (2005). *Foraging Behavior of North American Bears.* USGS Southwest Biological Science Center, Flagstaff, AZ. 9 pp. http://sbsc.wr.usgs.gov/cprs/research/projects/grizzly/pdf/FORAGINGBEHAVIOROFNORTHAMERICANBEARS.pdf.

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1. Brunsfeld, S.J., L. Ashland, C.R. Hatch, **D.J. Mattson**, A.L. Merkel, M. Sargent & G.H. Savage (1982). *Biomass resources in 66 African, Asian, and Latin American countries.* University of Idaho Forestry, Wildlife & Range Experiment Station, Contribution 231.

(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.
USGS Research Wildlife Biologist and Research Station Leader (retired)
Lecturer and Senior Visiting Scientist, Yale School of Forestry & Environmental Studies (retired)
Livingston, MT

Kyle Artelle, Ph.D.
Postdoctoral Fellow and Biologist
University of Victoria and Raincoast Conservation Foundation
Bella Bella, British Columbia

Jonathan Balcombe, Ph.D.
Biologist and author
Boynton Beach, FL

Valerie S. Banschbach, Ph.D.
Professor and Chair,
Environmental Studies
Roanoke College
Salem, VA

Robert L. Beschta Ph.D.
Emeritus Professor
Forest Ecosystems and Society
Oregon State University
Corvallis, OR

Bradley Bergstrom, Ph.D.
Professor, Biology Department
Valdosta State University
Valdosta, GA

Goran E. D. Blomberg, Ph.D.
Wildlife Ecology,
Michigan State University (Retired)
Lansing, MI

Gail Blundell, Ph.D.
Retired, Division of Wildlife Conservation
Alaska Department of Fish and Game
Juneau, Alaska

Barbara Brower, Ph.D.
Professor, Department of Geography
Portland State university
Portland, Oregon

Heather Bryan, Ph.D.
Raincoast - MITACS Postdoctoral Scholar
Applied Conservation Science Lab
Department of Geography, University of Victoria
&
Biologist
Raincoast Conservation Foundation
Sidney, British Columbia

F. Stuart Chapin III, Ph.D.
Professor Emeritus of Ecology
Institute of Arctic Biology
University of Alaska Fairbanks
Fairbanks, AK

Guillaume Chapron, Ph.D.
Associate Professor, Department of Ecology
Swedish University of Agricultural Sciences
Riddarhyttan, Sweden

Peter Chesson, Ph.D.
Professor, Department of Ecology and Evolutionary Biology
University of Arizona
Tucson, Arizona

Susan G. Clark, Ph.D.
Joseph F. Cullman 3rd Adjunct Professor of Wildlife Ecology and Policy Sciences
School of Forestry & Environmental Studies, and
Fellow, Institution for Social & Policy Studies
Yale University - Kroon Hall
New Haven, CT

Scott Creel, Ph.D.
Professor, Department of Ecology
Montana State University
Bozeman, MT

Irene Crowe, Ph.D.
President
Pettus Crowe Foundation
Washington, DC

Brooke Crowley, Ph.D.
Associate Professor, Departments of Geology and Anthropology
University of Cincinnati
Cincinnati, OH

Chris Darimont, Ph.D.
Raincoast Chair and Associate Professor
University of Victoria
&
Director of Science
Raincoast Conservation Foundation

Megan Draheim, Ph.D.
Faculty, Center for Leadership in Global Sustainability
Virginia Tech
Arlington, VA

Lawrence K. Duffy, Ph.D.
Director, Resilience and Adaptation Program
University of Alaska Fairbanks
Fairbanks, AK

John G. Duman, Ph.D.
Gillen Professor of Biological Sciences
University of Notre Dame
Notre Dame, IN

Jorge Echegaray, M.S.
Environmental Sciences
Researcher at GADEN
Vitoria-Gasteiz, Alava, Spain

William J. Etges, Ph.D.
Professor
Program in Ecology and Evolutionary Biology
Department of Biological Sciences
University of Arkansas
Fayetteville, AR

Robert A. Evans, M.S.
Supervisory Wildlife Biologist
USDA Forest Service (retired)
Iron River, MI

Tracy S. Feldman, Ph.D.
Assistant Professor
Department of Natural and Life Sciences
St. Andrews University
Laurinburg, NC

Daniel C. Fisher, Ph.D.
Professor, Department of Earth & Environmental Sciences
Professor, Department of Ecology & Evolutionary Biology
University of Michigan
Ann Arbor, MI

Jed Fuhrman, Ph.D.
McCulloch-Crosby Chair of Marine Biology
Department of Biological Sciences
University of Southern California
Los Angeles, CA

Barrie K. Gilbert, Ph.D.
Senior Scientist (retired)
Department of Wildlife Resources
Utah State University
Logan, UT

Bob Gillespie, Ph.D.
Coordinator Agriculture and Natural Resource Program
Agriculture and Natural Resource Program
Wenatchee Valley College
Wenatchee, WA

Anthony J. Giordano, Ph.D.
Founder & Chief Conservation Scientist
S.P.E.C.I.E.S.
Ventura, CA

John Grandy, Ph.D.
Executive Director
The Pegasus Foundation
&
Representative
The Pettus Crowe Foundation
Washington, D.C.

Donna Hart, Ph.D.
Department of Anthropology (retired)
University of Missouri
St. Louis, Missouri

Rick Hopkins, Ph.D.
Senior Conservation Biologist
Live Oak Associates, Inc.
San Jose, CA

Malorri Hughes, M.S.
Ph.D. Candidate, Biology Department
Portland State University
Portland, Oregon

Marian Kaehler, Ph.D.
Professor
Department of Biology
Luther College
Decorahm, IA

Ken Keefover-Ring, Ph.D.
Assistant Professor, Departments of Botany and Geography
University of Wisconsin-Madison
Madison, WI

Knut Kielland, Ph.D.
Associate Professor
Dept. of Biology & Wildlife
Institute of Arctic Biology
Fairbanks, AK

Alex Krevitz, M.A.
Biologist
Coarsegold, CA

Jennifer Leonard, Ph.D.
Principal Investigator, Conservation and Evolutionary Genetics Group
Estacion Biologica de Doñana (CSIC)
Seville, Spain

John Laundre, Ph.D.
Assistant Professor, Department of Biology
Western Oregon University
Monmouth, Oregon

Jesse A. Logan, Ph.D.
Project Leader (retired)
Rocky Mountain Research Station
USDA Forest Service

Wayne P. McCrory, B.Sc. (Hon. Zool. UBC), RPBio.
President, McCrory Wildlife Services Ltd.
New Denver, B.C. Canada

Andrew Martin, Ph.D.
Professor
Department of Ecology and Evolutionary Biology
University of Colorado
Boulder, CO

John Miles, Ph.D.
Professor Emeritus
Huxley College of Environmental Studies
Western Washington University
Arroyo Seco, NM

Susan Morgan, Ph.D.
Board Chair
The Rewilding Institute
Arroyo Seco, NM

Michael Paul Nelson, Ph.D.
Professor, Department of Forest Ecosystems and Society
Oregon State University
Corvallis, OR

Ronald M. Nowak, Ph.D.
Staff Mammalogist (retired)
Office of Endangered Species
U.S. Fish and Wildlife Service
Falls Church, VA

Paul C. Paquet, Ph.D.
Professor, Geography Department
University of Victoria, Victoria, BC
&
Senior Scientist, Raincoast Conservation Foundation
Sidney, BC

Debra Patla, M.S.
Research Associate
Greater Yellowstone Ecosystem Amphibian and Wetland Monitoring Project
Northern Rockies Conservation Cooperative
Moran, WY

Rebecca Parmenter, M.S.
Region II, NEPA Biologist (Retired)
U.S. Forest Service
Broomfield, CO

Kathleen Perillo, M.S.
Professor
Earth and Environmental Science
Clark College
Vancouver, WA

Mike Phillips, M.S.
Executive Director
Turner Endangered Species Fund
Bozeman, MT
&
State Senator, District 31,
Bozeman, MT

Eric R. Pianka, Ph.D.
Professor, Integrative Biology
University of Texas
Austin, TX

Rich Reading, Ph.D.
Associate Research Professor
Department of Biology
University of Denver
Denver, CO
&
Director of Research and Conservation
Butterfly Pavilion
Westminster, CO

Ian J. Renne, Ph.D.
Associate Professor, Department of Biological Sciences
Youngstown State University
Youngstown, OH

William J. Ripple, Ph.D.
Distinguished Professor of Ecology
Oregon State University
Corvallis, OR

Andrew Rowan, Ph.D.
Chief Scientific Officer
The Humane Society of the United States
Washington, DC

Paula Schiffman, Ph.D.
Professor
Department of Biology
California State University
Northridge, CA

Heidi H. Schmidt, M.S.
Curatorial Assistant
Missouri Botanical Garden
Saint Louis, MO

Richard C. Schultz, Ph.D.
Professor
Natural Resource Ecology and Management
Iowa State University
Ames, Iowa

Thomas C. Shirley, Ph.D.
Professor Emeritus
College of Fisheries & Ocean Sciences
University of Alaska Fairbanks
Fairbanks, AK
&
Professor Emeritus
Department of Biological Sciences
Texas A&M Univ.-Corpus Christi
Corpus Christi, TX

Steven R. Sheffield, Ph.D.
Professor of Biology
Department of Natural Sciences
Bowie State University
Bowie, MD

Winston P. Smith, Ph.D.
Principal Research Scientist
Institute of Arctic Biology
University of Alaska
Fairbanks, Alaska

Stephen F. Stringham, Ph.D.
President WildWatch
Director - Bear Viewing Association
Soldotna, Alaska

Teresa Telecky, Ph.D.
Vice President, Wildlife Department
Humane Society International
Washington, DC

Margaret K. Thayer, Ph.D.
Curator Emeritus, Field Museum, Life Sciences
Lecturer, Committee on Evolutionary Biology
University of Chicago
Chicago, IL

Blaire Van Valkenburgh, Ph.D.
Professor
Department of Ecology and Evolutionary Biology
University of California
Los Angeles, CA

Vic Van Ballenberghe, Ph.D.
Research Wildlife Biologist (retired)
U.S. Forest Service, Pacific Northwest Experiment Station
Anchorage, Alaska

Sacha Vignieri, Ph.D.
Senior Editor, *Science*
Seattle, WA

Samuel K Wasser, Ph.D.
Endowed Chair in Conservation Biology
Director, Center for Conservation Biology
Research Professor, Department of Biology
University of Washington
Seattle, WA

Jonathan G. Way, Ph.D.
Founder, Eastern Coyote/Coywolf Research
Osterville, MA

Matthew Weirauch, Ph.D.
Associate Professor, Department of Pediatrics
University of Cincinnati
Cincinnati, Ohio

Robert Wielgus, Ph.D.
Professor and
Director Large Carnivore Conservation Laboratory
Washington State University
Pullman, Washington

cc:
U.S. Senator John John Barrasso
U.S. Senator Mike Enzi
U.S. Congresswoman Liz Cheney
Diane Shober, Wyoming Office of Tourism
Scott Talbott, Director, Wyoming Game and Fish Department
Mark Anselmi, President, Wyoming Game and Fish Commission

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