Environmental Assessment

GRAY WOLF DAMAGE AND CONFLICT MANAGEMENT IN WYOMING

Lead Agency:	UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS) WILDLIFE SERVICES (WS) - WYOMING
Cooperating Agencies:	WYOMING GAME AND FISH DEPARTMENT
	U. S. FISH AND WILDLIFE SERVICE
Consulting Agencies:	WYOMING DEPARTMENT OF AGRICULTURE
	U.S. FOREST SERVICE
	BUREAU OF LAND MANAGEMENT (BLM)
	NORTHERN ARAPAHOE TRIBE

October 2015

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ACRONYMS

ADM B	Animal Damage Management Board
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BLM	Bureau of Land Management
CDFG	California Department of Fish and Game
CDV	Canine distemper virus
CE	Categorical Exclusion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CPV	Canine Parvovirus
DOW	Defenders of Wildlife
DPS	Distinct Population Segment
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
GTNP	Grand Teton National Park
GYA	Greater Yellowstone Area
IDFG	Idaho Department of Fish and Game
IGBC	Interagency Grizzly Bear Study Team
ILWOC	Idaho Legislative Wolf Oversight Committee
IWDM	Integrated Wildlife Damage Management
IUCN	International Union for Conservation of Nature
LRMP	Land and Resource Management Plan
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NER	National Elk Refuge
NHPA	National Historic Preservation Act
NOA	Notice of Availability
NRDC	Natural Resources Defense Council
NRM	Northern Rocky Mountains
NWRC	National Wildlife Research Center
RAG	Radio Activated Guard
RMP	Resource Management Plan
SHPO	State Historic Preservation Office
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USC	United States Code
USDA	U. S. Department of Agriculture
USDI	U. S. Department of Interior
USFWS	U. S. Fish and Wildlife Service
USFS	U. S. Forest Service
WDA	Wyoming Department of Agriculture
WGFC	Wyoming Game and Fish Commission

WGFD	Wyoming Game and Fish Department
WHA	Wolf Hunting Area
WTGMA	Wolf Trophy Game Management Area
WRR	Wind River Reservation
WS	Wildlife Services
WTGMA	Wyoming Trophy Game Management Area
WYO	Region of Wyoming exclusive of Yellowstone National Park and Wind River Reservation.
XN	Experimental, Nonessential Population
YNP	Yellowstone National Park

BACKGROUND AND SUMMARY

There are many positive ecological, ethical and aesthetic benefits associated with maintaining healthy wolf populations in native ecosystems (Weiss et al. 2007). Unfortunately, there are also circumstances when wolves can come in conflict with human interests. In Wyoming, these conflicts may include predation on livestock and pets and threats to human health and safety associated with habituated wolves. This Environmental Assessment has been prepared to analyze the potential environmental impacts of alternatives for the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program involvement in wolf conflict management in Wyoming.

In 1994, the U.S. Department of the Interior, Fish and Wildlife Service and cooperators reintroduced gray wolves (*Canis lupus*) as a Nonessential Experimental (XN) Population (50 CFR 17.84 (i)) in Yellowstone National Park (YNP) and Central Idaho (59 FR 60252)[1]. The Northern Rocky Mountains (NRM) wolf population grew steadily and expanded in number and distribution. The population recovery criterion of ≥ 10 breeding pairs[2] per state (Idaho, Montana, Wyoming) for at least 3 consecutive years was reached by 2002, and has been exceeded every year thereafter (USFWS et al. 2010). The current NRM wolf population is at least 1,691 wolves in 320 packs, and 78 breeding pairs (USFWS et al. 2015); in addition, packs have been confirmed in eastern Washington and Oregon. WS, the USFWS and cooperating federal, state and tribal partners have worked collaboratively on research and monitoring of the wolf population and on wolf conflict management. These efforts have included radio-collaring and monitoring more than 1,200 wolves in the NRM to assess population status, conduct research, and to reduce/resolve wolf conflicts.

The WGFD and USFWS have requested that WS continue its role as an agent of the State for managing wolf conflicts (WGFC 2011, USFWS 2014). Any WS wolf conflict management actions would be subject to USFWS and WGFD decisions and authorizations (Letter to R. Krischke, WS, from M. Jimenez, USFWS, Wyoming Wolf Recovery Project Leader, October 22, 2014; contract with WGFD 2012) and applicable federal, state local and tribal laws and regulations and court rulings. WS wolf conflict management assistance could be provided on private or public property when: 1) authorized or approved by the USFWS and/or WGFD as appropriate, 2) resource owners/managers request assistance to alleviate wolf conflicts, 3) wolf conflict or threats are verified, and 4) agreements or work plans have been completed specifying the details of the conflict management actions to be conducted. Depending upon the regulatory status of wolves and applicable management plans and regulations, the types of verified wolf conflicts that could be addressed include: 1) depredation/injury of domestic animals, 2) harassment/threats to domestic animals, 3) property damage, and 4) injury and/or potential threats to human safety (e.g., habituated/bold wolves)[1].

Three alternatives for WS involvement in wolf conflict management are analyzed in this EA, including the Current Program Alternative (the No Action/Proposed Alternative) which continues the current adaptive wolf conflict management program, with nonlethal methods preferred before lethal actions are taken[3] (WS Directives 2.101, 2.105). This alternative includes limits on wolf conflict management

[1] This rule established regulations allowing management of wolves by government agencies and the public to minimize conflicts with livestock. The USFWS authorized WS to investigate reported wolf predation on livestock and to implement corrective measures, including nonlethal and lethal actions, to reduce further predation.

[2] A breeding pair is defined as a pack containing ≥ one adult male ≥ one adult female and two or more pups on December 31.

[3] Nonlethal methods are generally implemented by the resource owner and usually WS is called after nonlethal methods have failed to stop the damage.

effective while wolves are federally protected under the ESA and managed under the special 10j rules (e.g., 1994, 2005 and 2008 10j rules) under which the nonessential experimental (XN) populations were reintroduced [50 CFR 17.84 (i)[4]], and authorizations from the USFWS or WGFD (Letter to R. Krischke, WS, from M. Jimenez, USFWS, Wyoming Wolf Recovery Project Leader, March 1, 2009; Letter to R. Krischke, WS, from B. Nesvik, Chief Wildlife Division, WGFD October 4, 2011). Under this alternative, WS would use and/or recommend the full range of legal, practical and effective nonlethal and lethal methods for preventing or reducing wolf conflicts while minimizing any potentially harmful effects of conflict management on humans, wolves, other species and the environment. This Alternative would serve as the environmental base line against which the potential impacts of the other Alternatives are compared (CEQ 1981).

Under a second alternative, WS would only use and provide advice on nonlethal methods for wolf conflict management. Under the third alternative considered, WS would not be involved in wolf conflict management in Wyoming. The limitations on WS actions under these two alternatives would not prevent the USFWS or WGFD, as appropriate, or property owners from using lethal methods in accordance with applicable federal, state and tribal laws, policies and plans.

The analysis evaluates the ability of each of the management alternatives to meet the established management objectives including the efficacy of the alternatives in reducing conflicts with wolves in Wyoming. Issues considered in detail for each alternative include: 1) impacts on the wolf population, 2) Effects on public and pet health and safety, 3) animal welfare and humaneness concerns, 4) impacts to stakeholders including aesthetic impacts, 5) impacts on non-target species including threatened and endangered species.

[4] 50 CFR 17.84 (i) is the rule which applies to states and tribes that do not have a USFWS-approved wolf management plan and is the rule in effect in Wyoming after the court vacated the USFWS decision to approve the state of Wyoming's wolf management plan in 2014. 50 CFR 17.84 (n) is applicable to wolf management actions on the Wind River Reservation which as a USFWS-approved wolf management plan.

CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

Gray wolf (*Canis lupus)* populations in North America, including the wolf population in the Northern Rocky Mountains (NRM) and Wyoming, have undergone dramatic recovery since reintroduction. 2014 was the thirteenth consecutive year that Wyoming has exceeded the numerical, distributional, and recovery goals established by the U.S. Fish and Wildlife Service (USFWS) (Jimenez et al. 2011, WGFC 2011). However, the expansion of the wolf population from backcountry areas into areas of greater human use and habitation has generally increased conflicts between wolves and humans (WGFC 2011). Conflicts with wolves include predation on livestock and pets and risks to human health and safety from potentially hazardous or threatening wolves. This Environmental Assessment (EA) has been prepared to evaluate the impacts of alternatives for U.S. Department of Agriculture (WS), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) involvement in wolf conflict management in Wyoming.

Wildlife damage management, a specialized field within the wildlife management profession, is the science of reducing damage or other problems caused by wildlife, and is recognized as an integral part of wildlife management (Berryman 1991, The Wildlife Society 2015). WS is authorized and directed by Congress to conduct wildlife damage management to protect American agricultural, industrial and natural resources, property and human health and safety from damage associated with wildlife (Act of March 2, 1931 as amended 46 Stat. 1486; 7 USC 426-426c). WS' mission is to provide Federal leadership in managing conflicts with wildlife (WS Directive 1.201)[5].

WS recognizes that wildlife is an important public resource greatly valued by the American people. Wolves have no intent to do harm. They utilize (i.e., reproduce, walk, forage, deposit feces, etc.) habitats where they can meet their basic needs. By its very nature, however, wildlife is a highly dynamic and mobile resource that can cause damage to agriculture and property, pose risks to human health and safety and affect natural resources. WS conducts programs of research, technical assistance and applied management to resolve problems that occur when human activity and wildlife conflict with one another. As wolf populations increase and expand their range, local decision makers must choose management strategies that balance competing needs for wolf protection and the reduction of wolf conflicts and wolf-caused damage (Mech 2001).

WS generally uses an adaptive integrated wildlife damage management (IWDM) approach (WS Directive 2.101, 2.105) where a combination of methods may be used or recommended concurrently or sequentially to reduce damage. IWDM is the application of safe and practical methods for the prevention and reduction of damage caused by wildlife based on local problem analyses (Slate et al. 1992) and the informed judgment of trained personnel. Wildlife damage management is not based on the premise of punishing the offending animal(s), but on reducing future damage. For example, effective damage management programs are not restricted to direct management of the animal(s) in question. Programs may involve adjusting human behavior (tolerance for damage, farming practices, wildlife feeding, etc.), rendering the resource inaccessible to the problem wildlife species, or managing habitat independent of or concurrent with directly managing the wildlife species in question through nonlethal (e.g., frightening devices) or lethal methods.

[5] WS Directives are available for review at the WS website http://www.aphis.usda.gove/wildlifedamage.

WS is a cooperatively funded, service-oriented program that provides assistance to requesting public and private entities and government agencies. Before WS responds to requests for assistance and conducts any wildlife damage management, a request must be received and an *Agreement for Control* must be signed by the landowner/administrator for private lands or other comparable documents for public and tribal lands must be in place. WS responds to requests for assistance when valued resources are damaged or threatened by wildlife. Responses can be in the form of technical assistance (advice) or operational damage management depending on the complexity of the wildlife problem, landowner/manager requests, and the funding that is available. WS activities are conducted in accordance with applicable Federal, State and local laws, Cooperative Service Agreements, "Agreements for Control", Memoranda of Understanding (MOUs) with other State and Federal agencies, and other applicable documents (WS Directive 2.210). These documents establish the need for the requested work, legal authorities and regulations allowing the requested work, and the responsibilities of WS and its cooperators.

Normally, individual wildlife damage management actions by WS could be categorically excluded from further National Environmental Policy Act (NEPA) analysis, in accordance with APHIS implementing regulations for NEPA (7 CFR 372.5(c), 60 Fed. Reg. 6,000, 6,003, (1995)). However, in this instance WS and the cooperating agencies have chosen to prepare an EA to: 1) facilitate planning, interagency coordination and the streamlining of program management; 2) clearly communicate to the public the analysis of individual and cumulative impacts of program activities; and 3) evaluate and determine if there are any potentially significant or cumulative adverse effects from the proposed program. The Wyoming WS program cooperates with the WGFD, the tribes and other agencies and groups to address wolf conflicts under the guidance in WGFC (2011) and the USFWS, as appropriate. This analysis relies on existing data contained in published documents (Appendix C), and applicable state and federal regulations and management plans.

1.2 PURPOSE

The purpose of the proposed action is to reduce adverse impacts of wolves on livestock and other domestic animals and human health and safety in Wyoming as requested and authorized by the USFWS and WGFD and Tribes as appropriate (50 CFR 17.84[6], WGFC 2011). This analysis considers actions which may be implemented while wolves are federally protected under the Endangered Species Act (ESA) as a nonessential experimental (XN) population and also actions which may be implemented in the event that management of wolves is transferred to the state.

1.3 HISTORY AND CURRENT STATUS OF THE WYOMING WOLF POPULATION

Gray wolves were extirpated from Wyoming by the 1930s. From that time through the early 1990s, there were occasional wolf sightings in Wyoming, but the animals appeared to be transients and there was no evidence of wolf reproduction in the state (WGFC 2011). In 1995 and 1996, the U.S. Department of the Interior, Fish and Wildlife Service and cooperators reintroduced gray wolves (*Canis lupus*) as a Nonessential Experimental (XN) Population (50 CFR 17.84) in Yellowstone National Park (YNP) and Central Idaho (59 FR 60252)[7]. The Northern Rocky Mountains (NRM) wolf population grew steadily

[6] 50 CFR 17.84 (i) applies to states and tribes that do not have a USFWS-approved wolf management plan and is the rule in effect in Wyoming after the court vacated the USFWS decision to approve the state of Wyoming's wolf management plan in 2014. 50 CFR 17.84 (n) is applicable to wolf management actions on the Wind River Reservation which has a USFWS-approved wolf management plan.

[7] This rule established regulations allowing management of wolves by government agencies and the public to minimize conflicts with livestock. The USFWS authorized WS to investigate reported wolf predation on livestock

and expanded in number and distribution. The population recovery criterion of ≥ 10 breeding pairs[8] per state (Idaho, Montana, Wyoming) for at least 3 consecutive years was reached by 2002, and has been exceeded every year thereafter (USFWS et al. 2010). In 2014, the USFWS estimated the NRM wolf population contained at least 1,657 wolves in 282 packs including at least 85 breeding pairs (USFWS et al. 2015) ; in addition, packs and breeding pairs that have been confirmed in eastern Washington and Oregon. At least 333 wolves in ≥44 packs (including ≥25 breeding pairs) inhabited Wyoming on December 31, 2013. Of the total, there were ≥95 wolves and ≥11 packs (including ≥8 breeding pairs) inside Yellowstone, ≥12 wolves and ≥2 packs (≥0 breeding pairs) in the Wind River Reservation, and ≥199 wolves and ≥30 packs (including ≥15 breeding pairs) in the rest of Wyoming (WYO)[9] (Figure 1-1). The WYO end of year wolf population dropped from 230 to 186 wolves in 2012, the first year with a state wolf hunt. The decrease was consistent with state management objectives for the species. The WYO population increased from 186 wolves at the end of 2012 to 199 at the end of 2013 and 219 wolves at the end of 2014, and has remained above the minimum delisting criterion of at least 100 wolves (Jimenez et al. 2012, WGFD 2013). WS, the USFWS and cooperating federal, state and tribal partners have worked collaboratively on research and monitoring of the wolf population and on wolf conflict management. These efforts have included radio-collaring and monitoring more than 1,200 wolves in the NRM to assess population status, conduct research, and to reduce/resolve wolf conflicts.

In 2007, the USFWS initiated a process to define a distinct population segment (DPS) of the gray wolf encompassing the eastern ⅓ of Washington and Oregon, a small part of north-central Utah, and all of Montana, Idaho, and Wyoming as part of the process for eventually delisting wolves in Wyoming. The USFWS also proposed to remove the gray wolf in the NRM DPS from the list of Endangered and Threatened Wildlife under the ESA. The proposal retained protections in a significant portion of Wyoming in the final rule if adequate regulatory mechanisms were not developed to conserve Wyoming's portion

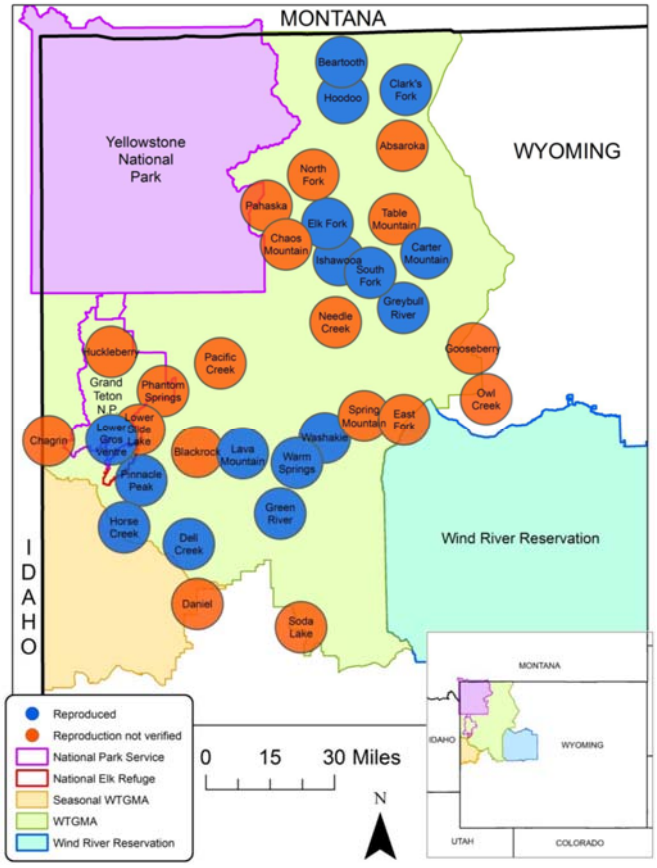

Figure 1-1. 2014 distribution of gray wolf packs in Wyoming (WGFD et al. 2015).

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and to implement corrective measures, including nonlethal and lethal actions, to reduce further predation. The rule also provided provisions for capture and relocation of wolves in situations where wolves are negatively affecting localized ungulate populations at an unacceptable level. Such actions could only occur if the translocation would not inhibit population recovery, and only after the applicable states or tribes define what constitutes an unacceptable impact, how impacts will be measured and identify other possible mitigation in USFWS approved state or tribal wolf management plans.

[8] A breeding pair is defined as a pack containing ≥ one adult male ≥ one adult female and two or more pups on December 31.

[9] WYO refers to the area of Wyoming exclusive of Wind River Reservation and Yellowstone National Park where WGFD has primary management authority for most resident wildlife (the USFWS manages resident species protected under the ESA with assistance from WGFD in this area).

of the wolf population. As part of the process, the state of Wyoming worked with the USFWS to develop a management plan for gray wolves that met the ESA requirements for preservation of the wolf population after delisting. Wolves in the NRM DPS, including Wyoming, were most recently removed from the federal list of threatened and endangered species in October 2012. The Wyoming Gray Wolf Management Plan completed in September 2011(WGFC 2011) and the Wolf Management Plan for the Wind River Reservation (Shoshone and Arapahoe Tribal Fish and Game Department 2007) subsequently became the principal guide for managing wolves in Wyoming. However, on September 23, 2014, the U.S. District Court vacated the USFWS decision to delist wolves in Wyoming and associated approval of the WGFD wolf management plan and restored prior status as a nonessential experimental population. Management of wolves and wolf damage and conflicts reverted to procedures which were in place prior to the delisting in October 2012 (50 CFR 17.84(i)).

1.4 NEED FOR WOLF CONFLICT MANAGEMENT IN WYOMING

The need for action in the NRM is based on verified wolf depredation, harassment, and threats to livestock, game farm animals and pets, property damage, and risks to human safety from potentially hazardous or threatening wolves or habituated/bold wolves. The need exists for a prompt, professional, effective program[10] to minimize wolf damage and conflicts and the associated negative attitudes and actions toward wolf conservation (50 CFR 17.40(o)). This determination is consistent with the opinion of wolf experts who have asserted that wolf distributions could expand if some form of wolf conflict management were implemented (Peek et al. 1991, Bangs et al. 1995, Mech 1995, Boitani 2003, Fritts et al. 2003, Mech and Boitani 2003, Bangs et al. 2004). In addition, one of the primary reasons that wolf conflict management continues to be needed in Wyoming is to comply with the commitment made by the Federal government when wolves were reintroduced. The clear intent of the rules under which wolves were reintroduced (50 CFR 17.84(i)), and subsequent modifications of those rules was not only to provide for the recovery and eventual delisting of wolves, but to also concurrently address the potential damage caused by wolves. As wolf conflicts increase or persist, there is an increasing need for prompt professional wolf damage management assistance to maintain public tolerance and acceptance of wolves (Bangs 1995, Fritts and Carbyn 1995, Mech 1995, Boitani 2003, Fritts et al. 2003, Mech and Boitani 2003, 73 FR 10514).

1.4.1 Wolf Predation on Livestock and other Domestic Animals

The primary need for action is the need to reduce wolf predation on livestock and domestic animals. Other types of conflicts occur and are discussed below, but these instances are less common. This type of conflict was anticipated in the USFWS planning process for the reintroduction of the wolf population. A recovered wolf population in the Greater Yellowstone Area (GYA) was expected to account for an average of 14 cattle (range: 1-17) and 70 sheep (range: 32-92) depredations annually (USFWS 1994). However, in 2010, 54 cattle, 83 sheep, and 1 dog were confirmed killed by wolves in the GYA; confirmed losses in Wyoming outside of the GYA consisted of 26 cattle, 33 sheep, and no dogs (WGFC 2011, Table 1; USFWS et al. 2011).

[10] One of the nation's leading experts in wolf biology and management noted that wolf conservation at the local level may become more socially acceptable if some form of localized wolf control is allowed (Mech 1995). The Wildlife Society is an international organization of professional wildlife biologists especially focused on North America states. This professional organization has stated that "Control of wolves preying on livestock and pets is imperative and should be prompt and efficient if illegal killing is to be prevented and human tolerance of the presence of wolves is to be maintained" (Peek et al. 1991).

Table 1-1. Confirmed livestock depredations and number of wolves killed in damage management actions in Wyoming, calendar years 2000-2013 (Jimenez et al. 2012, USFWS et al. 2015).

Depredations	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cattle	3	18	23	34	75	54	123	55	41	20	26	35	44	40	56
Sheep	25	34	0	7	18	27	38	16	26	195	33	30	112	33	6
Dogs	6	2	0	0	2	1	1	2	0	7	0	1	3	1	0
Goats	0	0	0	0	10	0	0	0	0	0	0	0	0	1	0
Horses	0	0	0	2	0	1	0	1	0	0	1	1	1	0	0
Total Depredations	34	54	23	43	105	83	162	74	67	222	60	67	160	75	62
Wolves Removed	2	4	6	18	29	41	44	63	46	31	40	36	43	33	37

Negative interactions associated with livestock depredation do not necessarily increase proportionately with wolf abundance; rather, they are localized events. In situations where there is suitable unoccupied habitat that will not result in a high degree of interaction between wolves and livestock, there is little relationship between wolf density and wolf conflicts. Stronger relationships between wolf density and wolf conflicts occur when wolf populations expand into areas where wolf habitat, agriculture and human development are mixed. Figure 1-2 shows the number of wolf packs involved in depredations on livestock each year, and the proportion of Wyoming's wolf packs that were involved in at least one verified depredation for each of the 13 most recent years (Jimenez et al. 2012, WGFD 2013). The proportion of Wyoming's wolf packs implicated in depredations was increasing each year up until 2006. This was likely related to the fact that as the wolf population grew and continued to spread out from public lands onto private lands, wolves were increasingly coming into greater contact and conflict with livestock. The decrease in number of depredating packs in 2007 and 2008 may be related to the fact that WS removed more wolves from depredating packs in 2007 and 2008 than in any years prior to, or since, 2007 (Table 1-1).

Sixty-two head of livestock (56 cattle, 6 sheep), and 1 goat) and 1 dog were confirmed as wolf-kills in Wyoming in 2014 (Table 1-1, USFWS et al. 2015). At least 17 packs were involved in at least one livestock depredation in 2013 (Figure 1-2, WGFD 2015). Management efforts removed 33 depredating wolves to address livestock losses due to wolves. Non-lethal control was routinely considered, but was often not applicable or cost-effective in many areas in Wyoming. In instances when non-lethal control methods were ineffective, wolves were killed through agency control actions in an attempt to prevent further livestock depredations. A combined minimum of $157,195.60 was spent on wolf damage management in WYO by WS ($60,957.80) and livestock depredation compensation by the State of Wyoming (96,237.76) in 2013 (WGFD 2013).

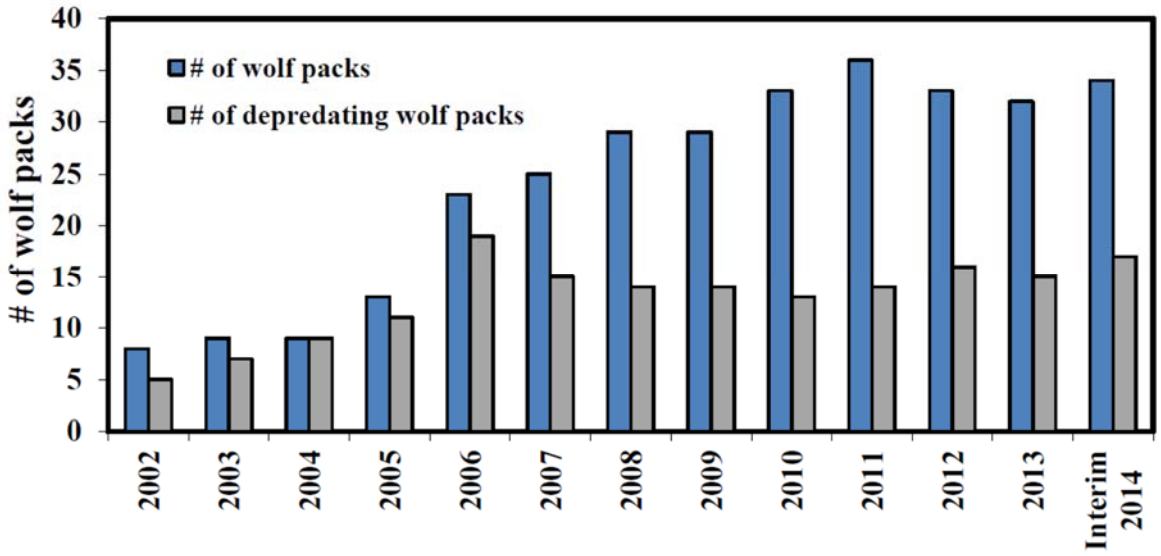


Figure 1-2. Annual number of wolf packs and number of wolf packs that were involved in ≥1 confirmed livestock depredation/year in Wyoming from 2000-12 (Jimenez et al. 2012, WGFD 2015). Data on depredating packs for 2014 only covers period from January 1 through September 23.

An assessment of factors that may have contributed to increases in wolf depredations suggested that wolf colonization, range expansion, and learning seemed to contribute to depredation increases (Harper et al. 2005). Wolves are apex predators, social animals, and young of the year probably learn from the adults what acceptable prey items are (Fuller et al. 2003). In addition, prey populations, such as deer, are often higher around agriculture areas, which may attract wolves to areas with livestock resulting in wolf/livestock conflicts.

It is important to recognize that the numbers in Table 1-1 represent a minimum number of livestock killed by wolves, and that more livestock were probably killed or injured but not confirmed as wolf predation (Bjorge and Gunson 1985, Oakleaf et al. 2003). Wolf predation is only confirmed in those cases where there is enough evidence remaining to determine that wolves in fact killed the animal. In many cases, wolves may have been responsible for the death of a rancher's livestock, but there was insufficient evidence remaining to confirm wolf predation. In some cases, those portions of the livestock carcass that might have contained the evidence of predation may already have been consumed, carried off, or decomposed. Some of these incidents might be classified as "probable" predation, depending on remaining evidence. But in many cases, there may be little or no evidence of predation, other than the fact that wolves are known to be in the area and some livestock have seemingly just disappeared. Bjorge and Gunson (1983, 1985) in Alberta suggested that cattle dying from predation are less likely to be detected than cattle dying from other causes and their estimates of predation rates during their study were likely low. Bjorge and Gunson (1985) recovered only 1 out of every 6.7 missing cattle during their study. Similarly, Oakleaf et al. (2003) conducted a study on wolf-caused predation to cattle on U.S. Forest Service (USFS) summer grazing allotments and concluded that for every calf found and confirmed to have been killed by wolves, there were as many as 8 other calves killed by wolves but not found by the producer.

Figure 1-3 shows the increase in the number of wolves and the concurrent increase in the number of confirmed incidents of wolf predation on sheep in Wyoming for the 13 most recent years.

Predation on cattle for the last seven years of the same time period showed a generally decreasing trend (Jimenez et al. 2012).

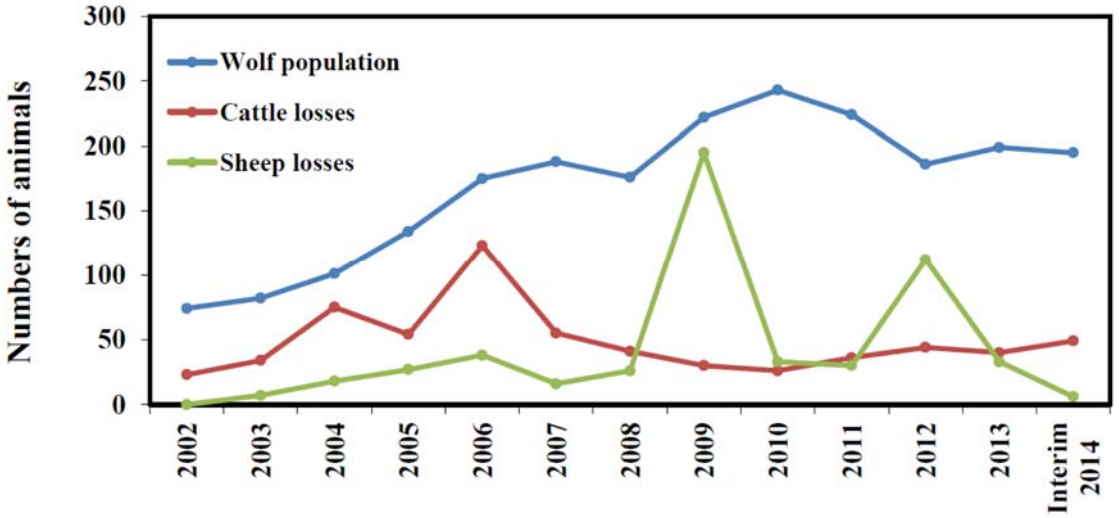


Figure 1-3. Size of the Wyoming wolf population in the WYO (area outside Yellowstone National Park and the Wind River Reservation) and number of confirmed cattle and sheep depredations/year in Wyoming from 2000 – 2012 (Jimenez et al. 2012, WGFD et al. 2015). Data for 2014 only include the period from January 1 through September 23.

Many of the confirmed incidents of wolf predation on livestock in Wyoming have involved one or a few animals killed or wounded per incident, but there have been situations where much larger numbers of livestock have been killed in a single incident, particularly in the case of attacks on sheep. In September 2003, for example, WS personnel confirmed wolf predation on 61 sheep in a single incident near Riggins, Idaho, and an additional 40 sheep were missing and never found after the night of the attack (USDA 2004). WS personnel confirmed that 17 ewes and 24 lambs were killed by wolves in a single incident south of Ten Sleep, Wyoming in June 2009. Muhly and Musiani (2009) reviewed data on wolf predation on livestock in Idaho, Montana and Wyoming from 1987-2002 and found that while most wolf attacks on cattle involved the death of only one animal per incident, wolf attacks on sheep typically involved killing about 14 animals per incident, with up to 98 sheep killed in a single attack.

Some wolf advocacy groups have pointed out that, in relative terms, only a very small proportion of livestock losses (less than 1% for cattle and less than 2.5% for sheep) are typically caused by wolves, and that other predators, such as coyotes, are responsible for many more livestock deaths than are wolves (Defenders of Wildlife 2007). However, it is important to recognize that these relatively low overall levels of loss are occurring with established conflict management programs already in place. It is also important to recognize that even though predation losses due to wolves represent a relatively minor portion of total overall death losses nationwide, as discussed above, these losses are never evenly distributed across the industry, and losses to individual producers can be significant (Fritts et al. 1992, Mack et al. 1992, Breck and Meier 2004, Shelton 2004).

Most livestock producers will experience little or no predation by wolves, while other producers in certain areas may suffer significant losses to wolves. Coyotes, by virtue of the fact that their populations are typically many times greater and more widely distributed than the wolf

population, do cause more overall predation losses, particularly to sheep. However, because of the size and hunting behavior of wolves, some types of livestock (e.g., adult cattle) may be more vulnerable to wolf predation than to predation by coyotes.

Assessing the relative likelihood of predation by individual wolves versus individuals of other more abundant and widespread predators provides insight as to why wolf predation is a bigger concern to some livestock producers and wildlife management agencies than is predation by other species. Collinge (2008) compared reported numbers of livestock killed by wolves and other predators with the estimated statewide populations of the four species most often implicated in predation on livestock in Idaho (***i.e***., coyotes, wolves, mountain lions (*Puma concolor*), and black bears (*Ursus americanus*). By determining the average number of livestock killed per each individual predator on the landscape and comparing these figures among the four species, his results indicate that individual wolves in Idaho are about 170 times more likely to kill cattle than are individual coyotes or black bears. Individual wolves were determined to be about 21 times more likely to kill cattle than were individual mountain lions. These comparisons highlight the importance of being able to implement effective wolf damage management procedures.

Domestic dogs and cats are occasionally killed and eaten by wolves (Fritts and Paul 1989, Treves et al. 2002, Wydeven et al. 2007). From 2000-2013, Wyoming WS and WGFD verified that wolves killed an average of 1.9 (range: 0-7) domestic dogs per year in Wyoming (Table 1-1). Wolf complaints involving dog depredations usually involve one dog being killed by wolves, but WS has documented multiple dogs killed during a single incident. Wolves may carry the carcass of a dog out of a yard and into more secluded area. There are probably other instances where wolves attacked dogs, but such incidents were either not reported or the dogs were just assumed to be "missing". When wolves come into contact with people and kill or injure their pets, there is both an economic and an emotional loss (Linnell et al. 2002). Many people are attached emotionally to their pets and have very strong feelings concerning their injury or loss. The dogs most commonly attacked by wolves in Wyoming are either livestock guarding dogs or hounds which occasionally encounter wolves during the legal sport hunting seasons for mountain lions. Individual livestock guarding dogs may be worth more than $1,000 each, and well trained, experienced mountain lion hounds are often valued at several thousand dollars each. Wolves have also occasionally killed or injured pet dogs near residences. Wolf attacks on pet dogs and hunting dogs raise public concerns about both pet and human safety.

1.4.2 Potential Role of Wolves in Disease Transmission to Wildlife, Livestock and Humans

Wolves in the NRM and Wyoming are known to have been exposed to a variety of diseases, including those caused by viruses (***e.g.,*** canine distemper, canine parvovirus, and canine infectious hepatitis), bacteria, and both internal (***e.g***., intestinal worms of various species, *Echinococcus sp*) and external (***e.g***., *Sarcoptes scabiei*, lice and ticks) parasites (IDFG 2008, Jimenez et al. 2010*a*, 2011). A complete list of diseases that wolves in Wyoming could encounter would closely mirror diseases present in domestic dogs and coyotes in the State. Wolves that interact with domestic dogs are likely to have higher exposure rates than wolves in remote areas. Wolf populations have the opportunity to develop individual and pack level immunity to some of the common pathogens over time, some of which may be conferred to offspring through maternal antibodies (Gillespie and Timoney 1981). Although diseases can be significant sources of mortality for wolves, they are generally not considered to be limiting at the population level. Despite evidence of ubiquitous exposure to various disease agents, wolves in Wyoming demonstrate high recruitment (Jimenez et al. 2011), suggesting long-term stability of populations. Negative effects associated with diseases are unlikely unless populations reach high densities (Kreeger 2003).

The protozoan parasite, *Neospora caninum*, causes abortions in cattle and has been shown to contribute to significant economic losses in the dairy and beef industry, with infected animals being 3 to 13 times more likely to abort than non-infected cattle (Trees et al. 1999, Dubey 2003, Hall et al. 2005). Domestic dogs and coyotes had been the only two species documented as potential hosts able to transmit *N. caninum* (Gondim et al. 2004a, b). However, Dubey et al. (2011) found the gray wolf to be a new natural definitive host for *N. caninum*, and reported that infected wolves shed viable *N. caninum* oocysts in their feces. Canines become infected by ingesting tissues (*i.e*., placenta, fetuses) contaminated with the organism. They then shed the organism in their feces. A cow grazing on a pasture contaminated with these feces can become infected with *N. caninum* (Dubey 2003). Gondim et al. (2004b) indicated that 39% (n = 164) of wolves from Minnesota and 11% of coyotes in Utah, Colorado, and Illinois (n = 113) tested positive for exposure to *N. caninum*. Mech (2004, unpubl. data) sampled 11 wolves collected on farms with a history of wolf depredation in five counties in Minnesota; 8 of 11 (73%) tested positive for exposure to *N. caninum*. However, it is unclear whether the presence of wolves would add to the risk already posed by other often more common, canids, and whether or not wolves might play a role in reducing the potential of disease spread as suggested for other ungulate (*e.g.*., deer, elk, moose (*Alces alces*), domestic sheep, and domestic cattle) diseases (Stronen et al. 2007). Data on the rate of seroprevalence (proportion of animals in the population that show evidence of having been exposed to the disease) of coyotes, dogs, and wolves needs to be defined for a particular geographic region before conclusions can be drawn (Gondim et al. 2004b).

During the winter of 2009, 17 wolves were captured near Jackson, Wyoming and tested for 2 strains of brucellosis (*Brucella canis* and *B. abortus*). All 17 wolves tested negative for *B. canis*, while two tested positive for *B. abortus*. To put these test results in perspective, the Supervisory Veterinarian for the WGFD (T. J. Kreeger, DVM, PhD) offered the following comments, "A positive serology titer for *B. abortus* in a wolf means that the wolf had been infected with the bacteria sometime in the past (probably in the last 12 months) and developed an immune response reflected in the antibodies measured by the diagnostic tests. A positive test does not mean that the wolf is currently infected with living bacteria, although it could be. How the wolves became infected by *B. abortus* is speculative. Possible ways of becoming infected include: 1) consumption of a fetus aborted by an infected elk or bison (*Bison bison*), 2) consumption of an adult, pregnant, infected elk or bison (particularly consumption of the reproductive tract), 3) consumption of an adult, infected, but not pregnant elk or bison (unlikely source), or 4) contact with the environmental site of an aborted fetus (also unlikely). Wolves can become infected with *B. abortus* and transiently shed the bacteria in the feces, although the number of shed bacteria is thought to be insufficient to infect cattle, elk, or bison" (USFWS 2009).

Foreyt et al. (2009) documented that the tapeworm *Echinococcus granulosus* occurred in 62% of wolves examined in Idaho, and that it was common to find thousands of these tapeworms in each infected wolf. *E. granulosus* requires two hosts to complete its life cycle. Ungulates are intermediate hosts for larval tapeworms which form hydatid cysts in the body cavity, often on the liver or lungs. Canids (*i.e.*, dogs, wolves, coyotes, foxes (*Vulpes, Urocyon* and *Alopex* spp.) are definitive hosts where larval tapeworms mature and live in the small intestine. Definitive hosts are exposed to larval tapeworms when ingesting infected ungulates. Adult tapeworms, 3-5 mm long, produce eggs which are expelled from canids in feces. Intermediate hosts ingest the eggs while grazing, where the eggs hatch and develop into larvae. Humans are at risk of becoming infected and developing hydatid cysts, primarily through ingestion of eggs which may be present on the fur of infected dogs, wolves or other canids. No human cases in Wyoming are known, but because echinococcosis is not a reportable disease, it may have been diagnosed in Wyoming and

never reported. In Idaho, a recent survey of health care providers found 7 or 8 cases that had not been reported by the medical community. Throughout the world, most human cases occur in indigenous people with close contact with infected dogs, but hunters and trappers handling wolves, coyotes or foxes may be at increased risk.

Wolves could possibly spread other wildlife diseases to dogs (e.g., sarcoptic mange) should they have contact with a dog or their environment and vice versa. For example, wolf deaths in the Great Lakes population have been attributed to mange (Thomas et al. 2005, Wydeven et al. 2007). Mange was first detected in Wyoming in 2002 (Jimenez et al. 2010*b*). Mange is fairly common in wolf populations throughout the world, including wolves in Canada, Alaska, Wisconsin, Minnesota, and Michigan. Based on other areas that have experienced epizootic mange infestations, mange in the northern Rocky Mountain wolf population will most likely be localized in specific areas and not threaten regional wolf population viability (Jimenez et al. 2010*b*, USFWS et al. 2009). Other diseases which are occasionally monitored in Wyoming wolves include canine distemper virus (CDV) and canine parvovirus (CPV). Over 80% of the wolves in Wyoming routinely test positive for CDV and CPV. Based on other areas of the world that have experienced epizootic CDV and CPV infections, these diseases will most likely occasionally cause some mortality, particularly among pups, but will be localized in specific areas/years, and not threaten regional wolf population viability (USFWS et al. 2011).

Although wolves clearly can and do carry diseases that could adversely affect livestock, other wildlife, or humans, the risk of significant disease issues with wolves appears to be low or, as of yet, undetermined. Therefore, WS does not expect to receive any requests for wolf damage management to control disease risks in the foreseeable future.

1.4.3 Wolf Conflict Management to Protect Human Safety

Wolves have high aesthetic and cultural value, and, while hearing and viewing wolves is extremely popular, not all of these interactions have been positive. However, when wolves approach human residences and threaten or kill people's pets or exhibit excessively bold behavior, people often become concerned about human safety. This is especially true when small children are present.

Attacks on humans have been recorded in Russia, Finland, Scandinavia, Germany, India, Afghanistan, Korea, central Asia, Turkey, Iran, and Greenland, but there have been few reported wolf attacks on people in North America (Linnell et al. 2002, McNay 2002, Geist 2008). There has only been one instance of a wolf attacking and injuring a person in lower 48 United States. In August 2013, a camper in Minnesota was bitten on the head by a wolf that was subsequently trapped and killed. The wolf in question had a deformed jaw prompting hypothesis that the rare behavior may have occurred because the animal was struggling to obtain wild prey. There have been only two documented fatal attacks by wolves on humans in North America in recent years. The first fatal attack occurred in November 2005 near Points North, Saskatchewan (McNay 2007) and the other in March 2010 near the village of Chignik Lake, Alaska. In the first case, evidence suggested several local wolves had become habituated to people, and the victim was attacked while out walking alone in a wooded area. Those wolves had been feeding on the victim's body before searchers found the remains. This is believed to be the first documented human mortality from wolves in North America. In the second case, Alaska officials concluded wolves killed a 32-year-old woman as she was jogging along a gravel road near the town of Chignik Lake, on the Alaska Peninsula (http://www.msnbc.msn.com/id/35913715/ns/us_news-life/).

In January 2005, an individual was attacked by a wolf while jogging near the community of Key Lake in northern Saskatchewan, Canada. The man was able to fight off the animal and later was flown to a hospital for non-life threatening injuries (CBC News 2005). In July 2007, a kayaker in a remote area of the North Coast in British Columbia, Canada was attacked by an old female wolf (Pynn 2007). The kayaker was able to stop the attack by repeatedly stabbing the wolf with a knife. The individual called for help on his marine radio and the wolf was shot by the individuals who came to rescue the kayaker. In this instance, there was no indication that the wolf had been fed or otherwise habituated to humans.

Most of instances of wolf aggression toward humans in Canada and Alaska during the period of 1900-2001 that were reviewed by McNay (2002) appeared to have an apparent causative factor (i.e. rabies (12), self-defense or defense of another wolf (14), presence of dog with person 6). However, in 19 cases, aggressive behavior appeared to be unprovoked. Wolf familiarity with (habituation to) humans appears to be an important factor contributing to aggressive behavior toward humans. Of the 18 unprovoked incidents of aggressive behavior by wolves reported by McNay (2002) for the period 1969-2001, 11 were associated with what he defined as habituated wolves, (*e.g*. wolves which had lost their fear response to humans after repeated non-consequential encounters). Non-habituated wolves in remote areas displayed unprovoked aggression in 7 cases. Bites were inflicted in all 11 cases where habituated wolves displayed unprovoked aggression, but only 2 of the 7 instances of unprovoked aggression by non-habituated wolves resulted in bites. Most of the bites by habituated wolves were minor, but 4 of the 11 bites were severe. The humans defended themselves by hitting the wolf with a heavy object, firing a rifle into the air or, in two instances, killing the wolf.

With a growing wolf population and many people living and recreating in occupied wolf range, opportunities for wolves to become habituated to humans and risks of adverse interactions with humans are likely to increase. The data provided by McNay (2002) indicate the importance of human behavior management and public education programs to prevent adverse human-wolf encounters. These efforts, coupled with nonlethal techniques designed to reduce or prevent wolf habituation to humans, can help prevent or resolve most situations where wolf behavior causes concern for human safety. However, there may be instances where removal of a bold, habituated wolf may be deemed necessary to reduce a human safety risk.

Linnell et al. (2002) reported several cases from around the world in which non-diseased wolves attacked people, but no humans were killed during the attacks; the wolves, in most cases, were later killed and examined. The wolves involved in those attacks seemed to have acclimated to the presence of people and had become more aggressive toward humans. Fortunately, in many of these incidents, other people accompanying the victims were able to drive the wolf away. In many cases the person attacked received only minor injuries and made a full recovery in a few days to weeks.

Aggression toward humans can at times be attributed to wildlife disease issues. Wild wolves rarely contract rabies, but it is possible; hence, there is serious concern for humans and their pets should they be bitten. McNay (2002) reported two people that died as result of bites from wolves with rabies in Alaska in the 1940s. In 2007, a pack of wolves attacked a group of sled dogs and strays in Marshall, Alaska (Pemberton 2007). The one wolf that was killed by villagers during the attack tested positive for rabies. All dogs involved in the incident were euthanized as well as free roaming dogs that may have been involved in the incident. In response, villagers and government officials were working to increase use of rabies vaccine and fenced enclosures for dogs. However, this type of incident is relatively uncommon, and rabies is rare in wolves south of the arctic in North America.

Incidences of wolf-related threats to human safety are rare. To date, Wyoming WS has not received any requests for this type of assistance. However, based on data from other WS programs in the region, these types of risks do occur and Wyoming WS could be asked to help address the risk.

1.4.4 Indirect Impacts of Livestock Predation

Although direct losses of livestock due to predation are often conspicuous and economically significant, they likely underestimate the total impact on producers because they do not consider indirect effects of carnivores as a result of livestock being exposed to the threat of predation (Howery and DeLiberto 2004, Lehmkuhler et al. 2007). Shelton (2004) suggested that the value of depredated livestock from predators is the "tip of the iceberg" concerning the actual costs that predators impose on livestock and producers, including increased costs associated with efforts to mitigate predation which may include night confinement, improved fencing, early weaning, choice of grazing area, and/or increased feeding costs from a loss of grazing acreage.

The presence of predators near livestock can invoke a fear response in the livestock. Fear is a strong stressor (Grandin 1998). Stress can result in disease and weight loss, reduces the value of meat, and interferes with reproduction. Stress prior to slaughter is thought to cause "dark-cutters," meat which is almost purple (Fanatico 1999). Dark-cutters are severely discounted because they are difficult to sell (Fanatico 1999). Chronic stress inhibits immune responses, which increases illness and decreases performance of livestock and humans alike. Many infectious diseases result from a combination of viral and bacterial infections and can be brought on by stress (Faries and Adams 1997). Harassment due to predators may directly cause weight loss due to increased energy expenditure associated with running and loss of sleep, but may also indirectly reduce the ability of ruminants to convert plant nutrients into weight gain due to decreased rumination time (Howery and DeLiberto 2004). Cattle and sheep exposed to harassment by predators become very skittish and spend much of their time remaining vigilant for predators (Kluever et al. 2008). They do not disperse and feed normally, and therefore may not take in the quantity and quality of feed they would have if unstressed, resulting in reduced weight gains at the end of the grazing season (Muhly et al. 2010).

The stress of being repeatedly chased can cause cattle to abort calves, calf early or give birth to a weak calf (Lehmkuhler et al. 2007). Presence of wolves in pastures increases activity of cattle when cattle are chased by wolves and when cows chase after predators to protect their calves. This increases heat stress during warm weather and risk of cold stress during cold periods from cattle that are sweated wet (Lehmkuhler et al. 2007). Chebel et al. (2004) discovered that heat stress (>29^{o} Celsius) prior to artificial insemination resulted in lowered conception rates for cows. Cows exposed to high heat index values during peri-implantation may have a greater risk of pregnancy loss (Garcia-Ispierto et al. 2006). Depredations in the NRM from wolves appear to overlap the calving and subsequent breeding seasons of spring-calving beef herds. This increased stress during the breeding season could result in greater numbers of "open" cows and fewer calves born the following year, reducing the economic viability of affected beef operations (Lehmkuhler et al. 2007).

Harassment by predators may also cause livestock to become nervous or aggressive. Aggressive or nervous animals may hurt humans and the other cattle that are around them. Not only are they more dangerous but they will also stress other cattle and reduce their performance. Fear-based behavior is likely to be the main cause of accidents due to a horse kicking or a cow or steer becoming agitated in a chute. Reducing fear improves both welfare and safety for humans and

animals (Grandin 1998). Harassment and predation by wolves can also affect the way cattle respond to livestock handling dogs and the ability of the dogs to control cattle movements (Howery and DeLiberto 2004).

Cows can be stampeded through fences when wolves are actively hunting/harassing livestock on a ranch. In addition to injuries sustained by cattle, there are associated costs (time spent fixing fences). Regrouping cattle after they have been stampeded is difficult, time consuming and stressful to the animals. Such efforts take time and money away from other commitments on the ranch (Lehmkuhler et al. 2007).

Producers with wolf problems spend extra hours on herd surveillance in addition to the time dealing directly with the damage. Many hours may be spent trying to locate missing animals or remains to qualify for compensation. Time spent addressing predation problems comes at a cost to other work. Negative impacts from predators may affect the general mood of farm operators. Livestock production typically is a small profit margin industry (Pope 1993). Increases in labor attributed to greater surveillance of pastures increases costs of production (labor, equipment and fuel), resulting in reduced economic return (Lehmkuhler et al. 2007).

The current recommendations to improve health in a cattle herd are to avoid overcrowding, rotate the cattle to fresh areas and avoid keeping them in the same areas year round (Lehmkuhler et al. 2007). Moving cattle too often results in increased stress, poorer performance and more sick cattle. Having to keep the cattle by the buildings to avoid predators is contrary to Best Management Practices for livestock production and may result in increased risk of exposure to pathogens (Lenehan et al. 2004), and, for some producers, increased need for supplemental feed. Concentrating cattle in small areas may increase the risk of transmitting food-borne pathogens due to increases in bacterial populations around the cattle and immunosuppression due to the stress of crowding (Lehmkuhler et al. 2007). Recent research has shown that the prevalence of pathogens in the soil decreases as the distance from hay bale rings is increased (Lenehan et al. 2004). It is widely accepted that post-partum cows and newborn calves should be moved to "clean" pastures as soon as possible following parturition to decrease the risk of disease transmission (Lehmkuhler et al. 2007).

In the NRM, most of the depredations occur during the spring and summer grazing season. Moving cattle closer to ranch headquarters often requires removing them off pastures and placing them in areas where increased foraging pressure may necessitate supplemental feeding. This may require use of feed that would ordinarily be used in the winter. Winter feed is the most costly feed input for cow-calf operations based upon Standardized Performance Analysis data. Producers forced to move cattle closer to ranch headquarters and use winter feed during the grazing season will have lower financial returns (Lehmkuhler et al. 2007).

1.4.5 Wolf Conflict Management in Wyoming and WS Wolf Conflict Management Procedures

Wolves can have both negative and positive ecological and social impacts in Wyoming. As wolf populations increase and expand their range, local decision makers must choose management strategies that balance competing needs to preserve the positive aspects of wolves while minimizing wolf conflicts and wolf-caused damage (Mech 2001). The WGFC seeks to maintain positive impacts of wolves while keeping negative economic impacts minimal and manageable (WGFC 2011). Control of offending wolves, improved livestock management practices (e.g., carcass management, fencing, etc.), compensation for losses, communication with the public and professional agency management have been suggested as means to enhance wolf recovery where

wolf-livestock conflicts exist (Fritts et al. 1992, Mack et al. 1992, Niemeyer et al. 1994, Bangs et al. 2006).

At the time of the reintroduction of XN wolves to Central Idaho and YNP, the USFWS addressed the issue of depredating wolves in their 1994 10j rule [at 50 CFR 17.84(i) (3) (vii)] with this specific language: "All chronic problem wolves (wolves that depredate on domestic animals after being moved once for previous animal depredations) ***will*** [emphasis added] be removed from the wild (killed or placed in captivity)." Thus, even when there were relatively few wolves in Wyoming, the rules under which wolf reintroduction took place required mandatory removal of chronic depredating wolves after relocation had been attempted. The 1994 10j rule definition of a chronic depredating wolf involved relocation of depredating wolves if fewer than six breeding pairs occupied an XN recovery area, but this approach has not been practiced in any areas of the NRM Recovery Area for many years, because relocation is no longer necessary to ensure viable wolf populations, and because all the suitable wolf habitat in the state is essentially already occupied by wolves. [USFWS, 294, response 12 accompanying the 2005 10j rule (70 FR 1286), provided further rationale for discontinuing relocation of depredating wolves.]

Following the issuance of the 1994 10j rules for management of the experimental, nonessential (XN) gray wolf population in the NRM, subsequent 10j rules (issued in 2005 and 2008) allowed increasingly greater flexibility for wolf management and provided for more aggressive management actions to deal with wolf depredations on livestock and other domestic animals if affected states or tribes have USFWS-approved wolf management plans (70 FR 1286, 73 FR 4720, 50 CFR 17.84 (n)). As of the Federal District Court Decision in September 2014 that vacated USFWS approval of the Wyoming state wolf management plan, only the Wind River Reservation has a USFWS approved wolf management plan that meets the requirements for the 2008 10j rules (50 CFR 17.84 (n); Shoshone and Arapahoe Tribal Fish and Game Department 2007).

Historically, Wyoming WS has cooperated with the USFWS and WGFD with wolf management. In 1997, a cooperative agreement was developed between USFWS and the APHIS WS Western Regional Office to control wolf depredations in the Northern Rocky Mountains, which includes Wyoming. Since 2008, Wyoming WS has cooperated with the WGFD on verification of livestock losses to wolves for compensation purposes. When WS receives a report of suspected wolf depredation, or of wolves harassing/chasing livestock or livestock guarding animals, WS typically responds by sending a field Specialist to conduct an on-site investigation within 48 hours of receipt of a complaint. Results of each investigation are documented on WS Form 200, Wildlife Services Depredation Investigation Report (see Appendix A). Specific criteria have been agreed upon by the USFWS and WS to classify reported incidents of wolf depredation as confirmed, probable, possible/unknown or other (see Page 2of Appendix A for discussion of these criteria). WS categorizes each complaint into one of four categories: 1) confirmed depredation, 2) probable depredation, 3) confirmed non-wolf depredation, and 4) unconfirmed depredation. Under the current program, WS may provide technical assistance to producers as appropriate, or upon request by the USFWS, WS may remove wolves. WS may capture wolves at the guidance of the current managing agency specifically to place a collar on an individual residing in a known or unknown pack. This action helps in identification of the location of a depredating pack if future actions are deemed necessary. For compensation for livestock losses paid for by the WGFD, WS uses the standard of “more likely than not” and reports the findings on a Wyoming Game and Fish Department Livestock Affidavit and provides a copy to the livestock producer and the WGFD.

1.5 ECOLOGICAL AND SOCIAL BENEFITS OF WOLVES

There are many benefits associated with the presence of a healthy wolf population in its native ecosystem. These benefits are both ecological and social (economic, spiritual, and aesthetic). Plans to address conflicts with wolves must balance the desire to reduce damage and risks to human safety and the benefits derived from wolves.

1.5.1 Social Benefits of Wolves

Wildlife generally is regarded as a source of economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Direct benefits are derived from a user's personal relationship or direct contact with wildlife and may include both consumptive (e.g., using or intending to use the animal such as in hunting or fishing) and non-consumptive uses (e.g., observing or photographing animals, spiritual relationship, etc.) (Decker and Goff 1987). See also discussion of impacts on stakeholders in Section 2.3.5 and in Chapter 4 analysis of impacts on stakeholders for each of the alternatives.

Viewing wolves or hearing them howl in their natural habitat is a popular activity in certain areas and is considered to add value to many people's outdoor experience. Organized tours for the purpose of viewing wolves or hearing them howl are conducted at some U.S. and Canadian national parks such as Yellowstone (Wyoming), Denali (Alaska), Wood Buffalo (Alberta, Canada), and Riding Mountain (Alberta, Canada). Howl tours are also held in northern Wisconsin by several groups (WDNR 1999, Wydeven and Wiedenhoeft 2005). Small or large group howling attempts can also be made in any area where wolves are known to be present. Such activities provide not only aesthetic viewing but there are also associated economic (tourism) benefits. A 2010-2012 survey of fishing hunting and wildlife-related recreation (USFWS et al. 2014 estimated that there were approximately 518,000 wildlife-watching participants in the state (residents and non-residents combined) that contributed over $350 million to the Wyoming economy. At least some of this activity was likely related to the presence of wolves, with economic benefits of wolves most likely for communities near public lands where wolves occur. At the time the survey was prepared there wasn't a hunting season for wolves in Wyoming, so this information is not reflected in the state statistics on hunting.

1.5.2 Importance of Wolves in Native American Culture and Beliefs

Wolves play an important role in tribal culture and beliefs. The exact nature of this relationship and role varies among tribes. An example of the role of wolves in tribal beliefs relevant to the proposed action was provided by the Northern Arapaho Tribal Historic Preservation Office.

> *Wolves played a vital role in our historic past for the Northern Arapaho. Before the introduction of the horse the wolf served as a mode of transportation carrying travois while migrating but they also were protectors, loyal friends and companions. For the Northern Arapaho the wolf goes back to the beginning of time. The role the wolves played during our migration of this land was beneficial to our survival and everyday living.*
>
> *The wolf was also a warrior society and of the utmost importance in medicinal values. The behavior and loyalty of the wolf were seen as virtues true within everyone in the tribe. It was believed that each person has a good and dark wolf inside them in order for them to survive. The wolf was observed in the wilderness for their hunting skills, their*

hierarchy and most of all their adaptive survival skills. When settlers came and annihilated the wolf the Arapaho knew they would soon be next. The creator said that one day man would inherit the earth but it is up to him to decide, if it would be the good or dark wolf which would prevail.

"The importance of the wolf's teaching's needs to be listened to today. We cannot continue to look at nature as a separate entity but as an encompassing entity in which all humans live in today. If we as a society do not take care of the caretakers of the Mother Earth, we too shall diminish." "Like the wolf we are managed, like a resource". (Elder Mark Soldier Wolf) The teachings and values of the wolf are only natural and a part of nature. We all learn from one another, but ignorance of a teaching is unheard of. The Northern Arapaho's creation story includes the story of the Wolf and the Raven. This story has taught our tribe in how to continue in life when things get difficult. Without these teachings we would not be where we are today.

The USFWS, WGFD and WS recognize the importance of wolves in tribal culture and will continue to work with individual tribes and Wildlife Commission to try and address their concerns regarding WDM in the State. Specific measures to address tribal concerns are noted in Standard Operating Procedures presented in Section 3.6. WS will also work with the tribes on any new issues relative to WS' involvement in the implementation of the new state wolf management plan.

1.5.3 Ecological Benefits

Interactions with other Wildlife Species

Wolves play an important role in predator/prey relationships. By culling old, young, sick, and injured individuals from a prey population, it is believed that wolves help maintain healthier, viable prey populations when other prey population mortality factors are in balance (Mech 1970). Similarly, wolves may help reduce risk of disease transmission from wild ungulates to livestock by preying on sick individuals and reducing the incidence of disease in wild ungulates (Stronen et al. 2007).

Wolves are important predators on beaver (Potvin et al. 1992), which in turn may affect trees, orchids, trout habitat, and forest roads. Predation by wolves on coyotes and other mesopredators may benefit smaller predators and ground nesting birds that can be affected by mid-sized predators (Crabtree and Sheldon 1999).

One example of wolf effects in YNP has been reduction of the coyote population by wolf predation (Crabtree and Sheldon 1999). Most of the reduction was from direct killing at wolf kills when coyotes attempted to scavenge on carcasses (Crabtree and Sheldon 1999, Ballard et al. 2003). Recently, however, coyotes have adapted to wolves through changes in use of the landscape and socially by living in smaller groups (J. Sheldon, unpublished data as cited in Hebblewhite and Smith 2005). The pre-wolf number of coyote packs in Lamar Valley was 11, after wolves were released it declined to 6, but has recently increased to 12 (R. L. Crabtree and J. Sheldon, pers. comm. as cited in Hebblewhite and Smith 2005). Further, there is evidence for competition between wolves and mountain lions where wolves are generally dominant over mountain lions (Ruth 2004). While mountain lions and wolves in YNP use prey and habitat differently, reductions in use of space by mountain lions has occurred since wolves were reintroduced (Ruth 2004). Competition between wolves and mountain lions appears to be minimal, as mountain lion prey selection and kill rates have not changed compared with pre-

wolf monitoring (Murphy 1998, Ruth 2004). However, in another 10 years post-wolf introduction in YNP, based on studies in Banff National Park (Kortello et al. 2007), Hebblewhite and Smith (2005) predict competition between wolves and mountain lions will increase to a degree that could reduce mountain lion abundance, and should prey continue to decline and become more limiting, future competition for prey cannot be ruled out.

Twelve different species of scavengers have been recorded using wolf kills in YNP and five visit virtually every kill: coyotes, ravens (*Corvus corax*), magpies (*Pica pica*), golden eagles (*Aquila chrysaetos*) and bald eagles (*Haliaeetus leucocephalus*) (Wilmers et al. 2003a, Wilmers and Getz 2005). Spatially and temporally, wolf-killed carrion is more available to scavengers post-wolf introduction. However, if wolves reduce elk numbers, less total carrion might be available, but carrion more evenly distributed might compensate for any negative effect of reduced carrion biomass (Wilmers et al. 2003a).

Besides avian scavengers, many mammals also scavenge wolf kills. Black bears are subordinate to wolves at carcasses (Ballard et al. 2003), although lone wolves or young wolves can be at a disadvantage to large black bears. Grizzly bears benefit from wolf-killed prey throughout the year, whereas prior to wolf restoration, carrion was primarily only available in late winter (Wilmers et al. 2003b, Wilmers and Getz 2005). Carcasses may also be important to bears during fall when other food sources fail or are scarce.

There are other scavengers besides vertebrates, and also indirect effects of wolf predation on flora and soil nutrients. Research is just beginning on this topic, but more species of beetles use carcasses than all vertebrates combined. Sikes (1994) found 23,365 beetles of 445 species in two field seasons examining wolf-killed carrion. Obviously, this underestimates the number of decomposers such as insects, mites, invertebrates, bacteria, and fungi, which likely number in the thousands (Hebblewhite and Smith 2005). In addition, even longer-term effects of carcasses are the localized nutrients they deposit. Bump and Peterson (pers. comm. as cited in Hebblewhite and Smith 2005) found elevated levels of nutrients around elk carcasses. Using soil samples, one at the carcass site and one away from it, they found 20–500% greater nitrogen (ammonium and nitrate), phosphorous, and potassium at the carcass. Bump and Peterson attribute this to direct nutrient leaching from carcasses and indirectly to urine and feces from carnivores and scavengers.

Another potential indirect effect is predation on prey exposed to diseases such as brucellosis (*Brucella* spp.). While empirical evidence for such an effect is scarce, Hebblewhite and Smith (2005) believe it is reasonable to expect that density-dependent disease prevalence in ungulates may be reduced by wolf predation (Packer et al. 2003), although in some instances, predation may actually increase disease prevalence (Holt and Roy 2007).

Indirect Impacts on Vegetation

Wolves may indirectly affect plant life because of wolf-caused changes to herbivore density and behavior (e.g., elk reduced their use of riparian areas and moved to higher areas because of wolf predation or threats of predation) (Mao et al. 2005, Beyer 2006, Ripple and Beschta 2006). Aspen have not been regenerating well in YNP because elk have been eating young aspen and researchers believed that elk would learn to avoid "high-risk areas" that wolves frequent. Thus, plants in those areas, such as aspen, would have a chance to grow large enough so that elk could not kill them and eventually an entire plant community could be restored through "cascading indirect effects" on other species and restore a healthier ecosystem. Fortin et al. (2005) found elk less likely to travel into aspen stands when wolves were present; while wolves were present,

elk moved more frequently into conifer forests. Creel and Winnie (2005) showed that in the presence of wolves, elk retreated into forest cover, whereas when wolves were absent, elk foraged in open grassland. Gude et al. (2006) found that in the Madison River Valley, elk responded to wolf presence by moving away from wolves, reducing elk impacts on vegetation. As a result of taller vegetation, a variety of biota, including songbirds, benefitted (Baker and Hill 2003, Hansen et al. 2005). It has been hypothesized that a reduction in herbivore foraging pressure created by wolves would result in an increase in browse, providing for more songbird habitat, riparian restoration and stability, and an increase in the number of beavers (*Castor canadensis*).

However, few studies have assessed the existence and strength of behavioral changes of herbivores in systems where predators and prey interact over large geographic areas and prey responses are mediated by the predator hunting mode (Schmitz et al. 2004, Schmitz 2005). Active predators, especially those that roam over large landscapes, such as wolves, rarely produce consistent predation risks at any one location or in any one habitat type (Schmitz 2005). Given the high costs of prey anti-predator behavior (i.e., habitat avoidance, foraging reductions), prey of active-hunting predators may be relatively unresponsive to predators and thus unlikely to demonstrate risk-induced changes in foraging or habitat selection necessary to bring about "behaviorally mediated trophic cascade" changes (Lima and Bednekoff 1999, Schmitz 2005). Creel et al. (2008) showed that elk in YNP and in habitats adjacent to YNP responded to "risky times" but not "risky places," a pattern attributed to elk risk allocation strategies.

Recently, YNP researchers had believed that aspen were benefiting from wolves via elk anti-predator behavior, whereby aspen are recovering in areas where elk are at a higher risk of predation (Ripple et al. 2001, Ripple and Beschta 2004, 2007, Fortin et al. 2005). Other researchers claimed similar increases in willow (*Salix* spp.) (Beyer et al. 2007) and cottonwood (*Populus* spp.) (Ripple and Beschta 2003) due to wolf-induced changes to elk foraging behavior.

Initially, elk responded to the reintroduction of wolves by increasing vigilance (Laundre et al. 2001). However, elk behavioral observations (i.e., patterns of vigilance, anti-predator movement, and risk of death) are consistent with the gradient of predation risk (Kauffman et al. 2010). For example, in response to wolf presence, elk have made short-term shifts away from habitat types that Creel et al. (2005) and Gude et al. (2006) classified as risky. But these anti-predator behaviors have not resulted in detectable shifts in broad scale, habitat use across YNP's Northern Range as observed from analyses of radio-collared elk before and after wolf reintroduction (Mao et al. 2005).

Elk in search of winter foods continued to forage on aspen trees and elk did not respond to a "landscape of fear" (i.e., the fear of wolf predation) (Kauffman et al. 2007, 2010). The elk did respond behaviorally to predation risk posed by wolves, but the small behavior changes to feeding and movements across the landscape did not translate to long-term benefits for aspen growing in areas risky to elk (Kauffman et al. 2010). Kauffman et al. (2010) did not find that the effects of wolf predation risk translate down to the aspen stands foraged by elk and their results are consistent with recent work evaluating elk behavioral responses to wolves (Gude et al. 2006, Liley and Creel 2007, Winnie and Creel 2007, Creel et al. 2008). In contrast, Kauffman et al. (2010) reported that aspen sucker survivorship was actually lower near the cores of wolf territories, likely due to wolves maintaining territories in areas of high elk density (Mao et al. 2005). In an analysis of elk movements, Fortin et al. (2005) found no evidence that elk avoid core wolf-use areas. What emerges from behavioral studies of elk and wolves is that,

while elk do respond to the predation risks posed by wolves, their responses are subtle and, over the course of an entire winter, do not result in meaningful cumulative changes in habitat use (Kauffman et al. 2010). Annual variation in other factors such as wolf territory locations and pack sizes, snow levels, and elk distribution may further act to erode the spatial consistency in wolf predation risk and thus limit cascading impacts of predation risk (Fortin et al. 2005).

Kauffman et al. (2010) suggests that aspen are not benefitting from the "landscape of fear" created by wolves, that claims of an ecosystem-wide recovery of aspen are not occurring and that those earlier assumptions were premature. Surveys conducted by Kauffman et al. (2010) of current conditions indicated that study aspen stands exposed to elk browsing were not growing to heights necessary for the trees to be invulnerable to elk. The only places where aspen suckers survived to reach a height sufficient to avoid browsing were in fenced areas (Kauffman et al. 2010). In addition, aspen stands identified as risky for elk were browsed just as often as aspen growing in less risky areas.

Kauffman et al (2010) not only confirmed that elk are responsible for the decline of aspen in YNP beginning in the 1890s, but also that none of the aspen groves studied after wolf restoration appear to be regenerating, even in areas risky to elk. Elk's fear of wolves does not appear to be benefiting aspen and Kauffman et al. (2010) concluded that if the YNP Northern Range elk population does not continue to decline, many of YNP's aspen stands are not likely to recover. Kauffman et al. (2010) suggested that a landscape-level aspen recovery is likely only if the elk population is further reduced.

On Isle Royale National Park in Lake Superior, balsam fir growth has been linked to wolf-moose interactions (McLaren and Peterson 1994). When wolves were relatively scarce, moose numbers grew, which led to depletion of balsam fir forage. It was observed that vegetation response followed moose response. When wolf numbers were higher, moose numbers were low and balsam fir growth increased (McLaren and Peterson 1994). These studies suggest that wolf recovery may present a management tool for helping to restore certain types of vegetation and to conserve biodiversity (Ripple et al. 2001, Ripple and Beschta 2004).

A study in Wisconsin and Michigan has shown that diversity and biomass of forbs in white cedar (*Thuja occidentalis*) stands was more diverse and at higher biomass in the interior than on the edge of wolf pack territories (Anderson et al. submitted). Differential use by wolves of core and edge portions of their territories cause deer to spend less time in the interior, and more time on the edge of wolf territories (Mech & Harper 2002). Since the 1990s, deer populations in much of northern Wisconsin have been above management goals, thus any predation by wolves may reduce some of the negative effects of deer herbivory on native plant communities.

In conclusion, there is evidence for direct and indirect effects of wolves in YNP (Hebblewhite and Smith 2005). Direct effects include limitation or regulation of elk by wolves, behavioral avoidance of wolves by elk, and competition with other carnivores. Indirect effects include the influence of wolves on willow and aspen growth, species that rely on these plants such as songbirds and beavers, and apparent competition between elk and alternate prey such as bison, moose, and caribou. It is also clear that the most numerous indirect interactions occur between wolves and scavengers. Between 12 and 20 vertebrate scavengers made use of wolf-killed prey, a small number compared to the 445 species of beetle scavengers. However, regardless of the prevalence of indirect effects, the dominant interaction that exists in YNP is between wolves and elk. Elk reduced group sizes and moved into forested cover in the presence of wolves, altered habitat selection behavior to avoid wolves in summer, and avoided aspen stands with higher predation risk (i.e., anti-predatory behavior).

Wolves have likely been influencing elk behavior in Wyoming similar to what has been documented in YNP, and would be expected to continue doing so under all of the Alternatives being considered in this EA, because USFWS and WGFD intend to ensure that Wyoming's wolf population is managed in a sustainable manner (USFWS 1994, 71 FR 43410, 73 FR 10514, 76 FR 61782, WGFC 2011).

1.6 WYOMING STATE POLICIES GOALS AND PROCEDURES FOR GRAY WOLF MANAGEMENT

The WGFC and WGFD are working to develop a state wolf management plan which meets state goals and objectives and the USFWS requirements for preservation of a healthy and viable wolf population as well as direction provided by the U.S. Federal Courts on this issue. The WGFC and WGFD will implement the gray wolf management plan upon federal delisting of wolves in Wyoming. Wyoming's plan will establish the framework for wolf management that provides for a recovered, stable, and sustainable wolf population that is connected genetically to other subpopulations of the NRM DPS (WGFC 2011). With the exception of provisions, the plan will include provisions to maintain no less than 100 wolves and 10 breeding pairs that the USFWS identified as necessary for recovery of the species. This will include a requirement to maintain an additional number of wolves above the 100 wolves and 10 breeding pairs minimum to ensure that the population does not inadvertently drop below the minimum level needed for recovery. The final population objectives in the plan are expected to be similar to those of Idaho and Montana, which should guarantee that the federal recovery criteria established by the USFWS are met and maintained after delisting.

To help ensure the health and long-term viability of the state wolf population, the final USFS-approved Wyoming wolf management plan is expected to include provisions for WGFD to collect, to the maximum extent practical, biological information, including genetic material, from all wolves that are killed by the public. WGFD will also monitor Wyoming's wolves using scientifically accepted methods[11] to determine the number of wolves and breeding pairs outside YNP and the Wind River Reservation (WRR). The final plan is expected to include provisions for: 1) maintaining a state wolf population of sufficient size to support the long term sustainability of state and regional wolf population; 2) providing opportunities for public harvest and using public harvest and agency control, when necessary, to reduce conflicts with livestock, ungulate herds[12], or humans; 3) maintaining a genetically viable wolf population; and 4) facilitating natural dispersal and genetic interchange within the NRM metapopulation by monitoring gene flow and genetic connectivity between subpopulations in the NRM. Wolf conservation measures will include, but are not limited to, revising genetics monitoring protocols, adjusting wolf management strategies to facilitate effective migrants, working with other states to promote natural dispersal into and within the GYA and, if necessary, relocating healthy, wild wolves between subpopulations.

1.6.1 Statewide WGFD Goals and Objectives

[11] The monitoring program will rely on accepted techniques using radio collars (both VHF and GPS) and aerial surveys. Monitoring and population status information will be published annually and provided to the USFWS and made available to the public.

[12] WGFD plans and research include monitoring and response to potential adverse impacts of wolves on wild ungulate populations, but WS is not proposing to become involved in WDM for game species population protections at this time.

A detailed description of goals and objectives for wolf management in Wyoming can be found in Addendum Wyoming Gray Wolf Management Plan WGFD (2012). Although specific details of the plan were vacated by the federal court, the overall objectives for the WGFD are anticipated to remain the same in future plans:

1. Manage for a self-sustaining, viable wolf population that provides for a diversity of values and uses.
2. Manage wolves as part of the native resident wildlife resource.
3. Provide for interchange of resident wolves with wolves from adjacent states/provinces as part of a larger metapopulation objective.
4. Allow wolves to persist where they do not cause excessive conflicts with humans or human activities.
5. Manage wolf populations so that wolf numbers will not adversely affect big game populations or the economic viability of those who depend on healthy big game populations[13].
6. Minimize wolf conflicts and adverse impacts where they occur.
7. Establish a strong and balanced public education program.

1.6.2 Population Objectives

The USFWS wolf population recovery plan requires 30 or more breeding pairs (an adult male and an adult female that raise at least 2 pups until December 31) comprising 300+ wolves well-distributed between Montana, Idaho, and Wyoming functioning as a metapopulation (a population that exists as partially isolated sets of subpopulations) with genetic exchange (either natural or, if necessary, agency –managed) between subpopulations. This requires Montana, Idaho, and Wyoming to each maintain a population of at least 10 breeding pairs and at least 100 wolves at the end of year. In order ensure these minimum levels are never compromised, Montana and Idaho each are required to manage for a population minimum of at least 15 breeding pairs and at least 150 wolves at the end of the year.

Upon delisting, Wyoming must maintain no less than 10 breeding pairs and at least 100 wolves within the state and a buffer number of wolves and breeding pairs above the minimum to ensure that the population does not inadvertently go below the minimum needed for recovery. The details of the buffer system and the relationship between the wolves in the YNP and Wind River reservation will be established in the new Wyoming wolf management plan which must be approved by the USFWS for delisting. In addition, State statute authorizes the WGFC to establish regulations to allow public harvest in designated areas when the wolf population is sufficient to sustain harvest. When developing or recommending wolf hunting seasons, the WGFD will consider the following: 1) wolf breeding seasons; 2) short and long range dispersal opportunity; 3) survival; 4) success in forming new or joining existing packs; 5) current year and average mortality; 6) conflicts with livestock; and 7) the broader game management responsibilities related to ungulates and other wildlife. WHAs will be small enough to direct harvest toward wolves in specific areas while managing harvest to maintain at least the minimum wolf population.

Wolves that occupy areas outside the WTGMA will be designated as a predatory animal and killing of wolves will not be regulated in areas of Wyoming where wolves are designated as such. The WGFC will not establish zones and areas within the WTGMA in which wolves may be taken as a predatory animal as is permitted with other trophy game species under State statute [Wyoming Statute 23-1-302(a)(ii)] and the WGFD will have no authority over wolves designated as predatory animals but will acquire genetic samples from wolves killed as predatory animals to the maximum extent practical.

1.6.3 Population Monitoring

While protected as a nonessential experimental population under the ESA, the USFWS is responsible for monitoring the wolf population. When delisted and placed under state management, the WGFD has primary responsibility for monitor breeding pairs and the total number of wolves in Wyoming in order to document their numbers, distribution, reproduction, and mortality. The WGFD would be responsible for monitoring all occupied habitat outside YNP, Grand Teton National Park (GTNP), the National Elk Refuge (NER), and the WRR. The National Park Service monitors wolves inside YNP (WGFC 2011) and GTNP; the USFWS Lander Fish and Wildlife Conservation Office and Shoshone and Arapahoe Tribal Fish and Game Department monitor wolves on the WRR (Shoshone and Arapahoe Tribal Fish and Game Department 2007;, and the USFWS monitors wolves on the NER. The agencies have agreed to share information regarding wolf population status, cause-specific mortality events, depredation statistics, genetics monitoring, and other pertinent wolf information from within their respective jurisdictions. The WGFD recognized the efforts and commitment these agencies have made in wolf recovery and urges continued federal funding at or above current levels in order for these wolf programs to continue after wolves are delisted.

1.6.4 Wolf Mortality

Disease, starvation, and intraspecific strife are the primary causes of wolf mortality in unexploited populations. Average annual mortality rates in unexploited populations are 45% for yearlings, and 10% for adults (USFWS 1994). However, human-caused mortality is the major factor in most wolf populations. Human-caused mortality includes legal and illegal harvest, agency management, vehicle accidents, and research-related mortalities such as capture myopathy. An important component of Wyoming's wolf management program will be to adequately monitor and manage human-caused mortality and all forms of known wolf mortality will be considered when making management decisions.

Analysis of radio-telemetry data from wolves in Montana, Idaho, and Wyoming from 1982 through 2004 indicates about 25% of wolves die each year. Agency management and illegal killing each removed about 12-15% of wolves annually. In addition, another 3% of the radio-collared wolves were accidentally killed each year through vehicle collisions, incidental trapping, and other human activities. About 6% of the wolf population died from natural causes such as disease, territorial strife, accidents, or being killed while attacking prey (Smith et al. 2010). Diseases and parasites have the potential to impact wolf population distribution and demographics (Mech et al. 2008, Almberg et al. 2009). Wolf population monitoring by WGFD will identify and track wolf mortality caused by diseases and parasites.

1.6.5 Research:

Past research conducted by the WGFD or their partners has focused on obtaining information that will help meet wolf population objectives, address potential impacts on ungulates, improve survey techniques, and manage wolf-related conflicts. Future research priorities are expected to include improving techniques to assess the status of the wolf population, including assessment of gene flow and genetic viability. Future research is also likely to include investigation of wolf habitat use patterns, prey selection and consumption rates, pack and territory sizes, age and rate of dispersal, gene flow, population growth rate, responses to hunting, and mortality factors. Research on wolf/wildlife interactions would be focused in areas of the state where wildlife may be most impacted by wolf predation, such as on elk feed-grounds and crucial wintering areas for

ungulates. WGFD, at this time, will not be actively pursuing research due to the change in wolf management authority from WGFD to USFWS (WGFD 2015).

1.6.6 Genetics/Connectivity

The genetic connectivity requirements for delisting wolves state that the NRM recovery areas must be functionally connected through emigration and immigration events, resulting in the exchange of genetic material between subpopulations. This relationship is consistent with the biological intent of the recovery plan and is an underlying prerequisite for successful wolf recovery in the NRM.

Designation of specific habitat linkage zones or migration corridors is impractical for a habitat generalist and highly mobile species like the wolf (Fuller et al. 2003). Outside refuges such as national parks, legal protection across broad landscapes and public education will facilitate those connections (Forbes and Boyd 1997). YNP and wilderness areas function as refugia throughout the geographic distribution of wolves in the NRM. The network of public lands in western Montana, central Idaho, and northwest Wyoming facilitate connectivity between the subpopulations. The legal protections and public outreach described in WGFC (2011) will preserve the integrity of wolf movement between the GYA subpopulation and other subpopulations in the NRM. Specific linkage corridors are not needed within Wyoming, because the wolf population inhabits one contiguous block in northwest portion of the state.

The WGFD recognizes dispersing wolves will travel through some habitats that are unsuitable for long-term occupancy due to high conflict potential. The majority of these areas will be outside of the WTGMA where the WGFD has no management authority. Public education efforts will emphasize that lone wolves sighted in previously unoccupied habitat may be dispersing animals, and that these sightings do not necessarily mean a pack is forming in any particular area.

The WGFD is committed, to the extent practical, to ensuring that genetic diversity and connectivity issues never threaten the GYA wolf population (USFWS et al. 2012). This will be accomplished by encouraging migration into the GYA wolf population. Conservation measures will include, but not be limited to, working with other states to promote natural dispersal into and within various portions of the GYA, if necessary by relocation or translocation of healthy, wild wolves in order to promote genetic diversity. The WGFD will coordinate with the USFWS, Montana, and Idaho to develop protocols to monitor genetic connectivity and viability of the NRM wolf population and assess whether genetic connectivity goals are being met. If the desired level of genetic connectivity is not being achieved, the WGFD will consult with the USFWS, Idaho and Wyoming to identify measures such translocation or other management techniques necessary to completely resolve the issue (USFWS et al. 2012).

1.7 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

1.7.1 Final EIS on the Reintroduction of Gray Wolves to Yellowstone National Park and Central Idaho

The USFWS issued a Final EIS (USFWS 1994) and ROD regarding the potential impacts of reintroducing wolves to YNP and Central Idaho. USFWS (1994) and 50 CFR 17.84 provide guidance on when, where, and how gray wolf conflict management may be conducted. Part of the analysis in the EIS assessed potential impacts of a fully-recovered wolf population on livestock, ungulate populations, and hunter opportunity. This EIS also assessed the anticipated

impact of wolf removals for protection of livestock and any decision made because of this EA process would be consistent with that guidance, if applicable.

1.7.2 Endangered and Threatened Wildlife and Plants; Final Rule to Identify the Northern Rocky Mountain Population of Gray Wolf as a Distinct Population Segment and to Revise the List of Endangered and Threatened Wildlife.

In 2009, the USFWS defined the NRM distinct population segment to include Idaho, Montana, Wyoming, the Eastern 1/3 of Washington and Oregon, and portions of north-central Utah (74 FR 15123). It also determined that the wolf population in the NRM DPS had met recovery goals and that protection under the ESA was no longer warranted in the DPS except in Wyoming where the existing management plans and regulation did not provide adequate regulatory mechanisms for purposes of the Act. This decision was later overturned by a U.S. Federal Court in August 2010.

1.7.3 Endangered and Threatened Wildlife and Plants; Reissuance of Final Rule to Identify the Northern Rock Mountain Population of Gray Wolves as a Distinct Population Segment and to Revise the List of Endangered and Threatened Wildlife.

Consistent with Congressional direction, in 2011 the USFWS reissued the final rule defining the NRM distinct population segment and delisted gray wolves in Idaho, Montana, the eastern portions of Washington and Oregon, and a small part of north-central Utah because threats have been reduced or eliminated (76 FR 25590). The decision retained XN status and associated protections for wolves in Wyoming.

1.7.4 Endangered and Threatened Wildlife and Plants; Removal of the Gray Wolf in Wyoming from the Federal List of Endangered and Threatened Wildlife and Removal of the Wyoming Wolf Population's Status as an Experimental Population.

In 2012, the USFWS determined that adequate management and regulatory mechanisms were in place in Wyoming and that further protection as an XN population under the act was no longer warranted (77 FR 55530). This Decision was vacated by a U.S. federal court in September 2014.

1.7.5 Environmental Assessment for Proposed Revision of Special Regulation for the Reintroduction of Gray Wolves into the Central Idaho and Yellowstone Areas (The latest 10j Rule)

The USFWS (2008) issued a Final EA and Decision in January 2008 on proposed changes to the 2005 10j rule [50 CFR 17.84(n)] which would allow greater flexibility in managing wolves shown to have an unacceptable adverse impact on ungulate populations. The changes only apply to states and tribes with USFWS-approved wolf management plans.[13] The USFWS EA assessed the ecological and other impacts related to the potential increase in take of wolves for protection of ungulates and domestic dogs.

1.7.6 Wyoming Gray Wolf Management Plan

The decision by the USFWS to approve the most recent version of the Wyoming wolf management plan (WGFC 2011) was vacated by a Federal Court in 2014. The WGFC and WGFD will develop and implement a USFWS-approved management plan for gray wolves upon

[13] At the time this EA was prepared, the Wind River Reservation in Wyoming had a USFWS-approved wolf management plan but the U.S. Federal court had vacated USFWS approval of the Wyoming state wolf management plan.

delisting by the USFWS. The plan will establish the framework for wolf management in Wyoming and will provide for a recovered, stable, and sustainable population of wolves that is connected genetically to other subpopulations of the NRM DPS. With the exception of the sections of the plan that were identified as problems by the U.S. District Court in 2014, any new wolf management plan in Wyoming is anticipated to be similar to the previous plan (WGFC 2011). The goal of WGFC (2011) was to ensure the long-term survival of wolves in Wyoming while minimizing wolf conflicts that result when wolves and people live in the same vicinity. Any subsequent plan will reflect the need to maintaining a genetically viable wolf population, and facilitation of natural dispersal and genetic interchange within the NRM metapopulation (Figure 1-1). When the state has a USFWS-approved wolf management plan, this EA will be reviewed and supplemented, if needed, for consistency with the state plan. All WS wolf management actions included within the Proposed Alternative in this EA would be implemented in a manner consistent with the provisions of the Wyoming Gray Wolf Management Plan.

1.7.7 Categorical Exclusion Records (CEs) for WS Wolf Conflict Management in Wyoming

In addition to the above-described EAs, CE records were prepared by WS in 2008-2014 for wolf conflict management to be conducted at the request of the USFWS or WGFD where wolf monitoring was desired and wolf predation on livestock had occurred. These documents analyzed the potential impacts of wolf removals expected to occur in response to depredations on livestock under the current program. These analyses indicated that expected wolf management actions would cause no significant impacts on Wyoming's wolf population, or on the populations of any non-target species.

1.7.8 Terms of Agreement (TOA) between the Secretary of the Interior, through the USFWS, and the State of Wyoming

These TOA were established in 2011 to facilitate an orderly transition from Federal management to State management and to further enhance the conservation of the gray wolf. Under the 10(j) rule and this agreement, WGFD became the "designated agent" of the USFWS to manage wolves in Wyoming.

1.7.9 Memorandum of Understanding (MOU) Between WS and the Wyoming Animal Damage Management Board

This document outlines the roles and responsibilities of WS and the "Predator Board" in dealing with a variety of wildlife damage problems in Wyoming, including wolf conflicts. Any actions conducted under either the Current or Proposed Alternative would be consistent with the guidance in this MOU or any updated version of the current MOU. The current MOU was signed in 2013, but this document has been revised several times over the years by mutual agreement to most effectively facilitate responses to wildlife damage problems in Wyoming.

1.7.10 USFS Land and Resource Management Plans (LRMPs)

USFS has LRMPs, or "Forest Plans," for their National Forests. WS, under a national MOU, has authority to conduct wolf management for the protection of private resources on their lands and is responsible for NEPA compliance. WS, USFS, and WGFD have annual work plan meetings to discuss management actions that are anticipated on each USFS National Forest. During these meetings, USFS identifies anticipated activities that are inconsistent with their LRMP. If an Alternative in this NEPA process were selected that was inconsistent with the LRMP, USFS could amend the LRMP to be consistent with the EA, or elements of that Alternative could be

modified when operating on that Forest. The decision would not be implemented on USFS lands until the inconsistency was resolved either through amendment of the LRMP or modification of the Alternative. Any inconsistencies would be identified and resolved before a gray wolf damage management project was conducted on a National Forest, unless an action were regarded as *emergency management* to resolve an immediate need such as taking a wolf that had attacked a person.

1.7.11 BLM Resource Management Plans/Environmental Impact Statements (RMP/EISs)

The BLM currently uses RMPs to guide land use decisions and management actions on lands they administer. Any decision made as a result of this EA process will be consistent with guidance in these RMPs regarding WS activities. In Wyoming, WS prepares annual Work Plans for each of the three BLM Districts (High Desert District, Wind River/Bighorn Basin (NW) District, and High Plains District). During the preparation of these plans, the BLM districts check the proposed action and provide information needed to ensure that WS actions are consistent with the RMPs for their districthttp://www.blm.gov/wy/st/en/field_offices.html.

1.7.12 Interagency Grizzly Bear Committee Guidelines

These guidelines address when and how management of nuisance and depredating grizzly bears would occur and defines agency roles and responsibilities. Any decision arising from this EA process would be consistent with the 1986 guidelines.

1.7.13 WGFD Wildlife Management Plans

WGFD has prepared strategic plans for big game and game birds, and management plans for black bear and mountain lion. These plans outline the management goals, objectives, strategies and methodologies for these species, and as other plans are developed, the EA would be reviewed to ensure consistency with the objectives of these species management plans.

1.7.14. Proposal to Permit Take as provided under the Bald and Golden Eagle Protection Act Final Environmental Assessment

Developed by the USFWS, this EA evaluated the issues and alternatives associated with the promulgation of new regulations to authorize the "take" of bald eagles and golden eagles as defined under the Bald and Golden Eagle Protection Act. The preferred alternative in the EA evaluated the authorization of disturbance take of eagles, the removal of eagle nests where necessary to reduce threats to human safety, and the issuance of permits authorizing the lethal take of eagles in limited circumstances, including authorizing take that is associated with, but is not the purpose of, an action (USFWS 2009). A Decision and Finding of No Significant Impact (FONSI) was made for the preferred alternative in the EA. The selected alternative in the EA established new permit regulations for the "take" of eagles (see 50 CFR 22.26) and a provision to authorize the removal of eagle nests (see 50 CFR 22.27). The USFWS published a Final Rule on September 11, 2009 (74 FR 46836-46879).

1.8 DECISION TO BE MADE

Based on agency relationships, MOUs and legislative direction, WS is the lead agency for this EA, and therefore responsible for the scope, content and decisions made. The WGFD, USFWS were cooperating agencies in the preparation of the EA. WS also consulted with, USFS, BLM, WDA and Northern

Arapaho Tribe during preparation of this EA. The WGFD, USFWS and consulting agencies had the opportunity to provide input during preparation of the EA to ensure an interdisciplinary approach in compliance with NEPA and agency mandates, policies and regulations.

Based on the scope of this EA, the decisions to be made are:

- Should WS work with the WGFD, USFWS to conduct a coordinated wolf conflict management program to alleviate damage to agriculture, property, and human health and safety? If so, what kind of program should be implemented?
- What mitigation measures and SOPs should be implemented by WS, WGFD, and USFWS
- Would the proposed action have significant impacts on the quality of the human environment and therefore, require preparation of an EIS?

1.9 GOALS AND OBJECTIVES

The goal of the proposed project is to conserve wolf populations while protecting livestock, other domestic animals and human health and safety in Wyoming as requested and authorized by the USFWS and WGFD and Tribes ungulate populations The following objectives were developed to achieve the overall program goal:

- The proposed action must not jeopardize the recovery of the state or regional wolf population.
- Management actions should not have significant adverse effects on non-target species populations.
- Wolf damage management activities must be conducted in accordance with authorities provided by the USFWS, WGFD, Tribes and applicable federal, state and local regulations.
- Wolf conflict management program should include a range of damage management techniques that allow for development of site-specific plans to effectively reduce damage of damage and conflicts with wolves, meet landowner/manager objectives for site use, and minimize potential for adverse environmental impacts.
- The program should be conducted by personnel trained and qualified in wolf damage management.
- There should be a system for monitoring the effect of management actions and cumulative impacts on the wolf population.

1.10 SCOPE OF THIS ANALYSIS

1.10.1 Actions Analyzed

This EA evaluates alternatives for WS involvement in wolf conflict reduction to protect agriculture, human and animal health and safety and property in cooperation with the WGFD,

USFWS and the other cooperating agencies [14]. Prompt, professional response to wolf conflicts would maintain and enhance local tolerance and acceptance of wolves (Fritts and Carbyn 1995, Mech 1995, Boitani 2003, Fritts et al. 2003, 73 FR 10514). Any direct action taken by WS to address wolf conflicts would be conducted at the request of the responsible management agency (the WGFD or USFWS in this case) or a specific tribe and in accordance with established management plans for gray wolves. It should be noted that the USFWS and WGFD could implement a WDM program with or without the involvement of WS. WS has no authority to regulate the management decisions made by the USFWS and WGFD and content and policies established in USFWS and WGFC are outside the scope of this EA.

1.10.2 American Indian Lands and Tribes

Wolves play an important role in some tribal culture and beliefs, but the exact nature of this relationship varies among tribes. The WGFD, USFWS and WS recognize the importance of wolves in tribal culture and will continue to work with individual tribes in an attempt to address their concerns regarding wolf conflict reduction in Wyoming. Currently, Wyoming WS has an MOU with the Shoshoni and Eastern Arapahoe Tribes to conduct conflict management activities. WS would only conduct wolf conflict management on tribal lands at the request of the tribe and only after appropriate authorizing documents (including MOUs) are signed. If WS enters into additional MOUs or agreements with other tribes, this EA and analysis would be reviewed and supplemented, if appropriate, to insure compliance with NEPA. MOUs, agreements and NEPA documentation would be prepared as appropriate before conducting additional activities on tribal lands. After delisting, non-Indian-owned fee title lands within the Wind River Reservation would be subject to the WGFD management plan and relevant laws and regulations.

1.10.3 Resources Not Currently Protected by WS Wolf Damage Management

The current wolf damage management program operates on a small percentage of properties in Wyoming. The EA also addresses the impacts of wolf conflict management on areas where additional agreements may be signed in the future. Because the proposed action is to reduce conflicts and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional management efforts could occur. The EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program.

1.10.4 Period for which this EA is Valid

If it is determined that an EIS is not needed, this EA will remain valid until WS identifies potential changes in impacts or issues which would warrant revision of the analysis in accordance with the NEPA and Council of Environmental Quality, and APHIS NEPA implementation regulations.

This EA has been prepared to address potential WS WDM actions in Wyoming while wolves are federally protected as an XN population and after eventual delisting when primary management authority is transferred to the WGFD and tribes. The lead and cooperating agencies understand that there is currently no USFWS approved plan for implementation after wolves in Wyoming are delisted. Analysis of impacts and proposed actions for implementation after delisting are based

[14] Tribal wolf management decisions are outside the scope of this analysis and decisions made in this EA do not alter the tribes' authority or rights relating to wolf management. However, this analysis does include the types of assistance WS may offer the tribes, if requested.

on prior wolf management plans prepared by WGFD and agency understanding of likely changes that will be made to address concerns expressed by U.S. federal courts. Once a new plan is approved and prior to implementing the provisions of the new plan, WS and the cooperating agencies will review this analysis in context of the new plan. If substantial differences exist between the provisions of the new plan and those anticipated in this EA, the EA will be amended in accordance with CEQ, USDA and APHIS NEPA implementing procedures.

1.10.5 Site Specificity

This EA analyzes the potential impacts of WS wolf conflict management on all public, private and tribal lands in Wyoming under MOU, Cooperative Agreement, and in cooperation with the WGFD, USFWS and other cooperating management agencies. This EA emphasizes major issues as they relate to specific areas whenever possible; however, many issues apply wherever wolf conflict, or potential wolf conflict, occurs and management actions are taken. WS personnel use the WS Decision Model (Slate et al. 1992) as the *"on the ground"* site-specific procedure for handling each damage management action conducted by WS. The Decision Model is a thought process that guides WS though the analysis and development of the most appropriate individual strategy to meet the need for action while minimizing risk of detrimental environmental effects from conflict management actions (see Chapter 3, Section 3.3.3 for a description of the Decision Model). The Decision Model (Slate et al. 1992) and WS Directive 2.201 describe the site-specific thought process that is used by WS. Decisions made using the model would be in accordance with plans, goals, and objectives of WS, USFWS and WGFD and any SOPs described herein and adopted or established as part of the decision.

WS, USFWS, WGFD and the other cooperating agencies analyzed the current program and proposed action, and the other alternatives in this EA against the issues that were raised. These issues were analyzed at levels that are *"site specifically"* appropriate for this action in Wyoming. Determining effects requires that WS look at the *context* of the issue and *intensity* of the action. Wolves can range over a large area that includes different land ownerships and political boundaries. Damage management actions are conducted on a much smaller portion of the habitat occupied by the target wolves. As professional wildlife biologists/managers, employees of WS, USFWS, WGFD and the other cooperating agencies analyzed effects of management actions on wolf populations, understanding that the damage situation with wolves may change at any time in any location because wildlife populations are dynamic and mobile.

Planning for the reduction of wolf conflicts is conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, insurance companies, etc. Although some of the sites where wolf conflicts will occur can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. The analyses in this EA are intended to apply to any action that may occur *in any locale* and at *any time* within Wyoming. As noted above, this EA emphasizes major issues as they relate to specific areas whenever possible; however, many issues apply wherever wolf conflicts and resulting management actions occur, and are treated as such. In this way, WS believes the EA meets the intent of NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with NEPA and still be able to meet needs for assistance with wolf damage management in a timely fashion.

In summary, WS, USFWS, WGFD and the other cooperating agencies have prepared an EA that provides as much information as possible to address and predict the locations of potential wolf

conflict management actions and coordinates efforts with WS, USFWS, and WGFD to ensure that wolf populations remain healthy and viable in each state. Thus, the EA addresses substantive environmental issues pertaining to wolf conflict management. To reduce damages, WS provides technical assistance and demonstrations to help prevent the need for operational conflict management. WS can and does provide an analysis of effects of their actions to reduce wolf conflicts within the scope of the EA. The site-specificity problem occurs when trying to predict conflict locations before the conflicts actually occur. By using the Decision Model (Slate et al. 1992), WS believes it meets the intent of NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with NEPA and still be able to accomplish its mission. WS determined that a more detailed and more site-specific level of analysis would not substantially improve the public's understanding of the proposal, the analysis, the decision-making process, and pursuing a more site-specific and more detailed analysis might even be considered inconsistent with NEPA's emphasis on reducing unnecessary paperwork (Eccleston 1995). In addition, considering cumulative impacts in one EA analyzing effects in the analysis area provides a better analysis than multiple EA's covering smaller zones.

1.11 SUMMARY OF PUBLIC INVOLVEMENT

Issues related to the proposed action were initially developed by WS, USFWS, WGFD and the other cooperating agencies based on an awareness of issues that have previously been raised regarding predator damage management in general, and wolf conflicts in particular in Wyoming and nearby states. As part of the WS environmental analysis process, and as required by the Council on Environmental Quality (CEQ) (1981) and APHIS-NEPA implementing regulations, this document will be made available to the public through "Notices of Availability" (NOA) published in the *Wyoming Tribune Eagle*, on the WS NEPA webpage; the federal rulemaking portal (http://www.regulations.gov/#!docketDetail;D=APHIS-2015-0029); email notices to entities who have registered for WS announcements (https://public.govdelivery.com/accounts/USDAAPHIS/subscriber/new), and mailings to additional entities within the state and elsewhere who have requested print notification. The EA will be made available for public comment from October 23 – November 25, 2015. The public notification process regarding the availability of a final EA and Decision will be identical to that used for the public comment period on the EA.

1.12 PREVIEW OF THE REMAINDER OF THIS EA

The remainder of this EA is composed of four Chapters and four Appendices. Chapter 2 discusses the issues considered in detail for each alternative, issues not analyzed in detail, and the affected environment. Chapter 3 describes each alternative, alternatives not considered in detail, specific damage management methods and Standard Operating Procedures (SOPs) for wildlife conflict management techniques. Chapter 4 analyzes the environmental impacts associated with each alternative considered in detail. Chapter 5 is a list of preparers, consultants and reviewers. Appendix A contains a copy of the depredation investigation form and describes criteria for classification of reported depredation incidents, Appendix B discusses the legal authorities of federal and state agencies and several relevant laws and Executive Orders and Appendix C lists the literature cited in the preparation of this document.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES IDENTIFIED AND EVALUATED IN THE EA

2.1 INTRODUCTION

Chapter 2 contains a discussion of the issues relevant to the analysis, including issues that received detailed environmental impact analysis in Chapter 4 (Environmental Consequences) and issues not considered in detail, with rationale. The identified issues have been or could be concerns to the public and/or professional communities regarding environmental impacts wolf conflict management activities. Issues relating to the reduction of wildlife damage were identified based on comments provided on similar analyses for wolf damage and conflict management in Montana, Idaho, and Wisconsin (USDA 2008, 2011, 2013*a*, 2013*b*) and during the interdisciplinary approach used in preparing this EA.

Pertinent portions of the affected environment are included in this chapter in the discussion of issues to be addressed in detail. Additional information on the affected environment is incorporated into the discussion of the environmental impacts in the section on the wolf damage and the benefits of wolves in Chapter 1, the description of the current program in Chapter 3 and Chapter 4.

2.2 AFFECTED ENVIRONMENT

This section contains background information relevant to the analysis. Additional information on the affected environment may be found in Chapter 1 and in Chapter 4, analysis of environmental impacts.

2.2.1 Wolf Habitat in the NRM and Wyoming

Historically, wolves in North America were well distributed and considered habitat generalists. They occurred in oak (*Quercus* spp.) savannah habitats of Mexico, prairies of the Great Plains, the Rocky Mountains, and the forest and tundra regions of the U.S. and Canada. The persistence of wolves in an area is primarily dictated by the availability and quality of habitat for its prey species, although land use (e.g., agriculture, housing) and societal tolerance for wolves are also factors. Availability of suitable habitat for denning is of secondary importance.

Wolves historically occurred throughout the NRM; however, much of their historical range has been modified for human use (i.e., housing, roads, industry, and agriculture). The vast majority of current suitable wolf habitat and associated wolf populations are secure in mountainous forested Federal public land (National Parks, wildernesses, roadless areas, and on some lands managed for multiple uses by the USFS and Bureau of Land Management) that is off limits or unsuitable for intensive levels of human development (USFWS 1993, 1996, 2007; Servheen et al. 2003, USFS 2006). The ranges of wolves and grizzly bears overlap in many parts of Wyoming and the GYA, and mandatory habitat guidelines for grizzly bear conservation on public lands guarantee, and exceed, necessary criteria for maintaining suitable habitat for wolves (USFS 2006). Wolves are currently well distributed from the Canadian border, south through Wyoming, and from the Washington and Oregon borders east into Montana and Wyoming. Of the 38 known wolf packs present in Wyoming at the end of 2011, home ranges of most were predominantly on USFS lands (Figure 1-1) (Jimenez et al. 2012).

The USFWS used two models to identify wolf habitat (Oakleaf et al. 2006, Carroll et al. 2006), which predicted different amounts of theoretically suitable wolf habitat in the NRM. Habitat

quality for wolves is based on adequate prey and security from excessive human-caused mortality. The general area in the NRM Recovery Areas (Montana, Idaho and Wyoming – USFWS et al. 2015) occupied by persistent wolf packs was determined by circumscribing a line around the outer points of radio-telemetry locations of all known wolf pack territories in 2006 (USFWS et al. 2007). The overall distribution of wolf packs within the NRM Recovery Areas was similar over the period of 2000 to present, despite a wolf population that more than doubled (USFWS et al. 2001, 2002, 2003, 2004, 2005, 2006, 2007, Bangs et al. 2009, USFWS 2012*a*, USFWS et al. 2015), although the density of packs and the habitat occupied by persistent wolf packs fluctuates (USFWS et al. 2005, 2006, 2007, 2009). In addition to the NRM Recovery Areas, the western gray wolf population has been gradually colonizing areas in surrounding states with breeding pairs first documented in Washington and Oregon in 2009. Wolf populations in Washington in Oregon continue to expand westward within these states (USFWS et al. 2015).

Wyoming has a diverse landscape, from high mountains to high deserts. Almost half of the state is public land, much in vast contiguous tracts. Carroll et al. (2006) ranked 29,808 mi^2 (77,202 km^2) in Wyoming as suitable habitat; approximately 30% of the state. The GYA is considered suitable wolf habitat because of large populations of natural prey and low potential for wolf conflicts (WGFC 2011). Outside of the GYA, much of the wolf's historical range within Wyoming has been modified for human use with land ownership and human use patterns resulting in varying levels of potential conflict with wolves. Eastern Wyoming is predominantly private agricultural land. While lone wolves can travel through, or temporarily live, almost anywhere (Jimenez et al. 2011), much of Wyoming is no longer suitable habitat for wolf packs and breeding pairs (Oakleaf et al. 2006, Carroll et al. 2006).

The GYA, which includes portions of Wyoming, is one of the last remaining large, nearly intact ecosystems on Earth; it encompasses an area of 19,000,000-20,000,000 acres, and includes Yellowstone and Grand Teton National Parks as well as a variety of surrounding federally managed lands in Montana, Idaho and Wyoming. A small proportion of privately held lands is encompassed in the GYA as well (USFWS 1994). The GYA provides secure wolf habitat and abundant ungulate populations (USFWS 1994) and lands are not available for development due to their land-use classifications, management guidelines for other species (i.e., grizzly bears, Canada lynx), habitat, access, and geological characteristics (USFWS 1993, 1996, 2007a, Serhveen et al. 2003, USFS 2006). Thus, these areas will continue to provide suitable habitat for a resident wolf population and will be a dependable source of dispersing wolves to help maintain a viable wolf population in the NRM and Wyoming (USFWS 1994, 76 FR 61782). State regulatory mechanisms in Wyoming and Federal land management practices/guidelines restrict the location and extent of development on public lands, and these activities are not expected to substantially impact prey or wolf security (USFS 2006, 76 FR 61782)).

The overall distribution of most Wyoming wolf packs has been similar since 2000, despite a wolf population in the State that has more than doubled (USFWS et al. 2001–2011, Bangs et al. 2009). At the end of 2010, "occupied areas" (including both pack-occupied areas and unsuitable areas between core recovery segments used only for dispersal) were estimated at approximately 18,000 mi^2 (46,600 km2) in Wyoming (76 FR 61782). This occupied area extends slightly further east than the WTGMA, includes about the western-third of the WRR and extends south to about Big Piney, Wyoming. Since 2006, the Wyoming and YNP wolf population has stabilized at approximately 300 to 350 wolves (USFWS et al. 2011). USFWS believes this largely stable population level and distribution is the result of the wolf population approaching biological carrying capacity, given available suitable habitat (76 FR 61782). Dispersing wolves routinely travel through unsuitable habitat and packs occasionally occupy such habitat (USFWS 1994, Bangs 2002, Jimenez et al. 2011). However, during the past 17 years, Wyoming wolf packs have

been unable to persist in areas intensively used for livestock production, primarily because of wolf conflicts (i.e., livestock depredations) with resultant agency removal of problem wolves and illegal killing (76 FR 61782).

WGFD manages resident ungulate populations to maintain them at densities compatible with habitat conditions and to provide for hunter harvest. In 2010, more than 1,133,364 wild ungulates, including about 103,810 elk, were estimated to inhabit Wyoming (WGFD Annual Report 2010). Wyoming supports about 50,000 elk and about 90,000 mule deer in northwestern Wyoming (76 FR 61782). 27 of Wyoming's 35 elk management units are at or above the WGFD numeric objectives for those herds; however, calf/cow ratios in several herd units are below desired levels (S. Smith pers. communication WGFD 2014). Wyoming has successfully managed resident ungulate populations for decades, The GYA will continue to support large populations of ungulates, and Wyoming will continue to maintain ungulate populations at densities that can support a recovered wolf population well into the foreseeable future (76 FR 61782).

Cattle and sheep are at least twice as numerous as wild ungulates, even on public lands (USFWS 1994). Livestock occur at varying densities in the GYA, with large expanses of the area not used for livestock production due to its land classification status (national parks, wilderness areas). However, in recent years, more than 500,000 acres (200,000 hectares) of public land grazing allotments have been purchased and retired in areas of chronic conflict between livestock and large predators, including wolves. Most wolf packs outside the public land areas have interacted with livestock, primarily cattle. Livestock and livestock carrion are routinely used by wolves, but wolf conflict management seeks to discourage chronic killing of livestock (USFWS 1994, 74 FR 15123, 76 FR 61782, WGFC 2011). Conflicts between wolves and livestock have routinely resulted in the removal of wolves, but the NRM wolf population continues to hold at a level well above recovery goals (Bangs et al. 1995, 2004, 2005, USFWS et al. 2007 – 2011, Jimenez et al. 2011, USFWS et al. 2015; See also Section 4.3.1.2).

Human population growth and development will continue in the NRM and Wyoming, including conversion of private low-density rural lands to higher density urban and suburban development; accelerated road development, and increasing amounts of transportation facilities (pipelines and energy transmission lines); additional resource extraction (primarily oil and gas, coal, and wind development in certain areas); and increased recreation on public lands (Robbins 2007, 76 FR 61782, WGFC 2011). In the six northwestern Wyoming counties most used by wolves, the human population is projected to increase approximately 22% by 2030 (from 122,787 counted in 2010 to 149,740 forecast in 2030) (Carroll et al. 2006, Wyoming Department of Administration and Information Economic Analysis Division 2012, U.S. Census Bureau Population Division 2005). Despite efforts to minimize impacts to wildlife (Brown 2006), development will make some areas of Wyoming and the GYA less suitable for wolf occupancy. However wolf habitat does not appear to be greatly affected by human-land uses such as snowmobiling, off-road vehicle use, or logging activities, except when these uses result in accidental or, intentional killing of wolves or changes in prey density (Fuller et al. 2003). Even active wolf dens can be resilient to nonlethal disturbance by humans (Frame et al. 2007).

The proposed action would include wolf conflict management by Wyoming WS on any private and/or public lands where wolf damage is occurring or could occur where: 1) resource owners/managers request assistance to alleviate damage, 2) management is authorized by the USFWS, WGFD or other responsible agency, 3) wolf damage or threats are verified, and 4) agreements or work plans have been completed specifying the details of the damage management action to be conducted.

Although no significant threats to suitable wolf habitat in Wyoming are known to exist in the foreseeable future, wolf managers will be required to regulate human harvest and illegal mortality, and manage conflict resolution (76 FR 61782, Smith et al. 2010). None of the human-use developments or increased human presence threatens wolf recovery or meaningfully impacts the amount of suitable wolf habitat in Wyoming or the NRM in the foreseeable future (Robbins 2007, 76 FR 61782). Wolves are habitat generalists and one of the most adaptable large predators in the world, and only became extirpated because of deliberate human persecution (Boitani 2003, Fuller et al. 2003).

2.2.2 Human Environment

The term "human environment" refers to existing relationships between people and the environment. The CEQ's NEPA Implementing Regulations define "human environment" as:

"*Human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment" (40 CFR 1508.14)."*

Therefore, existing human relationships with the animal species found in the affected environment, as well as all of the direct and indirect effects of those species on other aspects of the environment, are part of the "human environment" to which we must compare the effects of WS's proposed actions. Wolf conflict management by WGFD is part of the human environment that exists, or will exist, in the absence of any assistance actions by WS. Wolf conflict management methods used by WS can also be used by other agencies, such as WGFD or USFWS, or even by members of the public if/when allowed under State and local laws or perhaps as permitted by USFWS under current wolf "listed" status and if allowed under 10j or other USFWS-established rules or under WGFD management. All of these types of human relationships and interactions are established components of the human environment. Cultural, economic, social, legal, and other components of the affected environment are given further consideration in Section 2.3.3, 2.3.4 and 2.3.5 of this chapter and in Chapters 3 and 4.

2.2.3 The Environmental Baseline

To determine impacts of federal actions on the human environment, an environmental baseline needs to be established with respect to the issues considered in detail so that the impacts of the alternatives can be compared against the baseline. Based on the existing human environment described above, and the numerous types of human relationships that are established components of that environment, the baseline appropriate to use for analysis in this EA is not a "pristine" or "non-human-influenced" environment, but one that is already heavily influenced by human actions and direct management. Another way to evaluate impacts of the federal action in this situation is to compare against the *status quo* for the human environment that would exist with no federal WS involvement in wolf removals for conflict management purposes in Wyoming.

There are two possible scenarios that we have to consider when determining the "human environment" as defined by CEQ and to which we must compare the impacts of WS' wolf management assistance actions under the various alternatives analyzed in the EA:

Scenario 1: Wolves remain listed under the ESA - In this scenario, the "human environment" upon which we, as a federal agency, are evaluating our impacts in Wyoming, will be one in which the authorizations for wolf damage management have already been established by another federal agency – the USFWS – through its 10j rules established under the authority of the ESA. Further facts relevant to this scenario are:

- As authorized by the ESA, the USFWS has established regulations that have the force of law, to govern wolf management while wolves remain listed. Those regulations are the 10j rules described in 50 CFR 17.84 (i) and (n) (depending on whether the state or tribe has a USFWS approved wolf management plan).
- WS' potential actions as described herein are to assist the USFWS, and the WGFD, its partner in wolf management in Wyoming, in carrying out the decisions for wolf conflict management that the USFWS has already made via its 10j rules.
- The USFWS 10j rules governing wolf management authorize the management of wolves to reduce predation on livestock and domestic animals, pets and risks to human health and safety.

Therefore, the "human environment" and *environmental status quo* to which we must compare the effects of WS' alternatives in this EA includes already-established management decisions and authorizations.

Scenario 2: Wolves are delisted again – In this scenario, the "human environment" upon which we, as a federal agency, are evaluating our impacts in Wyoming, will be one in which the particular relationship of people with wolves in the environment is determined primarily by the Tribes and by the State of Wyoming through the WGFC and WGFD. This is based on the following premises:

- State wildlife management actions are not subject to NEPA compliance because NEPA only applies to *federal* actions.
- The States have the authority to manage populations of resident wildlife species. This will include wolves if/when they are delisted, without oversight or control by federal agencies with the following exceptions; 1) the state must have a USFWS approved management plan for wolves prior to delisting; 2) federally delisted T&E species are subject to a 5-year period of monitoring and oversight by USFWS following delisting to ensure that the species remains recovered; and 3) State management of previously listed species are also subject to long-term USFWS review to ensure that management actions do not pose a significant threat to the wolf population and will not reduce the population below thresholds established for recovery.
- Each State, including Wyoming, determines how resident wildlife will be managed within its boundaries by passing laws, regulations and policies via its representative form of government and through the development of management plans, as warranted.
- Each State's representative system of government is the established mechanism for determining the "collective" desires or endorsements of the people of a state. This is how a State determines the environmental condition, or *environmental status quo*, for those aspects of the human environment that are comprised of, or are directly or indirectly affected by, resident wildlife.
- It is reasonable and proper to rely on the representative form of government within a state as the established mechanism for determining the "collective" desires or endorsements of the people of a state.

Therefore, if/when wolves are delisted again, *they will be managed by the WGFD* and all of the *direct and indirect effects of wolves on other aspects of the environment* will become the established desired condition of the human environment, and therefore, part of the environmental baseline in Wyoming. That management is as currently described in WGFC (2011).

2.3 ISSUES CONSIDERED IN DETAIL FOR EACH OF THE ALTERNATIVES

Issues were identified based on an awareness of concerns previously expressed by representatives from various environmental and industry organizations, the general public, and other agencies. Some were used to prepare the detailed impact analyses of the Alternatives in Chapter 4. The issues were also used to identify minimization measures and to develop SOPs for reducing or eliminating the likelihood of adverse environmental effects from implementation of the proposed action. Some issues, however, did not receive detailed analysis for reasons articulated in Section 2.4. The following issues were determined relevant based on public and agency comments, and are analyzed in detail in Chapter 4:

- Ability of alternatives to meet management objectives and efficacy of methods
- Effects on the Wyoming wolf population
- Effects on public and pet health and safety
- Animal welfare and humaneness of methods to be used
- Impacts to stakeholders, including aesthetics of wildlife
- Impacts on non-target species including T/E species and ecosystems

2.3.1 Ability of alternatives to meet management goal and objectives

This section reviews the ability of each of the alternatives to achieve the management goal and objectives established in Section 1.9. The overall goal of the proposed action is to conserve wolf populations while protecting livestock and other domestic animals and human health and safety. Six objectives were identified in Section 1.9 as important to achieving the stated goal. This section reviews each alternative to determine if the alternative could be successful in meeting the objectives. This section includes a discussion of the available information on the efficacy of PDM methods. This evaluation is distinct from the environmental impact analysis, and is intended to aid the decision-maker in making a well-informed decision that considers both the ability of the alternative to meet the management objectives and the environmental consequences of the PDM alternatives.

2.3.2 Effects on the Wyoming Wolf Population

Wolves in Wyoming are currently managed in accordance with USFWS regulations for the establishment of a nonessential experimental wolf population in the NRM (50 CFR 17.84 (i)). Prior to delisting, the state must have a USFWS approve wolf management plan. Both the regulations and the state plan include provisions to ensure the ongoing health and viability of the gray wolf population in the state and the NRM. Some members of the public have expressed concern that wolf conflict management might result in cumulative adverse effects on the viability of Wyoming and NRM wolf population. This section reviews the potential direct, indirect and cumulative impacts from WS involvement in wolf conflict management in Wyoming in context of applicable state, federal and tribal regulations and plans for the protection and management of wolves (e.g., 50 CFR 17.84 (i), Shoshone and Arapahoe Tribal Fish and Game Department 2007).

2.3.3 Effects on Public Safety and Pet Health and Safety

One aspect of wolf damage management actions is their ability to reduce risks to public safety and domestic animals from wolf attacks and/or predation. At the same time, it is important to consider potential risks to public safety and domestic animal safety from methods used in conducting wolf conflict management. In particular, there may be concerns that the mechanical methods used for wolf capture and/or removal (*i.e.*, trapping, snaring, aerial shooting) or certain nonlethal methods such as use of livestock guarding dogs may be hazardous to people and pets.

Other individuals may be concerned that continued increases in wolf populations might threaten public and pet health or safety. Procedures for addressing risks to human health and safety from wolves are outlined in USFWS (1994), 71 FR 43410, 73 FR 10514, and 76 FR 61782, WGFC 2011).

2.3.4 Animal Welfare and Humaneness of the Methods to Be Used

Humaneness, in part, is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important and very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns, if *" . . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process.*" Suffering is described as a *" . . . highly unpleasant emotional response usually associated with pain and distress.*" However, suffering " *. . . can occur without pain . . . ,*" and" *. . . pain can occur without suffering . . .* "(AVMA 1987). Because suffering carries with it the implication of a time frame, a case could be made for " *. . . little or no suffering where death comes immediately . . .* "(CDFG 1991), such as shooting.

Pain obviously occurs in animals, but assessing pain experienced by animals can be challenging (AVMA 2007, CDFG 1991). The AVMA defines pain as being, "*that sensation (perception) that results from nerve impulses reaching the cerebral cortex via ascending neural pathways*" (AVMA 2007). The key component of this definition is the perception of pain. The AVMA (2007) notes that "pain" should not be used for stimuli, receptors, reflexes, or pathways because these factors may be active without pain perception. For pain to be experienced, the cerebral cortex and subcortical structures must be functional. If the cerebral cortex is nonfunctional because of hypoxia, depression by drugs, electric shock, or concussion, pain is not experienced.

Stress has been defined as the effect of physical, physiologic, or emotional factors (stressors) that induce an alteration in an animal's base or adaptive state. Responses to stimuli vary among animals based on the animals' experiences, age, species and current condition. Not all forms of stress result in adverse consequences for the animal and some forms of stress serve a positive, adaptive function for the animal. Eustress describes the response of animals to harmless stimuli which initiate responses that are beneficial to the animal. Neutral stress is the term for response to stimuli which have neither harmful nor beneficial effects to the animal. Distress results when an animal's response to stimuli interferes with its well-being and comfort (AVMA 2007).

The AVMA states *"... euthanasia is the act of inducing humane death in an animal" and that "...that if an animal's life is to be taken, it is done with the highest degree of respect, and with an emphasis on making the death as painless and distress free as possible*" (AVMA 2013). Additionally, euthanasia methods should minimize any stress and anxiety experienced by the animal prior to unconsciousness." Although use of euthanasia methods to end an animal's life is desirable, as noted by the AVMA, "*For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible*." (AVMA 2001).

AVMA (2013) notes, "*While recommendations are made, it is important for those utilizing these recommendations to understand that, in some instances, agents and methods of euthanasia identified as appropriate for a particular species may not be available or may become less than an ideal choice due to differences in circumstances. Conversely, when settings are atypical,*

methods normally not considered appropriate may become the method of choice. Under such conditions, the humaneness (or perceived lack thereof) of the method used to bring about the death of an animal may be distinguished from the intent or outcome associated with an act of killing. Following this reasoning, it may still be an act of euthanasia to kill an animal in a manner that is not perfectly humane or that would not be considered appropriate in other contexts. For example, due to lack of control over free-ranging wildlife and the stress associated with close human contact, use of a firearm may be the most appropriate means of euthanasia. Also, shooting a suffering animal that is in extremis, instead of catching and transporting it to a clinic to euthanize it using a method normally considered to be appropriate (e.g., barbiturates), is consistent with one interpretation of a good death. The former method promotes the animal's overall interests by ending its misery quickly, even though the latter technique may be considered to be more acceptable under normal conditions (Yeates 2010). Neither of these examples, however, absolves the individual from her or his responsibility to ensure that recommended methods and agents of euthanasia are preferentially used."

AVMA (2013) recognizes that there is "*an inherent lack of control over free-ranging wildlife, accepting that firearms may be the most appropriate approach to their euthanasia, and acknowledging that the quickest and most humane means of terminating the life of free-ranging wildlife in a given situation may not always meet all criteria established for euthanasia (i.e., distinguishes between euthanasia and methods that are more accurately characterized as humane killing). Because of the variety of situations that may be encountered, it is difficult to strictly classify methods for termination of free-ranging wildlife as acceptable, acceptable with conditions, or unacceptable. Furthermore, classification of a given method as a means of euthanasia or humane killing may vary by circumstances. These acknowledgments are not intended to condone a lower standard for the humane termination of wildlife. The best methods possible under the circumstances must be applied, and new technology and methods demonstrated to be superior to previously used methods must be embraced.*

Multiple federal, state, and local regulations apply to the euthanasia of wildlife. In the United States, management of wildlife is primarily under state jurisdiction. However, some species (e.g., migratory birds, endangered species, and marine mammals) are protected and managed by federal agencies or through collaboration between state and federal agencies. Within the context of wildlife management, personnel associated with state and federal agencies and Native American tribes may handle or capture individual animals or groups of animals for various purposes, including research. During the course of these management actions, individual animals may become injured or debilitated and may require euthanasia; in other cases, research or collection protocols dictate that some of them be killed. Sometimes population management requires the lethal control of wildlife species, and, the public may identify and/or present individual animals to state or federal personnel because they are orphaned, sick, injured, diseased (e.g., rabid), or becoming a nuisance."

Analysis of this issue must consider not only the welfare of the animals captured, but also the welfare of humans, livestock and other domestic animals if damage management methods are not used. For example, some individuals may perceive techniques used to remove a predator that is killing or injuring pets or livestock as inhumane, while others may believe it is equally or more inhumane to permit pets and livestock that depend upon humans for protection to be injured or killed by predators.

The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology. Wildlife Services personnel are concerned about animal welfare. WS is aware that techniques like snares and traps are controversial, but also

believes that these activities are being conducted as humanely and responsibly as practical. Wildlife Services and the National Wildlife Research Center are striving to bring additional non-lethal damage management alternatives into practical use and to improve the selectivity and humaneness of management devices. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations when non-lethal damage management methods are not practical or effective. Wildlife Services supports the most humane, selective, and effective damage management techniques, and would continue to incorporate advances into program activities.

Wyoming WS personnel are experienced and professional in use of management methods to increase humaneness as much as possible under the constraints of current technology, workforce, and funding. SOPs used to maximize humaneness are listed in Chapter 3. Furthermore, state regulations require that traps be checked every 72 hours, with WS state policy to check all wolf traps once per day.

2.3.5 Impacts to Stakeholders, Including Aesthetics of Wildlife

2.3.5.1 Variations in Perception of Wildlife Damage

During the last 200 years, broad-scale changes in land-use patterns (*e.g.*, housing developments, agriculture, roads, industrial complexes, etc.) have occurred as the increasing human population settled North America. Notable is the large-scale conversion of natural landscapes to agricultural and urban environments. As humans encroach on wild habitats, they compete with wildlife for space and other resources, which increases the potential for conflicts. Concurrent with this growth and change is a desire by some segments of the public to completely protect all wildlife, which can create localized conflicts with resource managers and individuals experiencing problems with wildlife. USDA (1997) summarizes the American perspective of the relationship between wildlife values and wildlife damage as follows:

"*Wildlife has either positive or negative values, depending on varying human perspectives and circumstances . . . Wildlife is generally regarded as providing economic, recreational and aesthetic benefits . . . and the mere knowledge that wildlife exists is a positive benefit to many people. However . . . the activities of some wildlife may result in economic losses to agriculture and damage to property . . . Sensitivity to varying perspectives and value is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well*."

Biological carrying capacity is the limit of the land or habitat to support healthy populations of species without long-term degradation of either the health of the species or the associated environment (Decker and Purdy 1988). The wildlife acceptance capacity (also known as cultural carrying capacity) is the limit of human tolerance for wildlife, or the maximum number of a given species that can coexist compatibly with local human populations (Decker and Purdy 1988). These capacities are especially important in areas inhabited by humans because they define the sensitivity of a local community to a specific wildlife species/problem. For any given situation involving a wildlife conflict, individuals directly or indirectly affected by the damage will have varying degrees of tolerance for the damage and the species involved in the damage. This tolerance determines the “wildlife acceptance capacity,” which is often lower than the “biological

carrying capacity." For example, the biological carrying capacity of gray wolves in Wyoming could be higher than their current population; however, for some individuals and groups, the area has as many or more wolves than can be tolerated (*i.e.,* for these individuals, the wildlife acceptance capacity has been reached or exceeded). Once the wildlife acceptance capacity of a species is reached or exceeded, humans will demand implementation of programs, both lethal and nonlethal, to reduce damage or threats of damage.

The human attraction to animals has been well documented throughout history, an idea supported by prehistoric cave paintings and the domestication of wild animals. Today's American public is no exception, as evidenced by the large percentage of households that have pets or observe wildlife. Some people also may consider individual wild mammals and birds as "pets" and exhibit affection toward these animals. They may also want to have more wild animals in their immediate environment. Some people feel a spiritual bond with wild animals and/or feel a moral or spiritual obligation to preserve wildlife species or individual animals. Conversely, some people have no emotional attachment to wildlife; some may even fear the presence of wild animals in their vicinity and demand their immediate removal. Others may have a more utilitarian relationship with wildlife and desire the preservation of species populations, but may also support removal of individual animals if their activities cause damage or threaten human health and safety.

Ideas about how conflict management programs should implemented and conducted are as unique as the almost infinite combinations of philosophies, psyches, aesthetic values, personal attitudes, and opinions found in humans. These differences of opinion result in concerns that the proposed action or the Alternatives would result in the loss of aesthetic or cultural/spiritual benefits to the general public and resource owners.

2.3.5.2 Aesthetic and Sociological Values of Wildlife

Wildlife generally is regarded as a source of economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective, dependent on what an observer regards as beautiful. Wildlife populations also provide a range of direct and indirect social and economic benefits (Decker and Goff 1987). Direct benefits are derived from a user's personal relationship or direct contact with wildlife and may include either consumptive (*e.g.*, using or intending to use the animal such as in hunting or fishing) or non-consumptive use (*e.g.*, observing or photographing animals) (Decker and Goff 1987). Indirect benefits, or indirect exercised values, arise without a human being in direct contact with an animal and are derived from experiences such as looking at pictures or videos of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Two forms of indirect benefits exist according to Decker and Goff (1987): bequest and pure existence. Bequest benefits arise from the belief that wildlife should exist for future generations to enjoy; pure existence benefits accrue from the knowledge that the animals exist in the human environment (Decker and Goff 1987) or that they contribute to the stability of natural ecosystems (Bishop 1987).

Some people directly affected by problems caused by wolves insist on the lethal removal of the problem animal(s) from the area where the conflict occurs. Others hold the view that all wildlife involved in conflicts should be captured and relocated to another area to

alleviate the problem, or that humans should learn to live with the conflict. Individuals not directly affected by a conflict may be supportive of affected humans, neutral, or totally opposed to any removal of wildlife from specific locations or sites.

Those who oppose removal of wildlife may do so because of emotional or spiritual ties to the animals, which are similar to the bonds that may exist between a human and a pet. Some may totally oppose wolf conflict management, especially if lethal methods are used, and want WS, USFWS and WGFD to teach tolerance of wolves causing conflicts. These individuals generally believe that individual animals have inherent value and should not be killed to meet the desires of mankind. They may also feel that individual animals have rights similar to those of humans and that, if it is inappropriate to treat a human in a given manner, then it is also inappropriate to treat an animal in that manner.

The goal of human-wolf conflict management is to provide relief from damage or threats of damage while minimizing the potential for negative impacts on the environment including aesthetic and social values. WS would only conduct human-wolf conflict management in consultation with WGFD or USFWS, as appropriate and after a request has been received from citizens, organizations, and others who are experiencing problems (*i.e.,* where a need exists).

2.3.6 Effects on Non-target Species Populations, Including Threatened and Endangered Species and Ecosystems

A common concern among members of the public and wildlife professionals, including WS and the WGFD is that the proposed action or any of the alternatives might have adverse impacts on populations of other native wildlife species, particularly state or federally-listed threatened and endangered species. A current list of federally listed T&E species was obtained from USFWS for Wyoming from the USFWS T&E website (http://www.fws.gov/wyominges/Pages/Species/SpeciesEndangered.html). At the time this EA was prepared, the federal list of T&E, proposed, and candidate species obtained for Wyoming includes eight mammals, five birds, one amphibian, five fish, and six plants. Of the species and subspecies currently listed in Wyoming under provisions of the federal ESA, excluding those listed but not found in Wyoming, 8 species are endangered, and 11species are threatened and five are proposed or candidate species. Additionally, two non-essential, experimental populations (NEP) exist in Wyoming, the black-footed ferret and the gray wolf.

There are 180 mammal, mollusk, reptile, fish, bird, and crustacean listed as Species of Greatest Conservation Need in Wyoming. Special efforts are made to avoid jeopardizing threatened and endangered species though biological evaluations of the potential effects of the alternatives and the establishment of special restrictions or standard operating procedures.

There may also be concerns that WS' activities could result in the disturbance of eagles that may be near or within the vicinity of WS' activities. Under 50 CFR 22.3, the term "*disturb*", as it relates to take under the Bald and Golden Eagle Act, has been defined as "*to agitate or bother a Bald and Golden Eagles to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.*" The environmental consequences evaluation conducted in Chapter 4 of this EA will discusses the potential for WS' activities to disturb eagles as defined by the Act.

In addition to direct impacts on target species though unintentional capture, injury, death or disturbance, there are also concerns that removal of wolves for damage management may result in indirect adverse disruptive impacts on ecosystems and biodiversity. Predators are an essential component of healthy native ecosystems. There are concerns that reductions in wolf populations could result in increases in other predators such as coyotes that could have different, or even greater adverse effects on livestock and or other wildlife species. There are also concerns that reductions in or absence of wolf populations could result in increases in herbivore populations, shifts in prey foraging behavior and, ultimately, changes in plant communities (i.e., impact trophic cascades). Chapter 4 reviews the potential for the proposed action to affect these ecosystem-level processes.

2.4 OTHER ISSUES RELEVANT TO THE ANALYSIS

Some issues were considered, but not addressed in detail for each of these alternatives. Reasons for not including these issues in the analysis in Chapter 4 are discussed below, but may relate to factors including that 1) the issue is a question or statement instead of an environmental impact and is not suitable for comparative analysis or 2) the response to the issue is essentially the same for each alternative, so there would be little benefit from comparative analysis.

2.4.1 Lethal removal of wolves during the spring and early summer months could potentially result in litters of wolf pups becoming orphaned.

Depending on the circumstances, lethal removal of wolves to address livestock depredation problems or risks to human health and safety may involve removing most or all members of a specific wolf pack, as authorized by the USFWS, WGFD or other responsible management agency. If these types of removals occur during the spring or early summer months, and the decision has been made to remove the entire pack, concerted efforts are made to remove all of the pups as well as the adults, in order to avoid orphaning the pups. When not all adult wolves are removed from a pack, a remaining wolf or wolves may continue to feed and care for the remaining pups (Packard 2003, Boyd and Jimenez 1994). There may be occasional circumstances however, where in spite of concerted efforts to humanely remove any pups left after all adult wolves have been removed, one or more pups may be left without any adult wolves to feed or care for them. The only way to avoid this circumstance altogether would be to limit wolf removal efforts during this time frame, so as to always ensure that at least one or more adult wolves were left to care for any pups. In some circumstances, this would be inconsistent with the objective of stopping chronic wolf predation on livestock.

Unfortunately, there could be occasional instances where dependent young may be orphaned during wolf damage management activities. To keep things in perspective, it is important to consider the amount of suffering and death that occurs in the absence of predator removal as well. Predators by definition kill and eat prey, which does not ordinarily represent a problem unless this behavior conflicts with human interests. But regardless of whether predation creates conflicts with human interests, prey species are typically subjected to pain and suffering when preyed upon by predators. Death in nature is notoriously harsh (Howard 1986), and it would be purely speculative to infer whether the fate of any potentially orphaned wolf pups would be any more or less harsh if their parents had not been killed through predator control activities. To the extent that predator control removes animals that would otherwise continue to kill or injure prey animals, the overall level of pain and suffering may be reduced.

We expect the orphaning of wolf pups would occur very infrequently, if ever, and find no reason to believe that it would result in a significant adverse effect on the ability to maintain a viable wolf population in Wyoming as desired by WGFD and USFWS.

2.4.2 Appropriateness of preparing an EA (rather than an EIS) for such a large area, rather than preparing multiple EAs for smaller, more site-specific areas.

Federal agencies have the discretion to determine the geographic scope of their NEPA analyses [*Kleppe v. Sierra Club,* 427 U.S. 390, 414 (1976)] and WS has determined that preparation of this EA to address wolf conflict management statewide is appropriate and consistent with wolf management objectives and plans (USFWS 1994), 71 FR 43410, 73 FR 10514, 76 FR 61782, WGFC 2011). USFWS (2008) prepared a single EA to collectively address specific aspects of wolf damage management in the three NRM wolf states (*i.e*., Idaho, Montana and Wyoming), whereas this EA only covers one state. If a determination is made through this EA that the proposed action would have a significant impact on the quality of the human environment, then an EIS may be prepared in compliance with NEPA. In terms of considering cumulative impacts, one EA covering the entire state of Wyoming may provide a better analysis than multiple EA's covering smaller zones within the state. A more detailed and site-specific level of analysis would not likely contribute to substantial improvement in the decision-making process, and pursuing a more site-specific and more detailed analysis might even be considered inconsistent with NEPA's emphasis on reducing unnecessary paperwork (Eccleston 1995).

2.4.3 Concerns that the Proposed Action may be highly controversial and its effects may be highly uncertain, both of which would require that an EIS be prepared.

The failure of any particular group or individual to agree with every act of a Federal agency does not necessarily create a controversy, and NEPA does not require the courts to resolve disagreements among various scientists as to the methodology used by an agency to carry out its mission [Marsh v. Oregon Natural Resource Council, 490 U.S. 360, 378 (1989)]. Although there is some opposition to wolf conflict management, there is not substantial scientific controversy in terms of the projects' size, nature, or environmental effect. If a determination is made through this EA process that the proposed action would have a significant effect on the quality of the human environment, then an EIS would be prepared.

2.4.4 If lethal control is implemented, effort must be taken to target the individual wolf or wolves responsible for the depredation.

WS personnel are highly trained in methods of identifying wolf depredations, and use sound scientific information for assessing depredation events (Acorn and Dorrance 1990). Agency personnel strive to target the specific wolf or wolves involved in depredation to stop the problem as quickly as possible and to reduce control and damage costs. However, like any wildlife management action in an uncontrolled situation, cannot guarantee that the wolf taken is always the specific individual involved in the depredation. In wolves, identification of depredating individuals is complicated by pack hunting behavior. When a pack is involved in a depredation incident, multiple individuals may have been involved in the depredation event and agency personnel cannot always determine which specific individuals were responsible. Pups also learn to identify appropriate prey items from adults. The 1994 Final USFWS EIS defined problem wolves as including adult and yearling wolves that depredate as well as pups of the year that feed on livestock killed by other pack members. Measures used to identify and target depredating wolves include, but are not limited to, careful analysis of wolf sign at the site by trained professionals, review of information on radio-collared wolves in the vicinity of the depredation,

and focusing wolf capture efforts in areas near the depredation site. Sign at the depredation site can often be used to determine if the depredation was caused by an individual wolf or multiple wolves. Because wolves are very territorial, the wolf or wolves responsible for the depredation are the ones most likely to return to the depredation site, and traps set near the kill site are most likely to capture the wolf or wolves involved in the depredation. When radio-collared individual wolves or packs are implicated in depredations on livestock (by proximity in time and space to the depredation), telemetry monitoring can be used to help target those wolves either through trapping efforts on the ground or by aerial shooting.

2.4.5 Producers should not expect to prevent all predation losses and some losses are a cost of doing business.

Livestock producers recognize that some level of predation losses are likely to occur, in spite of their efforts and agency efforts to reduce such losses. The agencies involved in wolf damage management do not expect to prevent all losses, nor are they proposing lethal wolf damage management as a solution to all depredation incidents. WS, USFWS and WGFD use an integrated approach to resolve wolf damage complaints. In some situations the use of nonlethal methods alone may be adequate for resolving wolf depredation complaints, but there will always be some situations which cannot be resolved with exclusive use of nonlethal methods. Most instances of wolf predation on sheep, for example, occur in spite of the use of herders and livestock guarding dogs by sheep producers to protect sheep from predation. For example, a recent 2014 NASS survey of sheep producers collected data on nonlethal methods used to reduce predation (NASS 2015). In Wyoming, nonlethal methods employed included livestock guarding dogs (36% of operations), guard llamas (16%), guard donkeys (7%), fencing 24%, shed lambing (47%), herders (13%), night penning (34%), frightening devices (7%), carcass removal (20%), culling vulnerable stock (34%), changing bedding grounds (13%), frequent checks (30%), altered lambing schedules to avoid period of greatest predation risk (5%), and other nonlethal methods (8%). Historically, the Defenders of Wildlife (DOW), a private wildlife and habitat conservation organization, had voluntarily compensated Wyoming livestock producers 100% of the value of livestock that are confirmed by WS as killed or injured by wolves and 50% of the value of livestock that are designated by WS as "probable" wolf predation. Although this program is no longer in existence, since 2008, the WGFD pays for livestock losses verified as killed by wolves. In some instances, WGFC regulations additionally allow for payment for missing livestock in open range settings if the producer had verified wolf-caused losses during the grazing season.

2.4.6 Impacts on Cultural, Archaeological and Historic Resources and Tribal Cultural Properties in Wyoming

The activities described under all the alternatives analyzed in this EA would not cause any significant ground disturbances and would not otherwise have the potential to significantly affect the visual, audible, or atmospheric elements of historic properties and thus are not undertakings as defined by the National Historic Preservation Act (NHPA). WS has determined that wolf conflict management actions are not undertakings as defined by the NHPA because such actions do not have potential to result in changes in the character or use of historic properties. The Wyoming State Historic Preservation Office (SHPO) has previously concurred with WS' assessment that predator conflict management activities are unlikely to have any effect on historic properties. A consultation between Wyoming WS and the SHPO resulted in another letter of concurrence from SHPO that WS activities as proposed in this EA would not likely result in any effects on historic properties (2/18/2015 letter to Rod Krischke). WS also offered the opportunity to initiate consultation on WS WDM actions in Wyoming and/or participate in preparation of the EA to the Eastern Shoshone and Northern Arapaho Tribes to identify any potential concerns regarding

possible impacts of WS' wolf conflict management activities on tribal cultural properties in Wyoming (letter 3/13/2014).

2.4.7 Irreversible and Irretrievable Commitments of Resources

The following resource values within Wyoming would not be adversely affected by any of the alternatives analyzed in this EA: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These will not be analyzed further.

Other than minor uses of fuels for motor vehicles and electrical energy for office maintenance, there are no irreversible or irretrievable commitments of resources. Relative to cumulative uses of these resources, the WS/ USFWS/WGFD wolf conflict management program as directed by the USFWS or WGFC (2011) produces very negligible impacts on the supply of fossil fuels and electrical energy.

2.5 Issues not Considered Because They are Outside the Scope of this Analysis

2.5.1 Circumstances under which livestock owners and other private citizens may legally take wolves.

Following the initial issuance of the original (1994) 10j rules for management of the XN gray wolf population in the NRM, subsequent 10j rules (issued in 2005 and 2008) have allowed greater flexibility in dealing with gray wolf depredations on livestock and other domestic animals, depending on whether or not the state or tribe has a USFWS approved management plan. (USFWS 2008). Wolves are currently managed by the USFWS (USFWS 1994, 71 FR 43410, 73 FR 10514, 76 FR 61782) and upon delisting will be managed by the WGFD and Tribes (WGFC 2011). This issue is outside the scope of this EA.

2.5.2 Issuance of permits to landowners to take wolves.

Wolves are currently managed by the USFWS (USFWS 1994, 71 FR 43410, 73 FR 10514, 76 FR 61782) and the issuance of permits to landowners and livestock producers by the USFWS is a decision of the USFWS and outside the scope of any decision that WS would make as a result of this EA. Should wolves be delisted, WGFD would issue permits to landowners to take wolves in depredation situations; such action would be outside the scope of this EA.

2.5.3 Desire for or opposition to a hunting season for wolves.

As long as wolves are listed under the ESA, hunting seasons will not be authorized, but should wolves be delisted again, WGFD would likely initiate public hunting and possibly trapping of wolves similar to that described in WGFC (2011). WS has no authority to either authorize or disallow hunting or trapping seasons for wolves. This issue is outside the scope of any decision that WS could make in conjunction with this EA.

2.5.4 Appropriateness of livestock grazing on public lands.

Regulating or authorizing livestock grazing on public lands is the responsibility of the respective public land management agency. The authority and regulation of livestock grazing on public lands is outside of WS' authority and therefore outside the scope of this EA.

CHAPTER 3: ALTERNATIVES

3.1 INTRODUCTION

This Chapter consists of six parts: 1) an introduction, 2) a description of alternatives considered and analyzed in detail, 3) a description of wildlife damage management strategies and methodologies, 4) a list of wolf damage management methods that could be used or recommended by WS, 5) a description of alternatives considered, but eliminated from detailed analysis, and 6) a table of mitigation measures and SOPs. Three alternatives were recognized, developed and analyzed in detail; and six alternatives were considered but not analyzed in detail, with supporting rationale presented.

Currently, the USFWS has primary management authority for wolves in Wyoming and policies and procedures for wolf management within the State have been established (USFWS 1994, 76 FR 61782, WGFC 2011). Wyoming WS acts as an agent for USFWS, at their request, in conducting wolf conflict management (Letter to R. Krischke, WS from M. Jimenez, USFWS, Wyoming Wolf Recovery Project Leader, October 22, 2014), or for WGFD (Letter to R. Krischke, WS from B. Nesvik, Chief Wildlife Division, WGFD October 4, 2011), but in the absence of WS involvement, the USFWS, WGFD, or other responsible management agency would be responsible for conducting wolf conflict management. The purpose of this EA is to examine the environmental impacts of various levels of WS involvement in Wyoming wolf conflict management during and after federal protection as an XN population. WS would be a designated agency of the responsible wolf management agency and therefore WS would respond to requests for assistance after the responsible agency had approved the specific action or class of management actions. The role of WS would be to assist the responsible management agency implement their management decisions.

3.2 DESCRIPTION OF THE ALTERNATIVES ANALYZED IN DETAIL

Under the first two alternatives, WS wolf conflict management assistance could be provided on private or public property and tribal lands when: 1) resource owners/managers request assistance to alleviate wolf conflicts and the management is authorized by the USFWS, WGFD the Tribes, 2) wolf damage or threats are verified, and 3) agreements or work plans have been completed specifying the details of the management action to be conducted. Before WS would conduct wolf conflict management on tribal-owned lands, the tribal council or other governing board would need to provide specific authorization.

For all alternatives, USFWS, WGFD, the Tribes or their designated agent, retains their authority to implement or authorize nonlethal or lethal actions in addition to WS actions consistent with the USFWS 10j rules and/or Wyoming regulations and management policies as appropriate (USFWS 1994, 71 FR 43410, 73 FR 10514, WGFC 2011). For example, USFWS, WGFD or the Tribes may issue permits to livestock producers or their agents who have experienced recent confirmed wolf predation on their animals or by authorizing USFWS, WGFD, or authorized WS personnel to remove wolves to address livestock depredations. These decision-making processes are currently the responsibility of USFWS, and upon delisting, they would be decisions of WGFD and outside of WS' decision making authority.

3.2.1 Alternative 1 - Continue the Current Wolf Conflict Management Program (No Action/Proposed Action)

CEQ (1981) guidance states that the "No Action" alternative can be defined as the continuation of current management practices. Consequently, the Current Program (Alternative 1) will be used

as the No Action alternative and the baseline for comparison with the other alternatives to determine if the real or potential impacts are greater, lesser, or similar. Cumulative environmental impacts result from incremental consequences added to other past, present, and reasonably foreseeable wolf conflict management actions by the USFWS, WGFD, Tribes, other agencies or individuals based on federal state or tribal management plans (e.g., USFWS (1994), 71 FR 43410, 73 FR 10514, 76 FR 61782, Shoshone and Arapahoe Tribal Fish and Game Department 2007). This Alternative would continue the Wyoming WS wolf conflict management program to protect livestock and other domestic animals and protect human safety as currently provided for under applicable agreements and plans and the 10j rules as appropriate (USFWS 1994, 71 FR 43410, 73 FR 10514, 76 FR 61782, WGFC 2011). Regardless of state, federal or tribal plans which may include provisions for WDM for the protection of ungulates, under this alternative, WS would not be involved in WDM to enhance ungulate populations. The No Action Alternative serves as the baseline against which the impacts of management alternatives can be compared and can be defined as a continuation of current management practices (CEQ 1981).

Under Alternative 1, wolf conflict management would continue to be conducted on private and public lands[15] in Wyoming as currently authorized by the USWFS when the resource owners/ managers request assistance to alleviate wolf damage, wolf damage is verified by WS, and an *Agreement for Control* or other work authorization documents have been completed. WS would provide technical assistance and operational wolf damage management using and/or recommending nonlethal and lethal management methods after applying the WS Decision Model (Slate et al. 1992). WS would be able to assist with wolf research, wolf monitoring[16] and wolf or wolf-dog hybrid removal when requested and authorized by the USFWS and WGFD, as appropriate. Nonlethal methods used by landowners could include, but would not be limited to, changes in ranch management practices and pet care/supervision, livestock guarding/management with herders/range riders, proper carcass disposal, frightening devices, exclusion, guarding animals, habitat modification, and behavior modification of problem wolves. Nonlethal methods used operationally by WS may include fladry and turbo-fladry, foot-hold traps and snares with "stops" (used to live capture wolves for attaching radio-collars), frightening devices (*e.g.,* electronic guard, RAG devices), aversive conditioning (*e.g.,* modified dog training collars) and nonlethal projectiles (*e.g.,* rubber bullets, bean bag rounds). Aversive conditioning and other experimental damage management techniques would only be used by WS after consultation and concurrence with USFWS or WGFD, as appropriate.

In determining the most appropriate wolf conflict management strategy, preference would be given to nonlethal methods when they are deemed practical and effective (WS Directive 2.101). Lethal methods would be used to reduce damage after practical and appropriate nonlethal methods have been considered and determined to be ineffective or inappropriate to reduce damage to acceptable levels, or used and failed to reduce or stop the damage. In some instances, however, the most appropriate response to a wolf damage problem could involve concurrent use of a combination of nonlethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy (*e.g*., some instances of risk to human safety from bold wolves or situations where the landowner has already implemented practical and effective nonlethal methods prior to contacting WS and is still experiencing damage problems). Lethal methods could include shooting, calling and shooting, aerial shooting, and euthanasia of wolves live-captured in foot-hold traps, snares or other live-capture devices.

[15] WS could use lethal wolf damage management methods on public land to reduce depredation when coordinated with the WGFD or USFWS and the respective public land management agency.

[16] Wolf trapping and radio-collaring for wolf population monitoring purposes is usually conducted on public land and coordinated with the WGFD or USFWS and public land management agency.

3.2.2 Alternative 2 – WS Nonlethal Wolf Damage Management Only

This Alternative would work in a similar manner as the Current Program Alternative except Wyoming WS would only use and provide advice on nonlethal wolf conflict management methods. The USFWS or WGFD, as appropriate, and property owners would still be able to use lethal methods in accordance with Federal regulations, state laws, and as authorized by the USFWS or WGDF, and the tribes depending on which agency has primary management responsibilities at the time.

Nonlethal methods used or recommended by WS could include animal husbandry practices including the use or herders/range riders, installation of fencing, electronic guards, fladry and turbo-fladry, aversive conditioning, nonlethal projectiles, use of livestock guarding animals, and/or other nonlethal methods as appropriate. WS would still investigate wolf depredation complaints to determine if the loss meets criteria for wolf damage compensation, and could assist USFWS or WGFD with radio-collaring wolves for monitoring purposes and/or to enhance effectiveness of nonlethal deterrents such as the RAG. WS could live-capture wolves or wolf-dog hybrids, but the responsible management agency would decide about the disposition of any animals captured.

3.2.3 Alternative 3 – No WS Wolf Damage Management by WS in Wyoming

Under this Alternative, WS would not be involved in wolf damage management in Wyoming, but the USFWS, WGFD or Tribes, as appropriate, and property owners would still be able to use lethal and nonlethal methods in accordance with Federal regulations and/or state and tribal laws and regulations, depending on which agency has primary management responsibility at the time.

If this Alternative is selected, WS would not provide any assistance with wolf damage and conflict management in Wyoming. All requests for wolf conflict management would be referred to the USFWS, WGFD, Tribes, or other responsible management agency as appropriate.

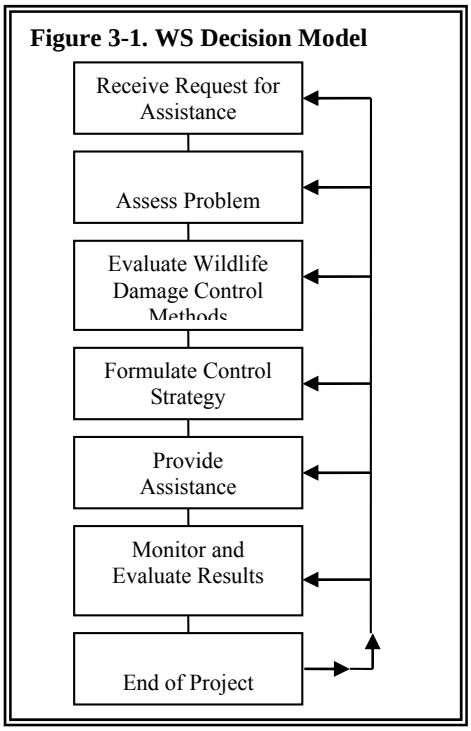
3.3 WOLF DAMAGE MANAGEMENT STRATEGIES AND METHODOLOGIES

Wildlife damage management is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife, and is an integral part of wildlife management (The Wildlife Society 2004). Wildlife damage management approaches and strategies that could be used are described below.

3.3.1 Integrated Wildlife Damage Management (IWDM)

During more than 90 years of resolving wildlife conflicts, WS has considered, developed, and used numerous methods for reducing wildlife damage problems. WS' efforts have involved research and development of new methods, improving existing methods and implementing effective strategies to resolve and prevent wildlife damage. Usually, the most effective approach to resolve wildlife damage is to integrate the use of several methods simultaneously or sequentially. Adaptive IWDM is the implementation and application of safe and practical methods for the prevention and reduction of damage caused by wildlife based on local problem analyses and the informed judgment of trained personnel. The WS Program applies IWDM to reduce damage after applying the Decision Model discussed in Section 3.3.3 to develop site-specific, adaptive management strategies (Slate et al. 1992). The philosophy behind IWDM is to

implement effective management techniques in the most cost-effective[17] manner while minimizing the potentially harmful effects to humans, target and non-target species, and the environment.



IWDM draws from the largest possible array of options to create a combination of techniques for specific situations. IWDM may incorporate cultural practices, habitat modification, animal behavior modification, removal of individual animals, local population reduction, or any combination of these, depending on the characteristics of the specific damage problem. The WS program also works closely with researchers at the NWRC, the research arm of the WS program. The NWRC Research Station at Utah State University is the leading predator research complex in the world and scientists there are dedicated to developing new methods to reduce predator damage. Research associated with this facility has been critical to the testing and development of nonlethal methods for wolf damage management (Shivik 2001, Shivik and Martin 2001, Bangs and Shivik 2001, Shivik et al. 2002, 2003), and has improved the selectivity, humaneness and efficacy of capture devices. State WS programs assist the NWRC with research projects and, because of the close collaboration between NWRC and the state programs, the latest research findings are available to be incorporated into state operational programs.

3.3.2 IWDM Strategies

3.3.2.1 Technical Assistance Recommendations (implementation is generally the responsibility of the requester)

Technical assistance includes demonstrations and/or recommendations on the proper use of some management devices (*e.g.*, propane exploders, electronic guards, fladry, RAG, etc.) and information on animal husbandry, wildlife habits, habitat management and animal behavior modification. Technical assistance is generally provided following an on-site visit or verbal consultation with the requester. Typically, several management strategies are described to the requester for short and long-term solutions to damage problems. These strategies are based on the level of risk, need and practical application. Technical assistance may require substantial effort by WS personnel to evaluate and discuss potentially practical methods, but the actual implementation of the recommended methods is the responsibility of the requester. Technical assistance also includes site visits and verification of the cause of damage as may be necessary for available compensation and financial assistance.

Education is an important element of program activities because wildlife damage management is about finding "balance" or coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature is not in static balance, but

[17] The cost of control may be a secondary concern because of overriding environmental, social, biological, health and legal considerations.

rather is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, presentations and demonstrations are provided to ranchers, homeowners and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Education and public outreach information is available from the WGFD (http://gf.state.wy.us/services/education/wolvesindex.asp), Montana Fish, Wildlife and Parks (http://fwp.mt.gov/tmc/vignettes/wolf.html) and Idaho Department of Fish and Game (http://fishandgame. idaho.gov/cms/wildlife/wolves/), and is also made available through news releases, and presentations to interested groups and organizations by the state agencies and WS. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are updated on recent developments in damage management technology, laws and regulations, and agency policies.

3.3.2.2 Operational Damage Management

Situations in which WS personnel conduct wolf damage management activities are referred to as operational damage management or assistance. Operational assistance is sometimes provided when the problem cannot practically be resolved through technical assistance and cooperator-implemented measures (e.g., guarding dogs, exclusion, and herd management). The initial investigation defines the nature and history of the problem, extent of damage, and verifies whether or not the problem was caused by wolves. Professional assistance is often required to resolve problems effectively, especially if the problem is complex, or the management technique requires the direct supervision by or involvement of an experienced wolf damage management professional. Wolf biology, ecology and behavior and other factors are considered (WS Decision Model, Figure 3-1) when developing site-specific damage management strategies (Slate et al 1992).

3.3.3 WS Decision Model used for Decision Making

WS personnel use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model (Slate et al. 1992) (Figure 3-1). The Decision Model is a problem-solving process similar to that used by all wildlife management professionals when addressing wildlife conflicts. The Decision Model is not intended to require documentation or a written record each time it is used, and it necessarily oversimplifies complex thought processes. Decisions made using the model would be in accordance with SOPs described herein and adopted or established as part of the decision. Trained personnel assess the problem, and evaluate the appropriateness and availability (legal and administrative) of damage management strategies and methods based on biological, economic and social considerations including:

- Species responsible for the damage (*e.g*., did wolves cause the problem or was it something else?)
- Magnitude, geographic extent, frequency, historical damage and duration of the problem including review of animal husbandry practices and producer efforts at nonlethal wolf damage management
- Status of target and non-target species, including T&E species
- Local environmental conditions

- Potential biological, physical, economic and social impacts
- Potential legal restrictions
- Costs of damage management

Following this evaluation, the methods deemed to be practical and potentially effective for the situation are incorporated into a management strategy. After this strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. When damage continues intermittently over time, WS and the responsible management agency personnel and the requester monitor and reevaluate the situation. If one method or a combination of methods fails to reduce or stop damage, a different strategy is implemented. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of a feedback loop between receiving the request and monitoring the results, with the damage management strategy reevaluated and revised, if necessary.

3.3.4 Local Decision Making Process

Wolf conflict management in Wyoming follows a "co-managerial approach" to address wolf conflicts as generally described by Decker and Chase (1997). Within this management model, trained personnel provide technical assistance regarding the biology and ecology of wolves and effective, practical and reasonable methods available, including nonlethal and lethal methods, to requesters of WS assistance to reduce wolf conflicts. Technical assistance on alleviating damage caused by wolves is also available from WGFD, the USFWS and private organizations. WS, USFWS, WGFD or Tribal leaders, as appropriate, may also facilitate discussions at local community meetings when resources are available, and may make recommendations. Resource owners and others affected by wolf damage or conflicts have opportunity for direct input into the strategies to resolve the problem(s). They may implement management recommendations provided by WS or others, or may request management assistance from WS, USFWS or WGFD, as appropriate. Local resource owners compare the benefits versus the damage when deciding which nonlethal methods they would want implemented. Resource owners must weigh the cost of implementing each methodology or a series of methodologies.

3.3.5 Consistency with Forest Service Land and Resource Management Plans (LRMPs) and BLM Resource Management Plans (RMPs)

Before an alternative can be considered for implementation on USFS or BLM-administered lands, it must be consistent with Land and Resource Management Plans (LRMP) or more commonly "Forest Plans" and BLM Resource Management Plans. If the Alternative is consistent with the LRMP and RMP, no additional action would be necessary by the USFS or BLM.

If an alternative(s) that is inconsistent with the LRMP or RMP is selected, the USFS or BLM could amend their LRMP or RMP to be consistent with the EA. The decision would not be implemented on the Forest System or BLM administered lands until the inconsistency is resolved either through amendment of the LRMP or RMP, or modification of the alternative(s). Any inconsistencies would be identified and resolved before the wolf conflict management project is conducted. A work plan is developed by WS with each National Forest and BLM District before any wolf conflict management can be conducted, or in rare instances, under emergency control only. Wolf management on Forest System and BLM lands in Wyoming would only be considered after consultation between the USFS, BLM, WGFD, and WS.

3.4 WOLF CONFLICT MANAGEMENT METHODS

USDA (1997, Appendix J) describes the methods currently available for predator damage management, and includes those that are also available to reduce wolf damage. Several of these were considered in this assessment because of their potential use to reduce wolf damage to agricultural resources, property and pets, and human health and safety. For a discussion of the advantages and disadvantages of various nonlethal and lethal wolf conflict management methods used in the NRM, see Bangs et al. (2006).

3.4.1 NonLethal Methods Available to WS, USFWS or WGFD Personnel and the Public

Some wolf conflict management methods are available for anyone to use. These consist of nonlethal preventive methods such as cultural practices (*e.g*., possible changes in livestock management) and localized habitat modification (*e.g.,* clearing brush, improving fencing, etc.) on private property. Cultural practices and other management techniques are implemented by the resource owners/managers. Livestock producers and resource owners/managers are encouraged to use these methods, based on the level of risk, need and professional judgment on their effectiveness and practicality. WS', USFWS's, WGFD's or Tribal involvement in the use of these methods is usually limited to providing recommendations or technical assistance.

Livestock Management Practices are implemented to prevent or reduce wolf conflicts and may include approaches such as: 1) maintaining healthy, well-fed animals, 2) properly disposing of dead livestock carcasses (*i.e*., removal, burying, liming, or burning), 3) conducting calving or lambing operations in close proximity to the ranch headquarters, when practical, 4) penning vulnerable livestock at night where practical, 5) monitoring livestock on a regular basis to detect any disease, natural mortality, or predation, and 6) incorporating other nonlethal methods. Property owners and land managers may implement these management practices, request the assistance of other agencies or private organizations to implement them, or take no action.

Exclusion with some type of fence or other barrier may be used to prevent or limit access by predators to livestock pastures, calving or lambing areas, or livestock confinement areas. Where practical and cost effective, sheep, calves or other vulnerable livestock may be penned near ranch buildings at night.

Fladry is a form of barrier and wolf deterrent involving red flags measuring approximately 3 x 18 inches, strung about 20 inches apart, hanging from a thin rope or cord suspended about 30 inches above the ground. Fladry is installed around pastures or other areas where livestock are confined to discourage wolf access. Part of the repellency provided by fladry is probably related to the frequent human visitation required to ensure that the flags remain freely suspended and that the line is properly maintained. Like many other frightening devices, wolves eventually habituate to this deterrent, but field trials have shown that fladry may provide deterrence for as long as 60 days (Musiani et al. 2003). Davidson-Nelson and Gehring (2010) reported that if maintained, fladry can exclude wolves from livestock for up to 75 days, however, Shivik et al. (2003) found that fladry did not effectively protect bait sites from scavengers, including wolves.

Turbo-Fladry is very similar to regular fladry with the exception that the cord is substituted with electrified wire attached to a standard livestock electric fence generator. As wolves habituate to the fladry line and try to cross under it, the negative stimulus they receive after getting shocked by the electrified barrier can increase the amount of time the barrier may remain effective.

Livestock guarding animals such as large, aggressive breeds of guarding dogs (*e.g.*, Great Pyrenees, Akbash, etc.) have been used with some success to protect livestock from wolves, but multiple guard dogs work better than just one or two guard dogs (Bangs et al. 2005, Urbigkit and Urbigkit 2010). Even with 3 or more dogs present, wolves occasionally kill or severely injure livestock guarding dogs. Livestock guarding dogs are generally not killed as prey but because of interspecific aggression (Bangs et al. 2005). Other types of livestock guarding animals, such as llamas, which have been shown in some circumstances to be effective in protecting sheep from coyotes, are not as effective in deterring wolves. Wolves probably view llamas as prey, and multiple instances of wolves killing and feeding on llamas have been documented in the NRM (USFWS et al. 2002, 2003, 2005, 2007, 2009, 2010).

Guarding and hazing involves using human presence to guard an area and then using pyrotechnics or other frightening devices to frighten wolves from the site if/when they arrive. Hazing can be used as an aversive technique, but requires that the technique be used consistently whenever the animal attempts to prey on the protected resource so they do not identify conditions when they can obtain prey without receiving a negative experience (Shivik 2004). If there are any radio-collared wolves in a pack which may pose a threat to livestock, nonlethal hazing efforts can be enhanced if the livestock producer or other personnel make use of a radio receiver to determine when wolves are near or approaching the livestock (Bangs et al. 2006). This requires diligent and persistent monitoring, but can make hazing much more effective.

- **Herders and/or range riders** can assist in the guarding and hazing of livestock and in some areas are extensively used. Herders/range riders are people that live with and/or spend significant time/effort with the livestock, often moving them from area to area, monitoring for predators, assisting with implementation of nonlethal management techniques (e.g., carcass removal, relocation of sick/injured animals, frightening devices), and/or quickly discovering a depredation event before environmental factors degrade the scene and/or before additional predation occurs.

Frightening devices are methods that usually involve lights, sound and/or motion devices designed to deter wolves from a certain area. Strobes and flashing lights, propane exploders, sirens, and various combinations of these devices have all been used in attempts to reduce livestock losses, with wide-ranging degrees of effectiveness (Linhart 1984, Andelt 1987). Animal habituation (becoming accustomed) to the stimulus is one of the primary limiting factors for repellents. Essentially, anything new or different is likely to elicit avoidance behavior by canids, but this effect disappears over time. Moving the devices intermittently and randomly as well as alternating the stimuli (*e.g.*, a different type of noise or light) may extend the effective period of the system (Shivik and Martin 2001). The period of efficacy may also be extended by using systems which are motion-activated or only activated when a wolf wearing a transmitter collar comes into close proximity to the protected site. The RAG is one such frightening device that employs this approach, and RAG devices have been field-tested in Idaho with some success (Breck et al. 2002). Use of the RAG in Idaho has been most effective in protecting livestock in small (≤ 40-60 acre), fenced-in areas.

Compensation for wolf damage does not reduce wolf conflicts, and does not preclude implementation of lethal actions, but can help offset some of the costs of wolf depredation and increase public support for wolf conservation. In some cases it may also help provide incentive to consider nonlethal methods of wolf control. Under state statutes, the WGFD is required to compensate livestock producers for livestock killed by wolves and in some circumstances may compensate for livestock missing at the end of the grazing season. WS employees are often able to provide this confirmation as part of the initial investigation into complaints of wolf damage,

but in some cases, the evidence remaining is insufficient to confirm that a wolf or wolves actually killed the animal. The conservation group DOW had previously administered a wolf damage compensation program, but discontinued that program in 2010.

3.4.2 Nonlethal Methods Available to WS, USFWS, WGFD, Tribes or Other Management Agency

Some nonlethal methods, research projects and population monitoring efforts involve capture and handling of wolves, which may not be conducted by the general public. Methods that require capture and handling of wolves would only be conducted by USFWS or WGFD personnel, agencies permitted by the USFWS or WGFD, or by WS.

Foot-hold traps can be effectively used to live capture wolves, and are an extremely important tool in wolf management. When wolves are trapped, they are ordinarily physically restrained, chemically immobilized, radio-collared and released on site, or euthanized on site. Effective trap placement, pan-tension devices and the selection and placement of appropriate lures and baits by trained personnel contribute to selectivity of the foot-hold trap. WS policy requires that foot-hold traps used for wolf conflict management have offset and laminated jaws or padded jaws to reduce foot injury to captured wolves (WS Directive 2.335). Traps may also be modified with small protrusions or "nubs" on the jaws to reduce the likelihood of the wolf's foot moving back and forth in the jaws, thereby reducing the potential for trap-related injury.

Disadvantages of traps include the difficulty of keeping them operational during rain, snow or freezing weather, and the fact that they cannot be 100% selective. Although pan-tension devices are effective in reducing the likelihood of unintentional capture of non-target species smaller than wolves (*e.g.*, red foxes, coyotes), they cannot preclude the occasional capture of larger non-target species such as mountain lions or black bears. They do, however allow for the option of releasing non-target animals which may infrequently be captured. Whenever WS employees deploy traps for wolves, they post warning signs at access points into the area to alert people to the presence of traps.

Foot snares are devices consisting of a cable loop and a locking device that captures an animal around its foot or lower leg. The cable may be activated around the lower leg with a spring-powered throw-arm (Aldrich-type) or trap-type (Belisle) device. The foot snare can be modified with a stop on the cable to restrict the closure of the loop. Careful snare placement, pan-tension devices and the selection and placement of appropriate lures and baits by trained personnel contribute to the selectivity of this device. As with foot-hold traps, when foot snares are used as a live-capture device, wolves would ordinarily either be radio-collared and released on site, or euthanized. Foot snares are more often used for capture of mountain lions and black bears than for wolves.

Dart guns are capture tools that utilize a dart filled with tranquilizer drug, fired from a specially designed firearm. They would ordinarily only be used on wolves when conducting live-capture operations from a helicopter. Once tranquilized, the animal may be handled safely and processed for research or monitoring purposes. Use of dart guns would have no effect on non-target species because positive target species identification is made before animals are darted. Thus, use of dart guns by WS personnel is expected to be 100% selective for target individuals and species, and would not pose a risk to non-target species and individuals. All WS personnel who would dart wolves or deliver immobilizing drugs attend a minimum 2-day accredited training course and an online distance learning module on immobilizing wildlife, and pass all associated post-course tests. To maintain certification, WS employees are required to receive 16 hours of continuing

education every 3-years and pass an online exam administered by the attending veterinarian at the USDA NWRC.

Snares can be used to live-capture animals around the neck with the use of a "stop" to prevent full closure of the loop, and improved methods for use are being developed for live-trapping wolves and other carnivores (Olson and Tischaefer 2004). Snares are ordinarily not affected by rain, snow and freezing weather to the extent that foot-hold traps are. These devices offer a degree of selectivity based on the size of the cable loop and the height of the loop above ground level. They also offer a viable live-capture alternative to foot-hold traps during the winter months, when freezing temperatures combined with restricted blood circulation could result in damage to a captured wolf's foot.

3.4.3 Nonlethal Methods which may Require Special Authorization from USFWS or WGFD, Tribes or Other Management Agency

Some animal behavior modification systems involve capturing and fitting wolves with radio-transmitting collars to deliver or trigger repellent stimuli (*i.e.,* aversive conditioning). Other systems sometimes referred to as "less than lethal munitions," involve shooting wolves with projectiles such as rubber bullets or bean bag rounds. These techniques involve intentionally using painful stimuli to modify wolf behavior; USFWS, WGFD or other management agencies may require permits or other authorizations to use these methods and any other experimental wolf conflict management techniques. Methods that require capture and handling of wolves would be conducted only by personnel from USFWS, WGFD or WS or personnel authorized by USFWS or WGFD[18].

Aversive Stimuli are stimuli that cause discomfort, pain and/or an otherwise negative experience paired with specific behaviors to achieve conditioning against these behaviors. One example is the use of a dog training shock collar that is activated when wolves come into close proximity to a protected area, such as a livestock pen (Shivik et al. 2003, Schultz et al. 2005).

Nonlethal Projectile use involves guarding an area and then using rubber bullets, bean bag rounds or other nonlethal projectiles to prevent a predation event. They can be used as an aversive conditioning technique, but require that the projectiles be used consistently whenever the predator attempts to prey on the protected resource, so it is less likely to identify conditions when it can obtain prey without receiving a negative experience (Shivik 2004). Methods which require around-the-clock presence of a person to guard the resource are most efficiently used when there are radio-collared wolves involved and the landowner/resource manager assists with the implementation. USFWS or WGFD may agree to allow the use of these methods and allow WS to train private individuals to use such methods.

3.4.4 Lethal Methods

These methods are specifically designed to lethally remove wolves in certain situations to stabilize, reduce or eliminate conflicts. The amount of removal necessary to achieve a reduction in wolf damage varies according to the effectiveness of other conflict management strategies, the conflict situation, and the level and likelihood of continual depredations. Under Alternatives 1 and 2, WS would conduct activities in coordination with USFWS or WGFD, and use the WS Decision Model (Slate et al. 1992) to determine when lethal management would be used. Under

[18] American Indian tribes have authority to use these methods on tribal lands without permission from the responsible management agency.

any of the Alternatives, livestock and domestic animal owners, their employees or agents, may shoot a wolf in the act of attacking said animals (71 FR 43410, 73 FR 10514, 74 FR 15123, 76 FR 61782, WGFC 2011). Livestock and domestic animal owners may also be issued permits by USFWS or WGFD to shoot wolves, in response to wolf conflicts. Once delisted, WGFD may establish provisions which allow livestock and domestic animal owners to also use traps to remove wolves in response to wolf conflicts The lethal wolf management techniques that would be available to WS under Alternatives 1 and 2 would include the use of foothold traps and snares, as described above under Section 3.4.2, followed by euthanasia, typically by gunshot to the brain, as recommended by the American Veterinary Medical Association (AVMA 2007, Julien et al. 2010). Additional lethal methods used under Alternatives 1 or 2 would include shooting, from the ground as well as from fixed-wing aircraft or helicopters.

Shooting from the ground is highly selective for the target species, and may be employed in conjunction with the use of auditory attractants (*e.g.*, sounds of prey animals in distress or imitations of wolf vocalizations). Removal of one or two specific animals by shooting in the problem area can sometimes provide immediate relief from a predation problem. Shooting is often attempted as one of the first lethal control options because it offers the potential of solving a problem more quickly and selectively than some other techniques, but it requires visually sighting the wolf within effective shooting distance. Shooting may sometimes be one of the only management options available if other factors preclude the setting of equipment (*i.e.*, traps or snares). During the 7-year period from FY 05 - FY 11, 16.0% (49/307) of all wolves lethally removed by WS in Wyoming were taken by shooting from the ground.

Aerial Shooting typically involves visually locating depredating individuals or packs from either a small single-engine fixed-wing aircraft or a helicopter, and shooting them from the aircraft with a shotgun. Shooting typically results in a relatively quick death. Depredation problems can sometimes be resolved very quickly and effectively through aerial shooting (*e.g.*, by starting the aerial operation in the vicinity of a recent wolf kill, and catching the wolf or wolves when they return to feed on the livestock carcass.). Cain et al. (1972) rated aerial shooting as "very good" in effectiveness for problem solving, safety, and lack of adverse environmental impacts. Smith et al. (1986) cited cost-effectiveness and efficacy as benefits of aerial shooting.

Good visibility is required for effective and safe aerial shooting operations, and relatively clear and stable weather conditions are necessary. Summer conditions limit the effectiveness of aerial shooting because the increased vegetative cover makes finding the animals more difficult, and the higher ambient air temperatures reduce air density, which affects low-level flight safety.

Aerial shooting is one of the most effective wolf conflict management tools available, with more wolf damage problems resolved by aerial shooting than by any other method. During the 7-year period from FY 05 - FY 11, 74.9% (230/307) of all wolves lethally removed by Wyoming WS were taken by aerial shooting.

Neck snares may be used as lethal or live capture devices. This device may be used wherever a wolf moves through a restricted area (*i.e.*, crawl holes under fences, trails through vegetation, etc.). They are easier to keep operational during periods of inclement weather than are foothold traps. During the 7-year period from FY 05 - FY 11, no wolves lethally removed by Wyoming WS were taken by neck snares.

Sodium Pentobarbital (Beuthanasia®-D) is a chemical euthanasia agent registered for domestic dogs, but may legally be used on other animals if said animals are not intended for human consumption. It is classified as a barbiturate. Barbiturates, by definition, depress the central

nervous system, beginning with the cerebral cortex, progressively leading to unconsciousness and ultimately, death. The primary advantage of barbiturates is their speed of action. Barbiturates induce euthanasia smoothly, with minimal discomfort to the animal (AVMA 2007). This method of euthanasia would likely only be used in the rare circumstance that an already sedated wolf was determined to have health issues such that it would be most appropriate to euthanize the animal. Carcasses of wolves killed using euthanasia chemicals would normally be given to the USFWS or WGFD or disposed of per direction from the appropriate managing agency and WS immobilization and euthanasia procedures and directives.

3.5 ALTERNATIVES CONSIDERED BUT NOT IN DETAIL, WITH RATIONALE

3.5.1 Bounties

Bounties, which are payments of funds for killing wildlife suspected of causing economic losses, are not considered effective for reducing wolf damage. This Alternative will not be considered in detail because:

- Neither USFWS or WGFD has authorized a bounty program for wolves
- Bounties are generally not effective in reducing damage because depredating individuals/local populations are not specifically targeted
- No effective process exists to prevent taking of animals from outside the damage management area for compensation purposes
- Fraudulent claims can occur (Waller and Errington 1961)

3.5.2 Eradication and Suppression

An Eradication Alternative would direct all WS program efforts toward planned, total elimination of wolves. This Alternative will not be considered in detail because:

- The attempted eradication of established wolf populations is contrary to State and Federal efforts to protect and conserve wildlife and contrary to ESA requirements
- Eradication of wolves is generally not acceptable to the public
- It is not realistic, practical, or allowable under present WS policy to consider large-scale population suppression.

3.5.3 Agencies Exhaust All Nonlethal Methods Before Attempting Lethal Methods

Under this Alternative, all nonlethal methods would have to be attempted and proven ineffective prior to using lethal wolf conflict management methods even though, in the professional judgment of WS, USFWS or WGFD personnel, some methods that would have to be attempted would be impractical (*e.g.*, would incur costs in excess of the value of resources protected), inappropriate (*e.g.,* use of a light siren device in areas near human residences) or most likely ineffective for the given situation (*e.g.*, where the predator appears to have habituated). This Alternative will not be addressed in detail for a number of reasons including: 1) time and resources of agencies and individuals experiencing damage may be unnecessarily expended when nonlethal methods are unlikely to be effective, based on circumstances, experience and professional judgment; 2) the potential that additional losses could be incurred while experimenting with nonlethal methods may be unacceptable to some and would likely result in an increase in individuals seeking to solve their own problems instead of working with WS, the

USFWS, or WGFD personnel; and 3) experimenting with nonlethal approaches may not be appropriate in the rare instance of a wolf-related threat to human safety.

3.5.4 Lethal Only Program

Under this Alternative WS would only provide technical and operational assistance with lethal damage management techniques. Prohibiting WS from using or providing technical assistance on effective and practical nonlethal wolf conflict management methods is not in the best interest of the continued recovery of the species, is contrary to agency policy and directives (WS Directive 2.101), and will not be analyzed further. In certain situations, nonlethal methods may provide a more effective short-term or long-term solution to wolf conflict problems than lethal methods.

3.5.5 Technical Assistance Only

Under this Alternative, WS would not conduct operational wolf conflict management in Wyoming but could provide information to requesters about methods or techniques they could use to reduce wolf conflicts. WS would also be able to conduct investigations of potential wolf depredation sites as required to administer the wolf damage compensation program. Because USFWS or WGFD could still use and authorize others to use nonlethal and lethal wolf conflict management techniques, the environmental impacts of this Alternative are encompassed in the evaluation of Alternatives 1, 2, 3, and 4 of this EA. Detailed analysis of this Alternative would not contribute substantive additional information to the understanding of the environmental impacts of the Alternatives, so this Alternative will not be analyzed in detail.

3.5.6 Wolf Damage Management Conducted by Licensed/Permitted Hunters and Trappers

With wolves currently protected under the ESA, neither USFWS nor WGFD can address wolf depredation problems by providing for take of depredating wolves primarily by private individuals holding appropriate licenses. An additional problem with this approach is that private hunters and trappers would not always have the time, resources, or training to promptly and effectively respond to site-specific damage problems. Once delisted, the salvage of wolf hides obtained through private depredation control activities could conceivably be authorized as an incentive to promote this approach, but the majority of wolf damage problems occur between April and September, when pelts would not be in prime condition for salvage and are of little value. Also, as noted in Section 3.4.4, approximately 75% of the lethal removal of wolves during wolf damage management operations in Wyoming is typically accomplished through aerial shooting, and the resources and expertise to conduct this activity would not likely be available to private hunters and trappers. If wolves are delisted, WGFD could focus hunter and trapper harvest of wolves in areas of chronic wolf depredation problems through the establishment of targeted harvest seasons and quotas. To the extent WGFD might be able to facilitate this, the cumulative impacts of this approach are already encompassed to a degree within the evaluations of the other Alternatives being analyzed. This approach would also be a nonfederal action and outside the scope of NEPA.

3.5.7 The Natural Resources Defense Council (NRDC) Alternative

In wolf damage management EAs prepared for nearby states, the NRDC proposed consideration of a "Nonlethal Before Lethal Methods" Alternative specifically requiring that: 1) cooperators show evidence of sustained and ongoing use of nonlethal/husbandry techniques aimed at preventing or reducing predation prior to receiving services from WS, 2) WS would use or recommend, as a priority, nonlethal techniques in response to a confirmed damage situation, and

3) lethal techniques would only be used when the use of nonlethal methods failed to keep damages below an acceptable level.

This Alternative is similar to the proposal in Section 3.5.3, but would require use of nonlethal methods on a more limited scale in terms of the diversity of nonlethal methods that would need to be deployed prior to receiving WS assistance. It would further restrict WS from implementing lethal methods unless use of nonlethal methods failed to keep wolf damage below a certain level determined to be acceptable. This Alternative is not considered in detail for the following reasons:

In Section 4.3.1.1 of the EA, we explain how most instances of wolf predation on sheep occur in spite of sheep producers' use of nonlethal methods including herders and livestock guarding dogs to help protect the sheep from predation. Therefore, the current situation for many wolf-caused livestock depredation problems is that the producers have already implemented one or more nonlethal strategies prior to receiving WS or other agency assistance.

The primary decision-makers for determining how wolf depredation situations are to be resolved (*i.e.,* USFWS or WGFD) have not established any requirement for producers to use prescribed nonlethal methods or strategies prior to receiving wolf conflict management assistance. Because WS acts as an agent of either the USFWS or WGFD for wolf conflict management in Wyoming, we do not consider it appropriate for WS to establish these types of conditions before providing service.

Some methods that would likely need to be implemented under this Alternative would be impractical, inappropriate, or have a low efficacy for a variety of reasons. For example, methods such as wolf-proof or wolf-resistant fencing could cost more than the value of resources protected; noise-producing scaring devices could disturb recreational users of public land grazing areas or nearby human residents; guard dogs might present human safety risks to recreational users of a public land grazing area; visual or auditory scaring devices may be ineffective in situations where wolves have habituated to such strategies already. The potential for additional losses to occur while having to take the time to experiment with nonlethal methods may be unacceptable to some, which would likely result in an increase in the number of individuals attempting to solve their own problems instead of working with WS, the USFWS, or WGFD personnel. In the rare event of a wolf-related threat to human safety, experimenting with nonlethal approaches may present too great a risk of failure at preventing human injury or fatality to be deemed appropriate by local government jurisdictions, USFWS or WGFD.

With respect to element two (2) in the NRDC proposed Alternative, WS already gives preference to using or recommending nonlethal methods when practical and effective as part of the Proposed Action Alternative (WS Directive 2.101) to the extent that it is allowed by the USFWS and/or WGFD when those agencies make decisions about how to resolve wolf damage situations. The practicality of a particular husbandry or other nonlethal method can vary substantially among producers and among depredation situations. Therefore, it is difficult, and many times impractical, to determine appropriate and reasonable criteria to dictate ahead of time which particular husbandry or other nonlethal methods should be required in given situations.

With respect to element three (3) in the NRDC proposed Alternative, it is difficult to determine an "acceptable level" of loss for individual livestock producers. In our experience, whether a given rate of loss is "acceptable" or not varies substantially among individual livestock producers. Some producers have lower costs of doing business -- for example, one producer might have no cost of financing for purchasing his ranch property while the next could be carrying a substantial

mortgage with considerable interest costs. What might be an economically tolerable or "acceptable" level of loss to one rancher could be economically unacceptable, or even financially devastating, to another. Additionally, if effective wolf conflict management methods are delayed until damage has increased to a certain predetermined level, conflicts may escalate to an excessive level before the problem can be resolved. Therefore, we believe it would be impractical to establish a standard or threshold of "acceptable losses" for providing assistance.

One purpose of having effective conflict management assistance available to livestock producers is to foster support for, or to at least minimize or reduce the amount of opposition to, wolf recovery. As stated in Section 1.4, prompt, professional management of conflicts with wolves is an important component of wolf recovery because it facilitates local public acceptance and tolerance of wolves (Fritts et al. 1992, Fritts 1993, Mech 1995). To establish an arbitrary threshold of "acceptable loss" before any wolf removals would occur would, in our view, be counterproductive to promoting acceptance of wolf recovery by the livestock industry. This is because we would expect that some, or perhaps many, producers experiencing losses to wolves would cease to request assistance from WS if the conditions for receiving such assistance were perceived too burdensome. Greater incidence of illegal wolf killings would likely result; additionally, increased political efforts to get laws changed by Congress would likely occur, as evidenced by recent legislation introduced to prevent wolves from being listed under the ESA.

The Alternatives selected for detailed analysis in this EA encompass a reasonable range as required by NEPA and include some of the suggestions in the NRDC proposal. Thus, we believe that inclusion of this Alternative would not contribute new information or options for consideration and analysis that are not already being considered in this EA.

3.6 STANDARD OPERATING PROCEDURES FOR WILDLIFE CONFLICT MANAGEMENT TECHNIQUES

Minimization measures and SOPs improve the safety, selectivity and efficacy of wildlife conflict management techniques. Most of the SOPs used by the WS program are discussed in detail in USDA (1997, Chapter 5). The following measures and SOPs apply to some or all of the Alternatives, as indicated in the columns. These SOPs only describe actions by WS and do not include actions by USFWS or WGFD. In some cases, if an action is not taken by WS, it may be implemented by USFWS or WGFD.

- Alternative 1 - Continue the Current Wolf Conflict Management Program (No Action/Proposed Action).
- Alternative 2 - WS Nonlethal Wolf Conflict Management Only.
- Alternative 3 – No Wolf Damage Management by WS in Wyoming

Standard Operating Procedures by Alternative	1	2	3
General Procedures and Conditions for Conducting Wolf Damage Management			
WS wolf conflict management would follow guidelines as specified and agreed upon in established guidelines and rules, and as authorized by the USFWS or other management agency.	X		
WS would conduct wolf conflict management only when and where a need exists.	X	X	
Wolf-dog hybrids could be killed by WS if they appear to be living in the wild and are unmarked, or they would be held in captivity while attempts are made to locate the owner. If no owner could be located, depredating wolf-dog hybrids could be euthanized or provided to local authorities.	X		
Nonlethal methods would be used when practical and effective, but lethal methods could also be applied alone or in combination with nonlethal methods in some cases to most effectively resolve a damage problem.	X		
WS could use lethal methods to remove wolves in cases of threats to human safety.	X		
WS would not initiate use of lethal wolf conflict management methods for protection of livestock until an authorizing agreement has been signed by the producer.	X		
Lethal depredation management activities would occur within specific areas as specified and authorized by the USFWS or WGFD.	X		
All wolf mortalities, while conducting wolf conflict management and wolf population monitoring, would be reported to the USFWS or WGFD.	X	X	
Wolves or wolf parts taken during wolf conflict management may be transferred to Native Americans for cultural purposes, educational use, or scientific research purposes when coordinated with and approved by USFWS or WGFD. Specimens not suitable, or not needed, for such use would be disposed of as directed by USFWS or WGFD.	X		
Animal Welfare and Humaneness of Methods Used by WS			
Nonlethal wolf conflict management methods such as guard dogs, scare devices, fladry and other methods, would be recommended and implemented, when appropriate.	X	X	
WS could provide training to landowners and resource managers in the safe and effective use of nonlethal projectiles when authorized by the USFWS or WGFD, as appropriate.	X	X	
Wolf capture, handling, and euthanizing (if permitted) would be carried out as humanely as practically possible.	X		
Traps and snares would be checked consistent with USFWS or WGFD rules and WS policy.	X	X	
Research would continue to improve the selectivity and humaneness of management devices and these would be implemented into the WS Program.	X	X	
Foot-hold traps would be equipped with pan-tension devices to reduce the incidence of smaller non-target animal captures.	X	X	
All WS Specialists dealing with wolf complaints would be trained in the capture, chemical immobilization, and medical handling of wolves to minimize accidental injury and death.	X	X	
Nonlethal projectiles (*e.g.*, rubber bullets and bean bag projectiles) may be used if authorized by USFWS or WGFD.	X	X	
Nonlethal projectiles would be used in a manner which would be unlikely to result in any permanent physical damage or death to a wolf.	X	X	

Standard Operating Procedures by Alternative	1	2	3
Personnel would be trained in the safe and appropriate use of wolf conflict management techniques and equipment.	X	X	
Safety Concerns Regarding Use of Capture Devices			
The WS' Decision Model, designed to identify the appropriate wolf conflict management strategies and their impacts, is used.	X	X	
WS would place traps and snares so that captured animals would not be readily visible from publicly used travel routes.	X	X	
Warning signs would be posted on main roads and/or trails leading into any areas where traps or snares were being used. These signs would be removed at the end of the conflict management activities.	X	X	
No traps or snares would be used by WS within ¼ miles of any residence, community, or developed recreation site, unless granted permission from the owner of a privately-owned property or an official from the appropriate public land management agency.	X	X	
Concerns About Impacts of Wolf Conflict Management Activities on T/E Species, Other Species of Special Concern, and Cumulative Effects.			
WS consulted with the USFWS on the impacts of wolf conflict management activities to Federally listed T/E species found in Wyoming and will implement reasonable and prudent measures or alternatives established by the USFWS for the protection of T&E species.	X	X	
WS personnel would attempt to resolve depredation problems by taking action against individual problem animals, or local populations or groups.	X	X	
WS foot-hold traps or spring activated foot snares set for wolves would incorporate tension devices to reduce the likelihood of capturing smaller non-target species.	X	X	
WS would not set foot-hold traps or snares for wolves within 30 feet of any exposed bait or animal carcass to reduce the likelihood of capturing non-target species.	X	X	
The USFWS, WGFD, or the appropriate land manager, as appropriate, would be notified as soon as possible, if a State or Federally listed T/E species is caught or killed.	X	X	
Cultural Resources/Native American Concerns.			
This EA has been provided to Native American Tribes for comment to determine if cultural issues have been addressed.	X	X	X
On private lands within recognized tribal reservation boundaries, WS will ask the affected landowner if the appropriate reservation personnel can co-investigate any complaint with WS. If allowed by the landowner, the tribe may co-investigate the complaint. WS and the tribe will consult regarding a course of action to address or resolve verified wolf complaints on these lands.	X	X	
WS will comply with requirements for notifying tribes as requested by the tribes.	X	X	
Public Land Issues			
On public lands, vehicle use would be limited to existing roads unless otherwise authorized by the land management agency.	X	X	
WS will meet annually with the land management agency to develop Work Plans which include delineation of areas where certain methods may not be used, for all or part of the year.	X	X	

Standard Operating Procedures by Alternative	1	2	3
Public land agencies will review work plans for consistency with land and resource management plans.	X	X	
During annual work plan meetings, public land management agencies aid WS in minimizing environmental risks by providing information on mitigation measures needed to protect public safety; threatened, endangered, and sensitive species; and other resource values."	X	X	
If wolf conflict management were ever requested to take place in Wilderness Areas or Wilderness Study Areas, it would only be conducted in coordination with the responsible land management agency and under applicable guidelines.	X	X	

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

Chapter 4 provides information needed for making informed decisions concerning alternatives for meeting the need for action described in Chapter 1 (i.e., reducing wolf conflicts and damage in Wyoming in context of the issues and affected environment discussed in Chapter 2. This chapter consists of 1) review of the ability of the alternatives to achieve management objectives and the efficacy of management methods; 2) analysis of environmental consequences of the alternatives for each of the issues considered in detail, and 3) summary of impacts.

Impacts of the alternatives are compared to the Current Program/ No Action alternative (CEQ 1981). CEQ guidance states that the "No Action" alternative can be defined as being the continuation of current management practices (CEQ 1981). The Current Program/No Action Alternative, has been in effect intermittently since April 2003 with occasional interruptions and changes depending on the legal status of wolves. Therefore, for purposes of analysis we use Alternative 1, as the "No Action" baseline when comparing the other alternatives to determine if the real or potential adverse effects of the alternatives are greater, lesser or the same (Table 4-3).

4.2 EVALUATION OF SIGNIFICANCE OF CUMULATIVE AND UNAVOIDABLE IMPACTS

The issues analyzed in detail are evaluated for each alternative including consideration of direct, indirect, and cumulative impacts. NEPA regulations describe the elements that determine whether or not an impact is "significant." Significance is dependent upon the context and intensity of the action. The following factors were used to evaluate the significance of impacts in this EA that relate to context and intensity for this proposal:

4.2.1 Magnitude of the Impact (size, number, or relative amount of impact)

Magnitude is defined as a measure of the number of animals killed in relation to their abundance, and may be determined either quantitatively or qualitatively. Cumulative impacts to Wyoming's wolf population would include the legal wolf removals conducted by WS, the USFWS, WGFD the tribes or other agency personnel and livestock producers for damage management; hunter harvest (when allowed); natural mortalities; illegal killing of wolves; and any other known sources of mortality. The cumulative impact on Wyoming's wolf population will be considered in the context of the applicable federal, state and tribal wolf management objectives.

4.2.2 Duration and Frequency of the Impact

Duration and frequency of wolf conflict management in Wyoming may be highly variable. Biotic and abiotic factors affecting wolf and other wildlife behavior affect the duration and frequency of wolf conflict management activities conducted by WS in Wyoming. Statewide, wolf conflict management could be seasonal or ongoing, but the frequency and duration of individual actions would be highly variable depending upon any number of factors affecting the behavior of the animals that are causing damage and the location of the potential damage. Wolf conflict management would only be conducted by WS when a request for assistance is received, the need for action is verified, and applicable authorizations or permits are issued by the USFWS, state or tribes, as appropriate. Depending on the status of wolves, duration and frequency of WDM

actions at individual sites may also be limited by applicable Federal, State and tribal management plans and rules. For example, under the applicable 10j rules, USFWS or WGFD wolf-take authorizations for livestock depredations are typically issued for a 45-day period following the most recent confirmed depredation.

4.2.3 Geographic Extent

Wolf conflict management could occur anywhere in Wyoming where wolf damage occurs or wolf management has been requested, agreements for such actions are in place; action is warranted, as determined by implementing the WS Decision Model (Slate et al. 1992); and management has been authorized by the applicable regulatory authority. Actions would be limited to areas where wolf damage occurs, or areas where a threat of damage exists. WGFC (2011) establishes clearly-defined boundaries for WDM activities in Wyoming.

4.3 ENVIRONMENTAL IMPACTS

This section analyzes the expected environmental consequences of each alternative on each of the issues analyzed in detail. The following issues were determined to be relevant, and are analyzed in detail below:

- Ability of alternatives to meet management objectives and efficacy of methods.
- Effects on the Wyoming wolf population
- Effects on public and pet health and safety
- Animal welfare and humaneness of methods to be used
- Impacts to stakeholders, including aesthetics of wildlife
- Impacts on non-target species including T/E species and ecosystems

4.3.1 Alternative 1 - Continue the Current Wolf Conflict Management Program (No Action/Proposed Action)

Under this and all the other alternatives, wolf conflict management in Wyoming is oriented toward reducing conflicts when and where they occur while maintaining wolf population recovery goals (USFWS 1994, 71 FR 43410, 73 FR 10514, 76 FR 61782, WGFC 2011). Wolf damage management actions would be conducted in accordance with applicable federal state and tribal regulations and wolf management plans including 50 CFR 17.84(i) for states and tribes that do not have a USFWS approved wolf management plan, 50 CFR 17.84(n) for states and tribes with a USFWS approved wolf management plan and agency plans such as the Wolf Management Plan for the Wind River Reservation (Shoshone and Arapahoe Tribal Fish and Game Department 2007). WS involvement is not required for implementation of any of the processes stipulated in the rule or plans and action may be conducted by the individual landowner/manager or permittee on grazing allotments, or agency personnel without WS assistance provided that applicable authorizations have been obtained.

<u>WGFD Management Direction (WGFC 2011)</u>

Although a revised state management plan has not been completed, based on existing plans (WGFD 2011, 2012) and guidance from the federal court, upon delisting, the State management goal will be to ensure the long-term viability of the gray wolf population. In order to ensure the population goal is achieved, WGFD is expected to maintain at least 13 breeding pairs and at least 130 wolves in the WYO (outside YNP and the WRR). This includes the minimum of maintaining ≥10 breeding pairs and ≥100 wolves needed for delisting plus a buffer to help ensure

that the population does not go below the minimum. However, the exact nature of the buffer above 10 breeding pairs and 100 wolves has not been finalized. The WGFD will also maintain balanced wolf and prey populations, ensure genetic transfer among states through maintenance of connectivity and functional metapopulation processes, and manage wolves to minimize conflict with humans and domestic animals. Although WS would not be involved in WDM for the protection of ungulates, this type of action could be conducted by the WGFD in accordance with applicable USFWS regulations (50 CFR 17.84(n) and state wolf and ungulate management plans, if a USFWS approved state wolf management plan is in place. The long-term WGFD objective is to maintain a viable wolf population in Wyoming, achieve short-term harvest goals to reduce conflicts, provide annual harvest opportunity, and provide for non-consumptive benefits (i.e., aesthetics of wolves in the environment) as well (WGFC 2011). Future population goals will incorporate knowledge acquired from year to year.

4.3.1.1 Ability of alternative to meet management objectives and efficacy of methods

This section reviews each alternative to determine if the alternative could be successful in meeting the overall goal of conserving wolf populations while protecting livestock, domestic animals and human health and safety in Wyoming and the objectives listed below and in Section 1.9. This evaluation is distinct from the environmental impact analysis, and is intended to aid the decision-maker in making a well-informed decision that considers both the ability of the alternative to meet the management objectives and the environmental consequences of the PDM alternatives.

- The proposed action must not jeopardize the recovery of the state or regional wolf population.
- Management actions should not have significant adverse effects on non-target species populations.
- Wolf damage management activities must be conducted in accordance with authorities provided by the USFWS, WGFD, Tribes and applicable federal, state, tribal and local regulations.
- Wolf conflict management program should include a range of damage management techniques that allow for development of site-specific plans to effectively reduce damage by and conflicts with wolves, meet landowner/manager objectives for site use, and minimize potential for adverse environmental impacts.
- The program should be conducted by personnel trained and qualified in wolf damage management.
- There should be a system for monitoring the effect of management actions and cumulative impacts on the wolf population.

Wyoming WS, at the direction of the USFWS or WGFD, as applicable, would apply an IWDM approach where the integration and application of approved methods for prevention and management, both nonlethal and lethal, are considered in resolving predation problems. The evaluation, selection and eventual application of methods considers the: 1) overall effectiveness of the method and its ability to resolve the problem, 2) specific type and magnitude of damage, 3) geographic extent, 4) duration,

frequency and likelihood of recurring damage, 5) non-target species vulnerability, 6) environmental condition and impacts, 7) social and legal factors, and 8) relative costs.

Efficacy of WDM Methods

The integrated and adaptive approach employed under the current wolf conflict management program in Wyoming typically involves use or consideration of both nonlethal and lethal measures to stop or reduce the likelihood of further wolf damage. Both nonlethal and lethal methods have limitations and no one method or strategy is universally effective or applicable for all situations. Under this alternative, WS would give preference to nonlethal alternatives where practical and effective. However, most nonlethal methods are best implemented by producers and WS involvement in these methods is often limited to technical assistance (advice, training) on how to use these methods for maximum efficacy. A recent 2014 NASS survey of sheep producers collected data on nonlethal methods used to reduce predation (all predators combined; NASS 2015). In Wyoming, nonlethal methods employed included livestock guarding dogs (36% of operations), guard llamas (16%), guard donkeys (7%), fencing 24%, shed lambing (47%), herders (13%), night penning (34%), frightening devices (7%), carcass removal (20%), culling older stock (34%), changing bedding grounds (13%), frequent checks in high risk areas (30%), altered lambing schedules to avoid period of greatest predation risk (5%), and other nonlethal methods (8%). Nationwide, the use of different types of nonlethal methods used by sheep producers varied depending on the size of the operation. For example, use of livestock guarding dogs (67%), herding (34%), culling older sheep (50%), and increasing checks in high risk areas (51%) were greater for operations of 1,000 sheep and lambs or more than for smaller flocks. Flocks with 25 – 99 sheep and lambs used livestock guarding dogs (44%), herding (13%), culling older sheep (26%), and increasing checks in high risk areas (22%). In contrast, predator exclusion fencing was used by 53% of operations with 25-99 sheep and lambs but only 35% by operations with 1,000 or more sheep and lambs. In a 2010 NASS survey of cattle and calf producers, 19% of producers used livestock guarding animals, 23% used predator exclusion fencing, 23% herding, 19% night penning, 4% frightening devices, 43% carcass removal, 29% culling older animals, 47% frequent checks in high risk areas and 8% other nonlethal methods (NASS 2011).

One of the most effective nonlethal deterrents to wolf predation may be the on-site presence of humans who remain near the livestock and are vigilant in trying to detect the presence of wolves so they can be consistently frightened away (Shivik 2004). These efforts can be rendered more effective if there are radio-collared wolves in the area and the livestock guardian personnel (e.g., herders and range riders) make use of radio-telemetry receivers to detect the nearby presence of wolves. The costs to provide 24/7 human presence around livestock would ordinarily be cost-prohibitive for livestock producers, but in some situations, outside parties with an interest in wolf conservation have provided such assistance at no cost to livestock producers, in order to promote greater tolerance for wolves. Defenders of Wildlife have paid for such efforts in the Big Wood River drainage of central Idaho during several recent summer grazing seasons, and while these efforts have not been 100% effective in eliminating wolf problems, they appear to have been effective in reducing the number of wolf attacks on sheep and livestock guarding dogs in this area (USDA 2010).

Electric fencing may hold some promise for protecting livestock from wolves, but fences tested for coyotes have been extremely expensive, high maintenance, and better suited for

small areas (Dorrance and Bourne 1980, Nass and Theade 1988, Paul and Gipson 1994), rather than range operations.

Although nonlethal methods are often only temporarily effective, they may sometimes offer protection for a long enough period of time to protect a resource when it may be most vulnerable. An example is the use of the RAG in small calving pastures. Breck et al. (2002) reported that this frightening device, activated by the radio signal from an approaching radio-collared wolf, was effective in keeping a radio-collared wolf pack away from several small calving pastures in central Idaho for 60 days. However, this device is only useful in those cases where at least one and preferably multiple wolves in the pack are radio-collared, and it is only useful for protecting relatively small areas. Fladry has also been used to deter wolves for up to 60 days before the wolves habituated to it and began killing livestock again (Musiani et al. 2003). Davidson-Nelson and Gehring (2010) reported that if maintained, fladry can exclude wolves from livestock for up to 75 days, however, Shivik et al. (2003) found that fladry did not effectively protect bait sites from scavengers, including wolves. Turbo-Fladry which substitutes the cord with electrified wire can increase the amount of time fladry barriers may remain effective. One consideration in the use of these temporarily effective nonlethal methods, however, is that if wolves will eventually be lethally removed anyway (after habituating to the frightening stimulus), the investment of time and resources in the nonlethal efforts may not be practical.

Bangs and Shivik (2001) reported that while some nonlethal methods may be temporarily effective, many are expensive to implement and none available at the time of their report were widely effective. Many nonlethal methods of preventing livestock losses to wolves have been tried and abandoned in the United States and Europe because of lack of effectiveness. Use of guard dogs alone has been tried against wolves in Minnesota with only limited success (Fritts et al. 1992). Coppinger and Coppinger (1996) showed the dominance of wolves over livestock guarding dogs in direct confrontations, and Coppinger and Coppinger (1996) and Bangs et al. (1998) reported that wolves have killed livestock guarding dogs. However, recent research by the NWRC indicates that some breeds of dogs may be more effective in reducing conflicts with wolves than others. This research is still underway and WS is assisting in these projects. Wolves have also been translocated to other areas, but many either returned to where they were caught or became a problem elsewhere (Fritts et al. 1984, 1985). Mech et al. (1996) concluded that where wolf populations are large and secure, translocation has little value in wolf management. Aversive conditioning, such as the use of shock collars, (Gustavson and Nicolaus 1987, Shivik and Martin 2001, Shivik et al. 2003) has not yet proven effective with wild wolves (Fritts et al. 1992).

In looking at the possible role of livestock husbandry practices in reducing wolf predation, Bradley and Pletscher (2005) assessed multiple factors potentially related to wolf depredations on cattle in fenced pastures in Montana and Idaho. They concluded there was no relationship between depredations and carcass disposal methods, calving locations, calving times, breed of cattle, or the distance cattle were grazed from the forest edge. They did find that depredations were more prevalent in pastures where elk were more likely to occur, where the pastures were larger in size, had more cattle, and where cattle were grazed farther from residences than pastures without depredations. Mech et al. (2000) likewise concluded there were essentially no differences in husbandry practices between farms in Minnesota that suffered chronic wolf depredations, as compared to

similar operations which experienced no depredations, and that farms with cattle farther from human habitation suffered more losses.

In assessing the effectiveness of various management approaches to dealing with wolf predation on livestock in the NRM, Bangs et al. (2009) concluded that while nonlethal tools were temporarily helpful in some situations, they were generally ineffective, particularly in areas that simply would have too many livestock conflicts for wolf packs to persist. Scaring wolves away from a specific location in an area with high livestock densities simply results in displacement of wolves and killing of livestock in adjacent areas where focused nonlethal efforts are not being employed. Bangs et al. (2009) also concluded that lethal management of problem wolves was usually effective in reducing conflict because it: 1) enhanced effectiveness of nonlethal control measures, 2) interrupted use of livestock as food by surviving wolves, 3) removed offending individuals, 4) reduced wolf density in conflict areas, 5) eliminated packs where chronic livestock depredations had been occurring, 6) helped to keep wolf packs out of unsuitable habitat, 7) made surviving pack members temporarily avoid or be more wary of people and/or areas with livestock, 8) reduced the pack's overall need for food, 9) made it more difficult for the fewer remaining pack members to kill larger prey like adult cattle or attack calves protected by cows, 10) increased the detection rate of subsequent depredations because livestock carcasses were consumed more slowly (so additional control could be applied more rapidly), 11) reduced compensation and control costs, and 12) moderated some of the public anger over wolf predation on livestock. Mech (1995) similarly concluded that in most circumstances, lethal removal of wolves was usually the only practical approach to resolving incidents of wolf predation on livestock. Karlsson and Johansson (2009) reviewed data on livestock predation by brown bears, wolves and lynx on farms in Sweden and concluded that the risk of predation greatly increased during the first several weeks after an initial predation incident. They suggested that control efforts, whether lethal or nonlethal, would be most effective if applied during this period of time following an initial depredation event.

Haight et al. (2002) and Cochrane et al. (2003) reported on a model developed to assess 3 different strategies for reducing wolf predation on livestock, including: 1) reactive management, where wolf removal occurred soon after depredations occurred, 2) delayed reactive management, where wolf removal occurred in the winter months prior to the grazing season in areas with a history of previous depredations, and 3) population-size management, where wolves were removed annually in the winter months from all areas near farms. The authors' concluded that: 1) each of these approaches reduced predation by about half compared with no action, 2) delayed reactive management and population-size management actually removed fewer wolves than reactive management because wolves were removed in winter before pups were born, and 3) population-size management was least expensive because repeated annual removal kept most territories near farms free of wolves.

Use of lethal WDM methods to reduce damage by and conflicts with wolves as proposed and currently conducted and proposed by the WS program is primarily intended as a short-term strategy to reduce depredations *at the specific locations* where the conflict occurs. Given wolf behavior and the targeted nature of the management effort, these removals are not intended or expected to have regional-level impacts on livestock losses, and studies conducted to assess the efficacy of lethal removals at the regional level have not detected reductions in losses. Musiani et al. (2005), did not detect regional-level decreases in livestock depredation in Montana, Idaho, Wyoming and portions of Alberta,

Canada over the period of 1987- 2003, but noted the removals were not intended or expected to have regional-level impacts. Harper et al. (2008) also failed to find regional-level impacts on livestock losses in Minnesota. Most recently, Wielgus and Peebles (2014) reviewed the effects of wolf mortality on reducing livestock depredations from 1987 to 2012 in Idaho, Montana and Wyoming and concluded that the odds of livestock depredations the year after WDM removals were conducted was positively correlated with the number of wolves removed up and until wolf mortality exceeded the mean intrinsic growth rate of wolves at 25%. But the authors also acknowledge that lethal control of individual depredating wolves may sometimes be necessary to stop depredations in the near-term. Findings of the study have been interpreted by some to indicate that lethal removal of wolves makes depredation problems worse instead of better. However, subsequent review of the methods and conclusions has identified several critical flaws in the methods used in the analysis which render this analysis unsuitable for use in evaluating the efficacy of WDM methods. The conclusions of this review are provided in Appendix D.

Bradley et al. (2015) completed a review of the impacts of lethal removal of wolves for WDM on local livestock depredations in Idaho, Montana and Wyoming over the period of 1989 to 2008. In their study, median time between recurrent depredations was 19 days following no removal of wolves, 64 days following removal of some individuals within the depredating pack (partial pack removal) and 730 days following removal of entire packs. Following removals, partial pack removals reduced the occurrence of subsequent depredations by 29% over a span of 5 years. Complete removal of packs reduced occurrence of subsequent depredations 79% over 5 years. Timing of removal was especially important for partial pack removals, with greatest efficacy achieved if removals were conducted within 7 days of the depredation, reduced success if removals were conducted between 7 and 14 days of the depredation, and no difference in losses if partial pack removals were conducted more than 14 days after the depredation occurred. There were no differences in depredation recurrence if breeding females or males >1 year of age were removed during partial pack removal. For partial pack removal, probability of recurrence of depredation event increased 7% for each animal left in the pack after the management response. However, the number of animals left in the pack was also directly related to the likelihood that a pack would meet criteria as a breeding pair the subsequent year, which is important for population restoration. Studies by Tompa (1983) and Bjorge and Gunson (1983, 1985) also documented reductions in local losses after removal of all or most of depredating packs in Alberta and British Columbia, Canada. In contrast, Harper et al. (2008) reviewed data from clusters of local farms and found no relationship between the number of wolves removed and depredation recurrence except at sheep farms and when >1 adult male was removed. Harper also did not detect any relationship between recurrence of depredation and the number of wolves removed, although findings may have been complicated by lack of information on total pack size and the proportion of the pack removed.

There has been some debate as to whether regulated wolf hunting may reduce livestock depredation. However, because of the variability among years in wolf predation on livestock, long-term wolf harvest data will be needed to determine the effects of legal harvest on livestock depredation. WGFD will continue to evaluate and investigate relationships between harvest and livestock depredation, and livestock depredation/conflict resolution are a primary component of large carnivore management (WGFD 2015).

Potential for Lethal Removal to Disrupt Pack Social Structure and Inadvertently Increase Predation on Livestock. Bradley et al. (2015) evaluated impacts of 3 management responses to livestock predation in Montana, Idaho and Wyoming over the period of 1989 to 2008. Management responses included no response, full pack removal and partial pack removal. Compared to no wolf removal, partial pack removal reduced the occurrence of subsequent depredations by 29%. Partial pack removal was most effective if conducted within the first 7 days following depredation. Partial pack removal had only minor benefits from 7-14 days after removal and no effect when conducted 14 or more days after removal. There was no evidence that depredations increased after partial pack removal. The status of the individual removed during partial pack removal did not affect the likelihood of depredation occurrence. There was no difference in depredation recurrence when a breeding female or >1 year old male was removed.

MacNulty et al. (2009a, 2009b) discussed evidence from observations of YNP wolves and suggested that as wolves age, their ability to kill elk declines due to physiological deterioration, similar to the decline in abilities of human athletes as they age. The authors' data suggested that 2-3 year old wolves were in the best physical condition to attack and kill prey, and the higher the proportion of wolves over age 3 in the population, the lower the rate at which they kill elk. Although data are lacking on this subject, it may be possible that if wolves are less able to kill elk or other natural prey as they age, they may be more likely to attack easier prey such as domestic livestock. Additionally, MacNulty et al. (2009b) suggest that net predator performance decreases with increasing prey size when prey is substantially more difficult to pursue and handle (i.e., wild ungulates vs. livestock). Furthermore, if poor predator locomotor performance narrows the range of potential prey to slower-moving species, this could conceivably put livestock at greater risk from an aging or unharvested wolf population. Data obtained from Wyoming wolf hunting seasons indicate that harvest is evenly distributed among sex and age classes of wolves, with lower pup harvest in 2013 than 2012. All age classes were similarly distributed in the harvest (D. Thompson WGFD 2014).

Ability of Alternative to Meet Management Objectives

This alternative would provide access to the full range of legally available WDM methods. No one method or class of methods is likely to resolve all conflicts with wolves. Access to the full range of WDM methods maximizes the likelihood that the program will be able to work with cooperators to develop effective site-specific management strategies to address damage by and conflicts with wolves in Wyoming. Based on review in Section 4.3.1.2, this alternative will not have individual or cumulative adverse impacts that would jeopardize the long-term sustainability of the state or regional gray wolf population.

Analysis in Section 4.3.1.6 indicates that, despite established SOPs to minimize risk of adverse impacts, the proposed action has the potential to result in injury or death of a limited number of individual non-target animals. However, these losses would not be of sufficient magnitude or scope to adversely affect non-target species populations. Consultation with the USFWS indicates that this alternative would have no effect on or be unlikely to adversely affect T&E species in the state and may affect, but would not result in jeopardy to Canada Lynx and grizzly bear populations. Once wolves are removed from the federal list of T&E species, there will likely be an increase in WDM actions conducted by entities other than WS. Many of these entities are not required to consult with the USFWS regarding measures to reduce risks to T&E species, so risks

associated with their actions may be greater than for WS activities. However, when provided access to prompt professional agency WDM assistance, many individuals will use the agency assistance. Consequently, risks to T&E species from non-WS entities are likely lowest for this alternative.

All WS WDM activities are conducted in accordance with authorities provided by the USFWS, WGFD, Tribes and applicable federal, state and local regulations. WS personnel are trained in safe and effective WDM practices and conduct WDM in accordance with applicable SOPs and WS Directives to improve program efficacy and reduce risks of adverse impacts on the human environment. The WS program reports on the impact of management actions to the applicable federal, state, and tribal agencies to coordination of management efforts, agency management of cumulative impacts on wildlife populations and review of environmental impacts of program activities. The WS program also monitors program activities and impacts to ensure that they remain within the parameters analyzed in this EA and would update the analsis as needed in accordance with CEQ, USDA and APHIS NEPA implementation regulations and procedures. WDM may be conducted by entities other than WS, particularly after wolves are delisted. The training and skill level of these entities is variable and in some instances WDM is likely to be conducted by individuals with less access to training and WDM methods than WS. Private entities may also not provide the same level of information to federal, state and tribal agencies on the impacts of their actions on wolves and non-target species populations as the WS program. However, when a prompt, effetive agency WDM program is in place, many individuals will seek agency assistance with WDM, so reporting and program monitoring are likely to be the most complete under this alternative.

4.3.1.2 Effects on the wolf population in Wyoming

Status of the NRM and Wyoming Wolf Population

USFWS (1987) initially specified a recovery criterion of a minimum of 10 breeding pairs of wolves for a minimum of 3 successive years in each of 3 core recovery areas. USFWS (1994) subsequently revised wolf recovery parameters in the NRM to stipulate that "Thirty or more breeding pairs comprising some 300+ wolves in a metapopulation, with genetic exchange between subpopulations, should have a high probability of long-term persistence." In addition, the metapopulation configuration and distribution throughout secure suitable habitat (e.g., YNP, NW Montana and central Idaho) would ensure that each core recovery area would provide a recovered population that would be distributed over a large enough area to provide resilience to natural or human-caused events that might temporarily affect one core recovery area. USFWS (1994) further determined that a metapopulation of this size distributed among the three core recovery areas within the identified NRM DPS would result in a wolf population that would fully meet recovery objectives.

The USFWS conducted another review of what constitutes a recovered wolf population in 2001 and 2002 (USFWS et al. 2002, 2003) to re-evaluate and update USFWS (1994). A majority (78%) of a panel of wolf experts supported USFWS (1994) conclusions and agreed that wolf population viability was enhanced by higher (500 or more wolves) rather than lower population levels (300) and longer (more than 3 years) rather than shorter demonstrated time frames. The USFWS also determined that an essential part of achieving recovery is an equitable distribution of wolf breeding pairs and individual

wolves in Idaho, Montana and Wyoming and the three core recovery areas, and concluded that NRM wolf recovery and long-term wolf population viability is dependent on its distribution as well as maintaining the minimum numbers of breeding pairs and wolves.

Minimum recovery goals (an equitably distributed NRM wolf population that does not go below 100 wolves and 10 breeding pairs in Montana, in Idaho, and in Wyoming) have been exceeded in the NRM DPS every year since 2002 (USFWS et al. 2011), and as listed in the Federal and State recovery plans, all threats in the foreseeable future have been sufficiently reduced or eliminated in Idaho and Montana.

The NRM DPS occupies nearly 100% of the core recovery areas recommended in the 1987 recovery plan (i.e., central Idaho, the GYA, northwestern Montana) (USFWS 1987) and nearly 100% of the areas where suitable habitat was predicted to exist in northern and central Idaho and the GYA (USFWS 1994). This pattern is expected to continue, because management plans for public lands in the NRM DPS result in forest cover, high ungulate densities, low to moderate road and livestock densities, and other factors critical to maintaining suitable wolf habitat. These goals were designed to provide the NRM gray wolf population with sufficient representation, resilience, and redundancy for its long-term conservation (73 FR 10514; See also Sections 2.2.1).

There appears to be enough habitat connectivity between occupied wolf habitat in Canada, northwestern Montana, Idaho and the GYA to ensure exchange of sufficient numbers of dispersing wolves to maintain demographic and genetic diversity in the wolf population (Oakleaf et al. 2006, Carroll et al. 2006, vonHoldt et al. 2008, vonHoldt et al. 2010). Wolf movements between Canada and northwestern Montana have been documented from radio-telemetry monitoring (Pletscher et al. 1991, Boyd and Pletscher 1999, Sime et al. 2007), wolf movement between Idaho, Montana and Wyoming has been confirmed. (71 FR 6634). In addition, USFWS-approved state wolf management plans in Montana (Montana Wolf Management Advisory Council 2003), Idaho (ILWOC 2002, IDFG 2008), and an interagency MOU (USFWS et al. 2012) commit to maintaining the metapopulation structure as well as sufficient genetic diversity utilizing various methods including relocation, if necessary, to ensure the long-term viability of the wolf population.

USFWS reviews of the status of the wolf population, made in conjunction with delisting indicate that sufficient secure wolf habitat and prey will remain available into the future (Section 2.2.1). The vast majority of suitable wolf habitat and the current wolf population are secure in mountainous forested Federal public land that will not be legally available for or suitable to intensive human development. The core recovery areas in the NRM have long been recognized as the most likely areas for maintenance of successful metapopulations, with dispersal between subpopulations (USFWS 1980, 1987, 1994; 71 FR 6634, WGFC 2011). Consequently, human development will not occur on a scale that could possibly affect the overall suitability of Wyoming or the GYA for wolves, and no foreseeable habitat-related threats will prevent these areas from supporting a wolf population that is capable of substantially exceeding recovery levels (76 FR 61782).

Impact of WDM Actions for Protection of Livestock and Human Health and Safety

Alternative 1 has been implemented by the USFWS and WGFD either under section 4(d) provisions of the ESA, section 10 permits from the USFWS, or authority granted to

WGFD by the USFWS. WS has been an agent of the USFWS or WGFD for purposes of resolving and reducing livestock and domestic animal losses caused by wolves (Letters to R. Krischke, WS from M. Jimenez, USFWS, Wyoming Wolf Recovery Project Leader, March 1, 2009, October 22, 2014; Letter to R. Krischke, WS from B. Nesvik, Chief Wildlife Division, WGFD October 4, 2011). WS implementation and use of IWDM strategies and methods under this alternative would continue as implemented under USFWS management and as directed by WGFD following delisting during the period of (WGFC 2011). Consistent with USFWS management, Wyoming's goal is to ensure the long-term viability of the gray wolf population in Wyoming (WGFC 2011, 2012). In order to ensure the population goal is achieved, WGFD is expected to maintain at least 13 breeding pairs and at least 130 wolves in the WYO (outside YNP and the WRR). This includes the minimum of maintaining ≥10 breeding pairs and ≥100 wolves needed for delisting plus a buffer to help ensure that the population does not go below the minimum. However, the exact nature of the buffer above 10 breeding pairs and 100 wolves has not been finalized. At the end of 2014, the gray wolf population in Wyoming remained above minimum delisting criteria, making 2014 the 12th consecutive year Wyoming has exceeded the numerical (breeding pairs and total wolves), distributional, and temporal delisting criteria established by the USFWS (WGFD et al. 2015, USFWS et al. 2015). The Wyoming wolf population generally increased since reintroduction until 2012 when wolves were delisted, at which point there was a decline consistent with WGFD management objectives (Figure 4-1). The wolf population in Wyoming currently occupies almost all of the available suitable habitat (WGFD et al. 2014b).

One of the goals of the USFWS and Wyoming wolf management plans is to quickly and efficiently resolve localized wolf conflicts while maintaining healthy wolf populations (USFWS 1994, 71 FR 43410, 73 FR 10514, 76 FR 61782, WGFC 2011). While federally protected under the ESA, the USFWS (USFWS 1994) focuses on resolving specific conflicts at specific sites (*i.e.*, livestock depredations and threats to human safety). The WGFD places similar emphasis on reduction of conflicts, but also employs public hunting of delisted wolves to the extent possible in attempting to reduce those conflicts. The different forms of wolf take for conflict management (*e.g.*, take by WS and take by land/property owners under permits) are interrelated. Take by one of these entities is likely to reduce the number of wolves that will be taken by another entity. For example, if lethal wolf conflict management by WS successfully resolves a problem, there may be no need for a landowner to take wolves, so take under permits would decline. Conversely, landowner removal of a wolf caught in the act of depredation may reduce or eliminate the need for additional wolf removal by WS. Similarly, when wolves are delisted, and where regulated harvest can help reduce the number of wolves and incidents of wolf predation on livestock, there would likely be fewer wolves taken by WS and private property owners during control actions.

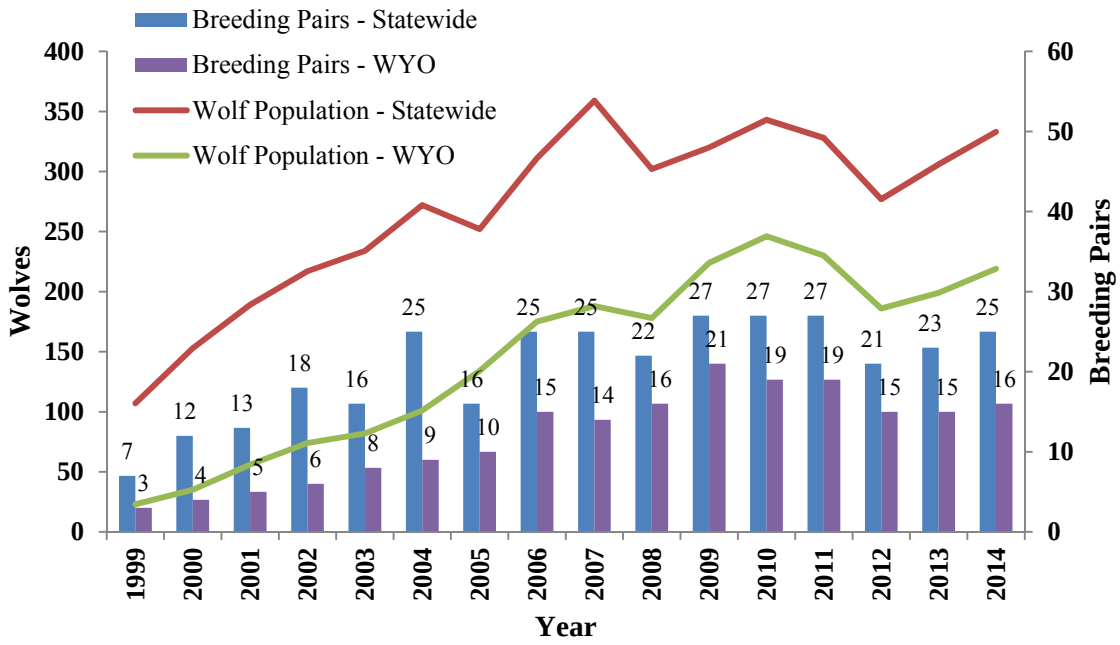


Figure 4-1. Statewide trend in wolf population and breeding pairs in Wyoming and in the WYO portion of Wyoming (area outside Yellowstone National Park and the Wind River Reservation), 1999-2015 (USFWS et al. 2002-2015; Jimenez et al. 2005-2012; WGFD et al. 2013-2014b).

Seventeen wolf packs in Wyoming (50% of the 34 packs in WYO) were involved in at least one depredation from January 1 to September 23, 2014 (WGFD et al. 2015). Depredating wolf packs averaged 6.4 wolves/pack (range = 2-22; WGFD et al. 2015). Lethal take of wolves in response to depredations might in some cases include removal of up to an entire pack, but there will likely also be cases where no wolves would be taken in response to depredations. The USFWS and/or their designated agents in the State and Tribes will continue to monitor and evaluate the wolf population annually to determine the wolf population status.

Management Actions to Protect Livestock and Human Safety

Under this Alternative, Wyoming WS, as requested by and coordinated with USFWS or WGFD, could continue to recommend nonlethal management methods when deemed practical and appropriate, or could lethally remove wolves to resolve wolf conflicts[19]. Additionally, livestock producers and/or their agents could legally shoot wolves to protect their livestock under existing USFWS or WGFD rules and/or under the authority of permits issued by USFWS or WGFD after confirmation of wolf predation. Once delisted WGFD regulations would allow for lethal removal of wolves to address a broader range of conflicts than is permitted while wolves are federally listed as an XN population. WGFC regulations will allow a property owners to immediately kill a wolf doing damage to private property: "doing damage to private property" is defined as "the

[19] Includes take by designated agencies for the protection of human safety. Does not include euthanization of sick or injured wolves (injuries that are not related to actions proposed in this EA).

actual biting, wounding, grasping, or killing of livestock or domesticated animal, or chasing, molesting, or harassing by gray wolves that would indicate to a reasonable person that such biting, wounding, grasping, or killing of domesticated animals is likely to occur at any moment."

Additionally, the WGFD may issue "lethal take permits" authorizing property owners to kill not more than two wolves in areas experiencing chronic wolf depredation within the WTGMA. WGFC regulations define "chronic wolf depredation" as "a geographic area limited to a specific parcel of private land or a specific grazing allotment described on the permit within the WTGMA where gray wolves have repeatedly (twice or more within a two-month period immediately preceding the date on which the owner applies for a lethal take permit) harassed, injured, maimed or killed livestock or domesticated animals." Wolves killed under the authority of a lethal take permit shall be reported to the WGFD representative specified on the permit within 24 hours.

The number of wolf removals for depredation management by the agencies and landowners for protection of livestock in Wyoming from 2005-2014 has ranged from 7% to 33% of the wolf population per year (Table 4-1). Wolves were delisted in 2012-2013, and WGFD policies for WDM and wolf harvest described above were in place. During this period, take for WDM was 43 and 33 wolves in 2012 and 2013, respectively, well within the range of WDM take for the period of 2005-2011 of 31-63 wolves per year (Table 4-1). The lack of marked increase in take for WDM while wolves were delisted may be attributable, in part, to the interrelated nature of different sources of WDM efforts, licensed harvest, and wolf population management by the WGFD.

Management Actions to Protect Ungulates

Under this Alternative (the current program), WS would not assist in wolf removals to protect ungulates. However, WGFD has indicated it will undertake wolf removals for this purpose on its own if a need for action is identified, subject to approval from the USFWS, as long as wolves remain listed (Letter to R. Krischke, WS from B. Nesvik, Chief Wildlife Division, WGFD October 4, 2011). While federally protected under the ESA as an XN population, WGFD would not be able to use lethal WDM methods for ungulate protection until a USFWS approved state management plan is completed and the USFWS requirements established in the special rules for wolves (50 CFR 17.84(n)) are met. The number of wolves which could be taken for this type of WDM is not known at this time, but, in accordance with applicable regulations and agency goals for the recovery and preservation of the species, would be adjusted and coordinated with other wolf removals so that cumulative take does not reduce the wolf population below minimum management thresholds established to protect the long-term viability of the species.

Other Types of Human-Related Wolf Mortality

In addition to the WDM actions listed above, human-related wolf mortality may also include factors such as collisions with vehicles, unintentional mortality in wildlife capture devices set to capture other types of animals, and illegal killing of wolves. Once delisted, wolves would likely also be taken during WGFD-regulated hunting seasons and in areas where they are designated as predatory animals.

Regulated Public Harvest. When wolves are delisted, regulated public harvest will be used by WGFD to manage the wolf population inside the WTGMA. The primary purpose of regulated public harvest of wolves in Wyoming will be to manage the wolf population and alleviate conflicts with livestock, domesticated animals, and unacceptable impacts to big game. As with all other forms of take, WGFD sets harvest limits in consideration of other known forms of take and mortality for the population to ensure that cumulative take does not reduce the population below mandatory minimum levels set for population recovery and preservation. Wolf hunting regulations will be developed annually through the same rule-making process used for other wildlife in Wyoming. The WGFD will generate management recommendations using the most recent wolf population, harvest, and mortality data and will present those recommendations to the public. The WGFD will then present final recommendations to the WGFC following the public input process. The WGFC will vote to approve, amend and approve, or reject the recommendations provided by the WGFD. Following approval, the WGFD will be responsible for implementing wolf hunting regulations. Wolf hunting seasons will primarily coincide with fall big game hunting seasons (Oct 1st -.Dec. 31st) and the WGFD expects most wolves will be killed opportunistically by hunters pursuing big game and quotas being reached before the proposed end of the season (WGFC 2011). Public harvest resulted in take of 67 wolves in 2012, 63 wolves in 2013 and 12 wolves in 2014 (WGFD 2013, 2014a, 2014b). Public harvest resulted in take of 63 wolves in 2012 and 62 wolves in 2013. As with all other forms of take, WGFD sets harvest limits in consideration of other known forms of take and mortality for the population to ensure that cumulative take does not reduce the population below mandatory minimum levels set for population recovery and preservation.

Incidental Mortality: Occasionally, wolves are killed accidentally (e.g., capture myopathy, vehicle accidents, or as incidental catch during legal trapping of other species). These types of mortalities are rare and, to date, have little impact on the state wolf population. WGFD will encourage other agencies and the public to report incidental mortalities within a reasonable timeframe. Prompt notification by the public will aid the WGFD in collecting important information from these types of mortalities.

Illegal Wolf Mortality: Wolves taken outside the framework established by State statute and WGFC regulation will be considered to have been taken illegally and will be investigated by WGFD law enforcement personnel. Appropriate law enforcement and legal action will be taken, which could include fines, jail terms, and/or loss of hunting privileges.

Natural Causes of Wolf Mortality

Natural causes of mortality in wolves may include factors such as disease, interspecific conflict and starvation. Primary diseases of concern for the Wyoming wolf population include mange, canine distemper virus and canine parvovirus. Mange and exposure to canine distemper have been documented in the wolf population in Wyoming (WGFD et al. 2015). For example, the 2005 decline in the state wolf population affected the wolves in YNP and was attributed to extremely poor pup survival, attributed to disease (Jimenez et al. 2006). However, in 2006, there was no evidence of disease and the population had rebounded (Jimenez et al. 2007). In 2008, the decline in the wolf population hit the YNP wolves more than the packs in the WYO portion of the state population (Figure 4-1; Jimenez et al. 2009). Interspecific strife and disease (mange) were the likely primary causes of the decline.

Table 4-1. Estimated Wyoming wolf population in the WYO (areas outside YNP and WRR), mortality from agency WDM actions and licensed hunting (when allowed), and percent population change from previous year, 2005-2014 (Jimenez et al. 2005, 2006, 2007, 2008, 2009, 2010a, 2011, 2012; WGFD 2013, 2014a, 2014b, USFWS 2015).

Year	Minimum Estimated Year-End Wolf Population	Known Mortality			% Estimated Mortality from Population[2]			% Change in minimum Estimated Wolf Population[3] (from previous year)
		Total	Agency and Public Take Actions[1]	WS	Total	Agency and Public Take Actions[1]	WS	
2005	134	51	41	41	28	22	22	+33
2006	175	59	44	44	25	19	19	+31
2007	188	75	63	63	29	24	24	+7
2008	178	79	57	46	31	22	18	-6
2009	224	40	31	31	15	12	12	+26
2010	246	58	40	40	19	13	13	+10
2011	230	51	36	36	18	13	13	-6
2012	186	124	109[4]	43	39	35	14	-19
2013	199	109	95[4]	33	35	31	11	+7
2014	219	64	52	31	23	18	11	+10

[1] Includes agency control, and authorized public take (permits from USFWS, predator control zone, hunter harvest).
[2] Total population for purposes of calculation adds known mortality to minimum population estimate.
[3] The percent change in population takes into account the agency removal data.
[4] Wolf hunting season open during these years.

Cumulative Impact on the Wyoming Wolf Population

Wolf populations are dynamic and can undergo major fluctuations. Many studies have examined various levels of mortality and harvest and the impacts these mortality levels have on gray wolf populations. Wolf populations have sustained human-caused annual mortality rates of 30 to 50% without experiencing declines in abundance (Keith 1983, Fuller et al. 2003). Based on mean pack size of 8, mean litter size of 5, and 38% pups in packs, Boertje and Stephenson (1992) suggested 42% of juveniles and 36% of adults must be removed annually to achieve population stability. Mech (1970) suggested that more than 50% of wolves older than 5-10 months must be killed to "control" the wolf population, but other researchers have indicated declines may occur with human-caused mortality at 40% or less of fall wolf populations (Ballard et al. 1987, Peterson et al. 1984,). Gasaway et al. (1983) reported stable wolf populations after early winter harvests of 16 to 24%, and wolf population declines of 20 - 52% after harvests of 42 - 61%. Ballard et al. (1997) suggests that the wolf population remained stable at 53% winter mortality, which included both natural and human-caused mortality. Fuller (1989) observed stable or slight increases in a wolf population with an annual human-caused mortality rate of 29%. Fuller et al. (2003) concluded that 30 to 35 % human-caused mortality of late fall or winter population could be tolerated by most wolf populations without causing population declines.

Mech (2001) looked at three scenarios for the management of Minnesota's wolf population when the population was estimated at 2,450 wolves during the winter of 1997-1998: 1) population and range limitation, 2) sustainable harvest, and 3) population

reduction. For population and range limitation, an additional number of wolves equal to the annual increase in the wolf population (statewide for population stabilization, in the periphery of occupied range for range limitation) would need to be taken as long as lethal wolf conflict management continued at its present or greater level. Using data from other regions of North America, winter harvests of wolves of 28-47% did not permanently reduce wolf populations for sustainable harvest. Wolf populations have been reduced in Canada and Alaska when 38-80% of the populations where removed during the winter. These populations rebounded after population reduction was ceased (Mech 2001). In their analysis of multiple data sets, Adams et al. (2008) found human-caused mortality rates <29% did not cause wolf population declines.

Haber (1996) reported that wolf populations may not be able to withstand repeated annual reductions of 25-50%. He believes these removals, in the form of hunting, trapping, and government control efforts, may have impacts on wolf population dynamics, social interactions, and the long-term health of the population. Haber also reported that it is difficult to fully understand the impacts of wolf exploitation because detailed comparative information on behavior from both exploited and protected wolf populations is scarce. Haight et al. (2002) modeled the impacts of various wolf removal strategies for wolf conflict management including reactive removal (wolves removed after depredation occurs), delayed corrective removal (wolves removed in winter from areas with a history of wolf conflicts); and population size management (wolves removed annually from all territories near depredation sites). None of the strategies threatened wolf populations unless the wolf population was isolated. The model predicted that populations could withstand a sustained harvest of 20-25%. The authors considered this to be a conservative estimate and that the model likely underestimated compensatory factors in wolf population biology.

Creel and Rotella (2010) noted that most assessments of the ability of wolf populations to withstand human-caused mortality assumed that human-caused mortality was compensated for by density-dependent reductions in non-harvest mortality factors. The authors used data from existing studies of wolf populations, and USFWS reports for the NRM wolf population published up through 2008 to assess the impact of human-caused mortality on total mortality and the impact of human-caused mortality on wolf population growth rates. Based on their modeling, Creel and Rotella (2010) concluded that human-caused mortality was actually highly additive to or potentially super-additive to natural mortality. Super-additive mortality rates might occur in situations wherein wolf removals disrupt pack structure such that breeding activity was disrupted. Risks associated with pack disruption and associated impacts on the response of wolf populations to human-caused mortality were identified as being particularly great for small packs with 4 or fewer adults. However, the authors also found little evidence of density dependence in wolf population growth rates which could have been an indication that the population was below its ecological carrying capacity and that density-dependent factors did not have strong influence on population dynamics at that time. The authors concluded that while wolf populations could be harvested sustainably, within limits, human-caused mortality was additive to other factors and the level of harvest that could be sustained was likely lower than predicted in other studies. Creel and Rotella concluded that NRM populations could sustain harvests of approximately 22% of the population. Berg et al. (2015) evaluated the impact of human harvest on the wolf population and pack structure in Denali National Park and Preserve and also concluded that human-caused mortality may be a largely additive source of mortality in wolves.

In social species like wolves, population structure (e.g., pack stability and reproductive success) can play an important role in overall population dynamics. Concern has been expressed that removal of breeding wolves could destabilize the breeding success of individual packs and have impacts greater than may be predicted based on Brainerd et al. (2008) found that 62% of packs in recovering populations retained territories despite breeder loss, and of those who lost territories, one-half became re-established. Furthermore, pup survival was primarily dependent on size of pack and age of pup because multiple pack members feed pups despite loss of a breeder. Pup survival in 84% of packs with breeder loss was similar or higher than packs without breeder loss (Mech and Boitani 2003).

Brainerd et al. (2008) stated that breeder replacement was highest and fastest in populations with more than 75 wolves. Similarly, Berg et al. (2015) observed packs remained intact in 67% of cases following breeder loss. Impact of breeder loss appeared to be context-specific and depended on the timing of removal and the size of the pack. Loss of breeders late in breeding season or just prior to parturition appeared to have the greatest effects, likely because there was little time for replacement individuals to become established in the pack. Availability of replacement individuals was also a factor, with impacts likely to be greater in small isolated wolf populations and when pack sizes are small (<6 wolves). Overall wolf population growth appeared to be resilient to the effects of breeder mortality. Breeder loss did not affect population growth in the current year or the year following removal. Pack dissolution had a marginal negative effect on population growth during the year in which the dissolution occurred but no effect the following year. In Wyoming, average pack size for the period of 2005-2014 has been 6.6 wolves with a range of 2-22 wolves per pack. As noted above, the wolf population in Wyoming currently occupies almost all of the available suitable habitat (WGFD et al. 2014b). The WYO area is adjacent to YNP where there is no wolf hunting and any WDM (protection of human health and safety) would be extremely rare. The USFWS and state agencies are working to ensure that state wolf populations are not isolated. Given this information, we believe it is reasonable to expect impacts on wolf packs and wolf population structure to be more similar to the saturated wolf population studied by Borg et al. (2015) than a low or recovering wolf population. Therefore, although some disruption of packs may occur as a result of WDM actions, these projects are not expected to be short term and unlikely to jeopardize the viability of the state wolf population. The fact that the total wolf population increased and the number of breeding pairs remained stable in the in the WYO by the end of 2013 2013, the year after the highest recorded human-caused wolf mortality rate since reintroduction and 2013 human-caused mortality of 31% supports this belief.

Data on wolf population trends in the WYO and human-caused mortality rates indicates that human-caused mortality has generally been at or below even the more conservative sustainable threshold estimated by Creel and Rotella (2010). The Wyoming wolf population has increased most years from 2005 – 2014. Wolf population declines documented in years when human-caused mortality was 22, 13, and 35% of the population in 2008, 2011 and 2012 (Table 4-1). Conversely, population increases were observed in 2007 and 2013 when human-caused mortality was 24 and 31% of the population, respectively. Mange and interspecific strife may have been contributing factors in population declines in 2008 and 2011. The decline in 2012 was in accordance with state management goals and consistent with state objectives when setting hunter harvest limits. The variability of wolf population response relative to human harvest

emphasizes the importance of population monitoring and use of adaptive management in wolf population management.

Under this or any of the other Alternatives, it is reasonable to expect that the USFWS or WGFD adaptive management approach will ensure that the cumulative impacts on Wyoming's wolf population do not result in the population dropping below approved recovery levels (WGFC 2011). Data posted in Table 4-1 indicates that the cumulative mortality in the population is within parameters the studies described above indicate can be sustained by wolf populations and/or used to adjust wolf populations to meet management objectives without jeopardizing the long-term viability of the population. In recognition of the importance of overall wolf population numbers and population structure, management objectives and thresholds set to ensure the future viability of the wolf populations include total population and breeding pair objectives. The wolf population in the WYO has met or exceeded minimum population recovery goals (100 wolves and 10 breeding pairs) and had a buffer above the minimum recovery goals (130 wolves and 13 breeding pairs) since 2005 even with lethal wolf removal to reduce damage by and conflicts with wolves, wolf removals in the predator management zone (when permitted) and wolf hunting seasons in 2012 and 2013, as well as all other sources of wolf mortality. Consequently, the cumulative impacts of the proposed action would not be expected to adversely affect the state or regional wolf population to the extent that this would result in a significant adverse effect on the quality of the human environment.

4.3.1.3 Effects on public and pet health and safety

WS conducted a formal risk assessment of methods used under Alternative 1 (USDA 1997, Appendix P pages 22-35). The assessment concluded that when traps, snares, aerial shooting, firearms and frightening devices are used by appropriately trained and authorized personnel, in accordance with applicable laws, regulations and agency policy, the current conflict management methods pose minimal or no risk to public and pet health and safety. The greatest risks to public health and safety from the use of wolf conflict management techniques are incurred by the individuals who use these methods. There have been no instances of capturing pets or public injury in equipment set by WS to capture wolves in Wyoming.

WS' traps and snares are strategically placed to reduce the likelihood of exposure to the public and pets. Appropriate warning signs are posted at access points to areas or properties where traps or snares are set to alert the public of their presence. Based on review of WS WDM programs in other states, it is possible to unintentionally capture pets in traps and snares. Any non-target take of pets is undesirable, and WS strives to prevent capture of pets. Consequently, occurrences of these types of events are rare, especially relative to total WS use of traps and snares and the number of target animals captured. There have been no reported injuries to WS, USFWS or WGFD personnel or the public from WS wolf management activities in Wyoming.

Firearm use is a very sensitive issue and a public concern because of fears regarding the potential for misuse of firearms. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program prior to using firearms on the job and a refresher course every 2 years afterwards (WS Directive 2.615). All firearm safety precautions are followed by WS when conducting conflict management and WS complies with all laws and regulations governing the lawful use of firearms. Shooting with shotguns or rifles would

be used to reduce wolf damage when lethal methods are determined to be appropriate and firearms would be used to euthanize captured wolves. WS employees who use firearms as a condition of employment are required to certify that they meet the criteria stated in the *Lautenberg Amendment*, which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

The low-level flights used for wildlife management including wildlife surveys like those conducted by the WGFD, USFWS, and other natural resource agencies are inherently higher risk than those for general aviation. Low-level flights introduce hazards such as power lines and trees, and the safety margin for error during maneuvers is diminished compared to high-level flights. Accidents have been associated with WS aerial operations and are a concern to WS. Some of WS's accidents have involved pilot error while others are directly related to mechanical failure. Wildlife Services developed the WS Aviation Training Center with the goal of reducing pilot error accidents to zero. The WS Aviation Training Center provides safety training, individual instruction and aviation consultation to all aviation programs in WS. The Center trains pilots to effectively respond to different types of mechanical failures and other safety concerns associated with low-level flight. Wildlife Services complies with all Federal Aviation Administration issued Service Bulletins, Airworthiness Directives, aircraft manufacturing recalls, and similar documents.

Wildlife Services' safety measures and training for aerial shooting are the same as those for aircraft used in surveillance with the addition that the individuals conducting the shooting also have specialized training in the safe and effective use of shooting from aircraft. Wildlife Services employees must have a clear view of the animal before shooting, so there is no risk of accidentally shooting a person. Overall risks to human health and safety are slightly higher to the flight crews because of the increased intensity and duration of the action but are still very low.

In 2007 and 2008, WS conducted a programmatic safety review to assess and improve employee safety (USDA 2008). The review covered nine WS program areas including the aviation program. The review of the aviation program was conducted by the Interagency Committee on Aviation Safety. The review team concluded that the WS aviation program is being operated in a safe, efficient and effective manner and that the program met the Interagency Committee on Aviation Safety requirements for the Gold Standard Certificate for Excellence. At the time of the report, the WS program was the only USDA aviation program to be awarded this certification. Wildlife Services' program pilots and contractors are highly skilled with commercial pilot ratings and have passed proficiency tests in the flight environment encountered by WS. Wildlife Services' pilots are trained in hazard recognition and surveillance flights would only be conducted in safe environments. Federal aviation regulations require pilots to fly a minimum distance of 500 feet from structures and people, and all employees involved in these operations are mindful of this. Although the goal of the aviation program is to have no accidents, accidents may still occur. However, the protective measures implemented by WS keep the risk of aircraft accidents and injuries to the public and aircraft crew low.

Drugs used in capturing, sedating, handling, and euthanizing wildlife for wildlife management purposes include ketamine hydrochloride, a mixture of tiletamine and zolazepam (Telazol), xylazine (Rompun), sodium pentabarbitol, potassium chloride, Yohimbine, antibiotics, and others. Wildlife Services would adhere to all applicable requirements of the Animal Medicinal Drug Use Clarification Act to prevent any

significant adverse impacts on human health from use of these methods. All drugs used in capturing and handling wildlife would be under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and WS.

This Alternative could provide relief from damage or threats to public health and safety for people who would have no relief from such damage or threats if nonlethal methods were ineffective or impractical. Many people directly affected by wolf depredations on domestic animals, especially pets that are killed in their yards, express concern for human safety and insist upon the removal of wolves from their property when they cause damage. Wolves that have become habituated to humans are unpredictable and may attack people or pets (Section 1.4.3, Linnell et al. 2002, McNay 2002). In many situations where wolves may pose a risk to health and safety, management of human behavior and nonlethal techniques may be sufficient to resolve the problem; however, in some situations, removal of the problem individual may be the most appropriate solution (WGFC 2011). Perceived threats to human safety from wolves would continue to receive a high priority response from WGFD and/or WS under this Alternative.

4.3.1.4 Humaneness and animal welfare aspects of the methods to be used

This alternative includes the use of lethal and nonlethal methods for PDM. Individual perspectives on what is and is not humane vary. Many individuals consider lethal methods to generally be less humane that nonlethal methods and methods such as traps and snares which capture and hold animals until the WS specialist arrives to be the least humane. Methods which pose a risks of capturing nontarget species or any risk of adverse impact on pets, even if low, may be considered inhumane and unacceptable by some individuals. Conversely, some individuals with domestic animals that have been injured, threatened or killed by wolves may see this alternative as being more humane because it has the greatest probability of promptly reducing the risk of continued killing or injury of their livestock and pets by wolves.

WS personnel are experienced and professional in their use of wolf conflict management methods. WS gives preference to nonlethal methods where practical and effective, however, most nonlethal methods are best implemented by the landowner/manager or permittee (e.g., use of livestock guarding animals, herders, fencing, and other animal husbandry practices), and WS involvement in these methods is limited to technical assistance on their safe and effective use. WS uses foothold traps that comply with Best Management Practices (BMPs) established by the Association of Fish and Wildlife Agencies (AFWA 2006, 2014). The BMP process scientifically evaluates the traps and trapping systems used for capturing furbearers in the United States. Evaluations are based on animal welfare, efficiency, selectivity, practicality and safety. Results of this research are provided as information to state and federal wildlife agencies and trappers. BMPs are intended to inform people about traps and trapping systems considered to be state of the art in animal welfare and efficiency.

Under this alternative, wolves would be killed by experienced WS personnel using the best and most appropriate method(s) available. WDM methods viewed by some persons as inhumane would be employed by WS under this alternative. These methods could include shooting, trapping, snares and aerial shooting. Over the period of 2005-2014 shooting (average 91% of annual take range 2-25%) was preferentially used by WS specialists when lethal methods were needed to address conflict problems. Snares were

not used for WDM during this period. Despite SOPs and state trapping regulations designed to maximize humaneness, the perceived stress and trauma associated with being held in a trap or snare until the WS employee arrives at the capture site to dispatch or release the animal, is unacceptable to some persons. Shooting generally results in a faster, more humane death, and is selective for target species, but is also considered unacceptable and inhumane by some individuals.

Although trapping is not the method most commonly used for lethal removal of wolves, it is the primary method used to live-capture wolves. Some individuals may prefer that methods such as cage traps be used to capture wolves and would perceive this method as being more humane than foot-hold traps and snares. Unfortunately, the use of cage traps to capture wolves is both impractical and ineffective because it is extremely difficult to get a cage trap large enough for an adult wolf into remote locations, and because it would be highly unlikely to capture an animal as wary as an adult wolf in a cage trap.

WS continues to work to improve the selectivity and humaneness of management techniques through research and development. Research is continuing to bring new findings and products into practical use. For example, the NWRC is currently conducting a study evaluating new breeds of livestock guarding dogs for their suitability in reducing predation by wolves and other large predators. However, until new findings and products are found practical, a certain amount of animal suffering could occur when some MDM methods are used in situations where non-lethal damage management methods are not practical or effective.

4.3.1.5 Impacts to stakeholder, including aesthetics of wildlife

Social and recreational concerns are discussed in USFWS (1994), 71 FR 43410, 73 FR 10514, 76 FR 61782, the Wyoming Gray Wolf Management Plan (WGFC 2011), and relevant portions have been referenced as appropriate. Public reaction would be variable and mixed because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to reduce conflicts/problems between humans and wolves. The impacts of this alternative to stakeholders would primarily depend on their values towards wolves and their relationship to the damage problem. This alternative would likely be favored by property owners who are experiencing damage because this alternative has a likelihood of successfully resolving wolf conflicts, but others may be dismayed with this alternative if wolves were lethally removed to resolve their damage problem. Individuals not directly affected by the threats or damage may be supportive, neutral, or totally opposed to any removal of wolves from specific locations or sites. Some individuals would strongly oppose this alternative because they believe it is morally wrong to kill or use animals for any reason or they believe the benefits from wolves outweigh the associated damage. Individuals totally opposed to lethal wolf conflict management methods want agencies to emphasize tolerance for wolf damage and threats to public and pet health or safety.

As discussed in Sections 1.5.1, 1.5.2 and 2.3.5, wolves have high non-consumptive (*i.e.,* viewing, hearing, photographing) and indirect (*e.g*., spiritual and existence) values for many people. The ability to view and aesthetically enjoy wolves at a particular site could be temporarily limited if these wolves are removed. New animals would most likely reoccupy the site in the future if suitable habitat exists, although the length of time until new wolves arrive is variable, depending on habitat features, time of year, and the population density of wolves in the vicinity. Given the relatively healthy number of

wolves and wolf packs in Wyoming (Jimenez et al. 2011, 76 FR 61782), and given that this action will not jeopardize the viability of the wolf population, other opportunities to view, hear, and aesthetically enjoy wolves will continue to be available to the public. WDM would not be conducted in Yellowstone National Park, one of the primary areas where the public can go to view wolves, except in the exceedingly rare instance of a demonstrable threat to human safety that cannot be adequately resolved using other methods and only at the request of YNP authorities. The likelihood of getting to see wolves will probably be greatest for people who have knowledge of wolf behavior and habits and make the effort to visit sites with adequate habitat outside of conflict management areas. People interested in seeing or hearing wolves could contact their local USFWS or WGFD office to inquire about the best opportunities.

The IWDM approach, which includes nonlethal and lethal methods as appropriate, provides relief from threats/attacks on livestock, pets and potentially even people who would have no relief from such damage or threats if nonlethal methods were ineffective or impractical.

4.3.1.6 Effects on non-target species populations, including State and Federally listed Threatened or Endangered (T&E) species and ecosystems.

Concerns about potential risks to non-target species and ecosystems from the proposed action include concerns that the proposed action may have direct adverse cumulative impacts on wildlife populations through disturbance, injury or death of non-target animals including T&E species. There are also concerns that removals of individual wolves or wolf packs for damage management may have indirect adverse impacts on non-target species and ecosystem function (i.e., the proposed action may have disruptive impacts on trophic cascades) and biodiversity. Wolves are apex predators with the potential to impact prey species population size and distribution (Section 1.5.3). Prey species, in turn, may impact vegetation community composition and structure. There is concern that the magnitude and duration of wolf removals would be of sufficient magnitude and duration that the proposed action would indirectly result in loss of ecosystem benefits from wolves and decreased biodiversity.

Direct Impacts on Non-target Species Populations

The species at greatest risks of incidental take during WDM actions are coyotes, this species is abundant in Wyoming, and they occur at varying levels in many of the same areas where wolves occur. Coyotes are the only species for which the annual average unintentional mortality as a result of WDM actions was more than one individual per year over the period of FY 2006-2013 (Table 4-2). This species is attracted to the same types of baits and lures used to attract wolves to trap sets, and most unintentional take of coyotes occurs when trapping wolves. The use of pan-tension devices on foothold traps set for wolves helps reduce the number of unintentional captures, but does not eliminate all such captures. Some of the unintentionally captured coyotes taken during wolf trapping efforts are released, but in other cases, they are euthanized because they present potential predation threats to other resources in the area, particularly on sheep range.

Wyoming's coyote population has been conservatively estimated at 49,854+22,718 (Gese and Terletzky 2009). A population model developed by Pitt et al. (2001) assessed the impact of removing a set proportion of the coyote population in one year and then allowing the population to recover (referred to as pulse removal). In the model, all

populations recovered within 1 year when up to 60% of a population was removed. Recovery occurred within 5 years when 60-90% of the population was removed. Pitt et al. (2001, 2003) also evaluated the impact of removing a set proportion of the population every year for 50 years (sustained removal). When the removal rate was <60% of the population, the population size was the same as for an unexploited population although a shift in population structure was noted. For example, the population with 50% removal had fewer transient animals, a younger age structure, and higher reproduction. Sustained removal rates of >70% of the population resulted in removal of the entire population after 7 years, but the authors acknowledged that annual removal of 70% of the population would become increasingly difficult at low densities. The model did not take into consideration immigration of coyotes from surrounding areas. Immigration of non-territorial individuals from surrounding areas would enable natural populations to withstand greater levels of harvest than indicated by Pitt et al. (2001). The findings of Pitt et al. (2001) are consistent with an earlier model developed by Connolly and Longhurst (1975), and revisited by Connolly (1995) that indicated coyote populations could withstand an annual removal of up to 70% of their numbers and still maintain a viable population. The total statewide average annual take of coyotes (intentional for damage management and unintentional) by WS during the 6-year federal fiscal year period 2007-2011 and 2013 is 9,678 individuals, or 19.4% of the estimated statewide population, well below the sustainable harvest level (Table 4-1). The state of Wyoming does not collect data on harvest of coyotes by the public. Given that direct impacts of the proposed action and all other WS actions are well below the levels which may be sustained by the coyote population and that the coyote population in Wyoming has persisted throughout historic periods of greater WS and public take of coyotes, the proposed action would not have an adverse individual or cumulative impact on the coyote population.

With the exception of grizzly bears (discussed below), populations of the other species which have been taken by WS (lethal or nonlethal) are sufficiently healthy that the state permits harvest of these species. The removal of an annual average of one individual per year is not of sufficient magnitude to have an adverse direct or cumulative impact on these species.

Threatened and Endangered Species: The Wyoming WS program has consulted with the USFWS regarding the potential impacts of all Wyoming WS activities on T&E species in the state including the current and proposed WDM program (Letter to R. Krischke, WS from R. Mark Sattelbert, USFWS February 6, 2015 and March 10, 2015 Biological Opinion). WS has determined that program activities will have no effect on piping plover (*Charadrius melodus*), interior least tern (*Sterna antillarum*), whooping crane (*grus americana*), Kendall Warm Springs dace (*Rhinichthys osculus thermalis*), pallid sturgeon (*Scaphirrynchus albus*), bonytail (*Gila elegans*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), Colorado pikeminnow (*Ptychocheilus lucius*), Wyoming toad (*Bufo baxteri*), Colorado butterfly plant (*Gaura neomexicana* spp. *coloradensis*), blowout pensemon (*Penstemon haydenii*), Ute ladies'-tresses (*Spiranthes diluvialis*), desert yellowhead (*Yermo xanthocephalus*) and western prairie fringed orchid (*Platanthera praeclara*) because the proposed action would not be conducted in habitats where these species occur, because the proposed action will not result in take of these species or alteration of their habitats, or because of established SOPs and conservation measures (Letter from R. Krischke, WS from R. Mark Sattelberg, USFWS January 28, 2015.

The USFWS concurred with WS' determination that state program activities may affect but were unlikely to adversely affect Preble's meadow jumping mouse (*Zapus hudsonius preblei*), and yellow-billed cuckoo (*Cocyzus americanus*). The USFWS also issued concurred with WS' conference determination that Wyoming WS' activities were not likely to adversely affect black-footed ferrets (*Mustela nigripes*) and northern long-eared bat (*Myotis septentrionalis*). Although some types of wildlife damage management activities conducted by the Wyoming WS program may affect but are unlikely to adversely affect Preble's meadow jumping mouse, black-footed ferrets and northern long-eared bats, the proposed WDM activities are anticipated to have no effect on these species. WS conducts minimal WDM activities in cuckoo habitat. Wyoming WS aerial operations (shooting, telemetry/surveillance and hazing), ground shooting, and propane exploders/ pyrotechnic devices could potentially disturb the cuckoo. To reduce potential disturbances, Wyoming WS would minimize activities such as shooting, and use of frightening devices in known occupied cuckoo breeding/nesting habitat (through consultation with USFWS) from late-April through late September, the time when they could be in Wyoming. If cuckoos are observed by WS during the normal course of duties in areas outside breeding habitat, during the breeding season, the use or recommendation of frightening devices would be discontinued unless the risk to cuckoos or human health and safety is greater (i.e., at airports).

Through consultation with the USFWS, WS determined that the grizzly bear and the Canada lynx might potentially be affected by WS wolf damage management activities. The USFWS has concurred that WS "wolf damage management methods are not likely to adversely affect grizzly bears in Wyoming (USDI 2015), and are not likely to jeopardize the continued existence of Canada lynx (USDI 2007).

The USFWS determination regarding grizzly bear was based, in part, on the following considerations"

- The location and habitat of most operations will occur outside of occupied grizzly bear habitat. The majority of occupied grizzly bear habitat in Wyoming occurs on Federal lands while most Wyoming WS predator damage management activities occur primarily on private lands.

- Based on 20 years of data from Wyoming, Montana, and Idaho, Wyoming WS has incidentally captured seven grizzly bears using the control methods proposed for wolf damage management and Montana WS incidentally captured one grizzly bear. As a result, the potential to capture and/or injure grizzly bears using the proposed control methods has been reduced. The potential for captures that result in mortality has also been reduced.

- Of the seven incidental captures in Wyoming, only one incident resulted in a grizzly bear mortality (incidental capture in a neck snare). Five were released unharmed and one escaped on its own. Under current management policy, Wyoming WS does not utilize neck snares set for mountain lions, black bears, or gray wolves, with or without stops, within occupied grizzly bear habitat between March 1 and December I unless specifically authorized.

- WS will implement several conservation measures that will reduce the likelihood of adversely affecting grizzly bears (WS 2014). These measures include:

  - WS will assist the USFWS and WGFD with grizzly bear recovery by maintaining interagency coordination and communication, reporting grizzly bear sightings, assisting with grizzly bear damage management, and assisting with research projects related to grizzly bear conservation and recovery;
  - WS personnel will be trained in the identification of grizzly bears (particularly in distinguishing between black bears and grizzly bears) and grizzly bear sign, training will be conducted by
  - WS in collaboration with the local USFWS or WGFD offices and by attending annual bear handling workshops organized by the USFV/S and WGFD; and
  - WS personnel will carefully consider the possibility of the presence of grizzly bears before conducting any predator damage management activities within or adjacent to occupied grizzly bear habitat and if there are foreseeable conflicts with grizzly bears, WS will adjust their operations accordingly to minimize the chances of adversely affecting grizzly bears.

- If grizzly bear sign occurs in the area WS will attempt to set wolf traps away from livestock carcasses to reduce the likelihood of capturing a grizzly bear: if grizzly bears are in the area, APHIS-WS would utilize scents at trap sites that are less attractive to grizzly bears, such as wolf urine/scat and wolf traps would be staked solidly with an appropriate drag attached to the trap.

Based on the above information and a review of the last 10 years data that 5 grizzly bears might be unintentionally captured by Wyoming WS (all Wyoming WS damage management actions combined including WDM). Of the 5 captures, no more than 2 are expected to result in the death of the bear. The USFWS has determined that this level of mortality will not result in jeopardy to the grizzly bear population (USDI 2015).

The majority of WS wildlife damage management actions in Wyoming occur below 7,000 feet in open grazing areas, mountain valleys, prairies, high desert and sagebrush habitats that are not generally preferred by Canada lynx, although dispersing lynx may move through these areas. There have been no instances of unintentional capture, injury or death of a Canada lynx in the last 30 years of the Wyoming WS program. Conservation measures and terms and conditions used by WS to reduce risks to Lynx in addition to WS SOPs include:

- All WS personnel will be trained in the identification of Canada lynx and lynx sign. Recent maps of lynx locations obtained from the USFWS will be used in training;
- All sightings of Canada lynx will be reported to the USFWS as soon as possible;
- Coordinate wildlife damage management activities on U.S. Forest Service lands and Bureau of Land Management lands during work plan meetings to share information about lynx observations or issues that may affect WS activities.
- If lynx or lynx sign are observed, restrict coyote and bobcat control actions in the area and contact the Service within one working day of observation, or as soon as possible thereafter to discuss additional management options. Restrictions are as follows:

  - Disallow use of fish oil and anise oil attractants, fresh meat and visual attractants of the type that entice felids in coyote sets where lynx or lynx sign are observed. For purposes of this BO, visual attractants are of the type expected to attract lynx such as feathers, shiny metal or fabric that are suspended in the air and have movement with the wind.
  - Disallow use of M-44s where lynx or lynx sign are observed.
- Restrict wildlife damage management actions in suitable lynx habitat. Suitable lynx habitat in Wyoming is identified as subalpine forests dominated by subalpine fir and Engelmann spruce, and the upper montane forests of mesic lodgepole pine, including mixed stands of pine, aspen and spruce. In Wyoming, the subalpine and upper montane forest zones, are typically 8,000 to 12,000 feet in elevation. Vegetation communities such as high elevation sagebrush and riparian and wetland shrub habitats, adjacent to subalpine and upper montane forest communities, also provide suitable lynx habitat. Dry forests, such as ponderosa pine and climax lodgepole pine are not suitable lynx habitat. (Ruediger *et al.* 2000). These restrictions are as follows:
  - Disallow use of fish oil and anise oil attractants, fresh meat and visual attractants of the type that entice felids in coyote sets within suitable lynx habitat.
  - Disallow use of M-44s in suitable lynx habitat.
  - Only use foot-hold traps and foot snares for mountain lions, bears, and wolves that are equipped with pan tension devices set to trip at weights that will preclude capture of lighter-weight lynx.
- Positively identify the species of a target animal, prior to implementing any lethal management action involving shooting or aerial hunting and actions conducted at den sites.
- When using neck snares to capture mountain lions and bears ensure that the cable loop is large enough to preclude capture of lynx (12 inches or greater).
- 10. M-44s sets will not be baited with fish oil or anise oil attractants, fresh meat or visual attractants statewide.
- Immediately call tracking dogs off lynx trails and harness them.
- Immediately release any lynx incidentally trapped, captured or inadvertently treed, and notify the Service as soon as possible. If a lynx has been injured and cannot be rehabilitated or safely released, it may be euthanized by WS at the capture site. Any such euthanasia will be considered a take under the incidental take statement. WS will use humane measure to euthanize the injured animal and will contact the Service as soon as possible regarding the incident.

Based on the above information and information presented in the WS Biological Assessment and USFWS BO the USFWS that the proposed action would not result in the death of more than 2 Canada lynx and that this level of take would not jeopardize the Canada lynx population (USFWS 2007, verified in letter to R. Krischke, WS from M. Sattelberg, USFWS November 14, 2014).

In addition to consultation with the USFWS regarding impacts on threatened and endangered species, WS also works with land management agencies and tribes to address concerns about potential risks to species of special concern to the agency or tribe. These concerns and applicable risk minimization measures are generally addressed during annual work plan meetings.

Table 4-2. Direct impacts on species unintentionally taken by Wyoming WS during wolf damage and conflict management operations (lethal and non-lethal), MIS FY 2006 –FY 2013.

	Estimated Statewide Population[3]	6-Year Total WS Unintentional Take[2] (Euthanize)	6-Year Total WS Unintentional Take[2] (Released)	Hunter Harvest	WS Unintentional Take as % of Population (Euthanized)	WS Unintentional Take as % of Hunter Harvest[4] (Euthanized)
Coyote	49,854 ± 22,718[1]	3	5	Data not available	>0.01%	Data not available
Red Fox	Data not available	0	1	Data not available	Data not available	Data not available
Grizzly Bear	712	0	3	NA	NA	NA
Black Bear	Data not available	1	3	374	Data not available	>0.01%
Badger	Data not available	0	1	1,224	Data not available	>0.01%
Bobcat	Data not available	1	3	2,137	Data not available	>0.01%
Mule Deer	426,000	1	4	34,045	>0.01%	>0.01%
White-Tailed Deer	57,571	1	1	14,872	>0.01%	>0.01%
Pronghorn	484,000	0	3	53,675	0%	0%
Mountain Lion	Data not available	0	1	253	Data not available	0%

[1] Based on information provided in Gese and Terletzky 2009
[2] Includes 6-year total number of animals taken by WS through WDM activities by FY (MIS FY 2006-2013).
[3] Cumulative take impacts are the effects on the 6-year annual average population provided by WGFD of a species from all known causes.
[4] Cumulative take impacts are the effects on the 6 year annual average hunter harvest provided by WGFD Annual Tables.

Risks Associated with the Use of Aircraft: Wildlife Services uses low-level fixed-wing aircraft and minimal use of helicopters to manage damage by other predators throughout much of Wyoming. Wildlife Services may also use aerial hunting to remove wolves. Fixed-wing aircraft are the primary tool used for aerial hunting in Wyoming, but a limited use of helicopters is employed in locations where the terrain is rough, heavily wooded, or mountainous. Wyoming WS aerial hunting operations occur in relatively remote rangeland areas where tree cover is, at most, scattered to allow for visibility of target animals from the air. Requests for aerial hunting in Wyoming are fairly constant, especially during the months from March to September. In addition, Wyoming WS spends relatively little time over any one area. Disturbance associated with WS use of aircraft in Wyoming does not reach the level which would constitute chronic exposure.

A concern is sometimes expressed that aerial hunting might disturb other wildlife species populations and wild horses and burros to the point that their survival and reproduction could be adversely affected. Deer, wild horses, pronghorn antelope, and other wildlife are occasionally seen during aerial hunting operations. However, WS avoids horses and wildlife seen during aerial operations and presents little disturbance to them. Particular effort is made to avoid non-target animals displaying any signs of aversion to the aircraft. The U.S. Department of the Interior, Bureau of Land Management (BLM) Annual Work Plans specify that WS personnel in "hot pursuit" of a target animal by aircraft may pursue it into a NO PLANNED CONTROL AREA unless an obvious conflict will occur

- High Desert District BLM Work Plan: WS personnel in hot pursuit of a target animal by aircraft may pursue it into a No Planned Control Area or a Restricted Control Area unless an obvious conflict will occur, such as approaching a dwelling or flying over a concentration of wintering elk, mule deer, or antelope. When coyotes are moving into Planned Control Areas from adjacent No Planned Control Areas, WS may conduct control on a case-by-case basis after coordination with the appropriate Field Manager (Pinedale, Kemmerer, Rawlins, or Rock Springs).

- High Plains District BLM Work Plan: WS personnel in "hot pursuit" of a target animal by aircraft may pursue it into a No Planned Control Area or a Restricted Control Area unless an obvious conflict will occur, such as approaching a dwelling or flying over a concentration of wintering elk, mule deer, or antelope or game animal parturition areas during reproductive periods.

- Wind River/Bighorn Basin District (Northwest) BLM Work Plan: WS personnel in "hot pursuit" of a target animal by aircraft may pursue it into a No Planned Control Area or a Restricted Control Area unless an obvious conflict will occur, such as approaching a dwelling or flying over a concentration of wintering elk, mule deer, or antelope or game animal parturition areas during reproductive periods. Wild horse herd areas would also be avoided when horses are located in or near flight paths and during foaling periods (March 1 to July 31).

Waterbirds and Waterfowl: Low-level overflights of two to three minutes in duration by a fixed-wing airplane and a helicopter produced no drastic disturbance of tree-nesting colonial waterbirds, and, in 90% of the observations, the individual birds either showed no reaction or merely looked up (Kushlan 1979). Belanger and Bedard (1989, 1990) observed responses of greater snow geese (*Chen caerulescens atlantica*) to man-induced disturbance on a sanctuary area and estimated the energetic cost of such disturbance. Belanger and Bedard (1989, 1990) observed that disturbance rates exceeding two per hour reduced goose use of the sanctuary by 50% the following day. They also observed that about 40% of the disturbances caused interruptions in feeding that would require an estimated 32% increase in nighttime feeding to compensate for the energy lost. They concluded that overflights of sanctuary areas should be strictly regulated to avoid adverse effects. Conomy et al. (1998) quantified behavioral responses of wintering American black ducks (*Anas rubripes*), American wigeon (*A. americana*), gadwall (*A. strepera*), and American green-winged teal (*A. crecca carolinensis*) exposed to low-level military aircraft and found that only a small percentage (2%) of the birds reacted to the disturbance. They concluded that such disturbance was not adversely affecting the

time/activity budget[20] of the species. Aerial operations conducted by APHIS-WS would not be conducted over Federal, State, or other governmental agency property without the concurrence of the managing entity and would be coordinated to minimize potential for any adverse effects on waterbirds and waterfowl.

Raptors: The Air National Guard (1997) analyzed and summarized the effects of overflight studies conducted by numerous Federal and State government agencies and private organizations. Those studies determined that military aircraft noise initially startled raptors, but negative responses were brief and did not have an observed effect on productivity (Air National Guard 1997). A study conducted on the impacts of overflights to bald eagles suggested that the eagles were not sensitive to this type of disturbance (Fraser et al. 1985). During the study, observations were made of more than 850 overflights of active eagle nests. Only two eagles rose out of either their incubation or brooding postures. This study also showed that perched adults were flushed only 10% of the time during aircraft overflights. Evidence also suggests that golden eagles are not highly sensitive to noise or other aircraft disturbances (Ellis 1981, Holthuijzen et al. 1990). Finally, one other study found that eagles were particularly resistant to being flushed from their nests (see Awbrey and Bowles 1990 as cited in Air National Guard (1997)). Therefore, there is considerable evidence that eagles would not be adversely affected by overflights during aerial operations.

Mexican spotted owls (*Strix occidentalis lucida*) (Delaney et al. 1999) did not flush when chain saws and helicopters were greater than 110 yards away; owls flushed to these disturbances at closer distances and were more prone to flush from chain saws than helicopters. Owls returned to their pre-disturbance behavior 10 to 15 minutes following the event and researchers observed no differences in nest or nestling success (Delaney et al. 1999), which indicates that aircraft flights did not result in adverse effects on owl reproduction or survival.

Andersen et al. (1989) conducted low-level helicopter overflights directly at 35 red-tailed hawk (*Buteo jamaicensis*) nests and concluded their observations supported the hypothesis that red-tailed hawks habituate to low level flights during the nesting period; results showed similar nesting success between hawks subjected to overflights and those that were not. White and Thurow (1985) did not evaluate the effects of aircraft overflights, but found that ferruginous hawks (*B. regalis*) were sensitive to certain types of ground-based human disturbance to the point that reproductive success may be adversely affected. However, military jets that flew low over the study area during training exercises did not appear to bother the hawks, nor did the hawks become alarmed when the researchers flew within 100 feet in a small fixed-wing aircraft (White and Thurow 1985). White and Sherrod (1973) suggested that disturbance of raptors by aerial surveys with helicopters may be less than that caused by approaching nests on foot. Ellis (1981) reported that five species of hawks, two falcons (*Falco* spp.), and golden eagles (*Aquila chrysaetos*) were "incredibly tolerant" of overflights by military fighter jets, and observed that, although birds frequently exhibited alarm, negative responses were brief and the overflights never limited productivity.

Grubb et al. (2010) evaluated golden eagle response to civilian and military (Apache AH-64) helicopter flights in northern Utah. Study results indicated that golden eagles were

[20] An animal's activity budget is how it divides its time between activities (e.g. foraging, incubating eggs, building shelter, etc) daily or seasonally.

not adversely affected when exposed to flights ranging from 100 to 800 meters along, towards, and from behind occupied cliff nests. Eagle courtship, nesting, and fledglings were not adversely affected, indicating that no special management restrictions were required in the study location.

The above studies indicate raptors were relatively unaffected by aircraft overflights, including those by military aircraft that produce much higher noise levels. Therefore, we conclude that aerial operations would have little or no potential to adversely affect raptors.

Passerines (e.g. songbirds): Reproductive losses have been reported in one study of small territorial passerines ("perching" birds that included sparrows and blackbirds) after exposure to low altitude overflights (see Manci et al. 1988 as cited in Air National Guard (1997)), but natural mortality rates of both adults and young are high and variable for most of those species. The research review indicated passerine birds cannot be driven any great distance from a favored food source by a non-specific disturbance, such as military aircraft noise, which indicated quieter noise would have even less effect. Passerines avoid intermittent or unpredictable sources of disturbance more than predictable ones, but return rapidly to feed or roost once the disturbance ceases (Gladwin et al. 1988, United States Forest Service 1992). Those studies and reviews indicated there was little or no potential for aerial operations to cause adverse effects on passerine bird species.

Pronghorn (antelope) and Mule Deer: Krausman et al. (2004) found that Sonoran pronghorn (*Antilocapra americana sonoriensis*) were not adversely affected by military fighter jet training flights and other military activity on an area of frequent and intensive military flight training operations. Krausman et al. (1986) reported that only three of 70 observed responses of mule deer (*Odocoileus hemionus*) to small fixed-wing aircraft overflights at 150 to 500 feet Above Ground Level (AGL) resulted in the deer changing habitats. The authors believed that the deer might have been accustomed to overflights because the study area was near an interstate highway that was followed frequently by aircraft. Krausman et al. (2004) also reported that pronghorn and mule deer do not hear noise from military aircraft as well as humans, which potentially indicates why they appeared not to be disturbed as much as previously thought.

Mountain Sheep: Krausman and Hervert (1983) reported that, of 32 observations of the response of mountain sheep to low-level flights by small fixed-wing aircraft, 60% resulted in no disturbance, 81% in no or "slight" disturbance, and 19% in "great" disturbance. Krausman and Hervert (1983) concluded that flights less than 150 feet AGL could cause mountain sheep to leave an area. Another study (Krausman et al. 1998) found that 14% of bighorn sheep had elevated heart rates that lasted up to 2 minutes after an F-16 flew over at an elevation of 400 feet, but it did not alter the behavior of the penned bighorns. When Weisenberger et al. (1996) evaluated the effects of simulated low altitude jet aircraft noise on desert mule deer (*Odocoileus hemionus crooki*) and mountain sheep (*Ovis canadensis mexicana*), they found that heart rates of the ungulates increased according to the decibel (dB) levels, with lower noise levels prompting lesser increases. When they were elevated, heart rates rapidly returned to pre-disturbance levels suggesting that the animals did not perceive the noise as a threat. Responses to the simulated noise levels were found to decrease with increased exposure.

Bison: Fancy (1982) reported that only two of 59 bison (*Bison bison*) groups showed any visible reaction to small fixed-winged aircraft flying at 200 to 500 feet AGL. The study suggests that bison were relatively tolerant of aircraft overflights.

Domestic Animals and Small Mammals: A number of studies with laboratory animals (*e.g.*, rodents (Borg 1979)) and domestic animals (*e.g.*, sheep (Ames and Arehart 1972)) have shown that these animals can become habituated to noise. Long-term lab studies of small mammals exposed intermittently to high levels of noise demonstrate no changes in longevity. The physiological "fight or flight" response, while marked, does not appear to have any long-term health consequences on small mammals (Air National Guard 1997). Small mammals habituate, although with difficulty, to sound levels greater than 100 db (United States Forest Service 1992).

Although many of the wildlife species discussed above are not present in all areas where FSDM occurs, the information was provided to demonstrate the relative tolerance most wildlife species have of overflights, even those that involve noise at high decibels, such as from military aircraft. In general, the greatest potential for impacts to occur would be expected to exist when overflights were frequent, such as hourly and over many days that could represent "chronic" exposure. Chronic exposure situations generally involve areas near commercial airports and military flight training facilities. Even then, many wildlife species become habituated to overflights, which appear to naturally minimize any potential adverse effects where such flights occur on a regular basis.

APHIS-WS would generally only conduct overflights on a relatively small percentage of the land area of the State or Territory involved in WDM, which indicates that most wildlife would not be exposed to overflights. Additionally, such flights would occur infrequently throughout the year which would further lessen the potential for any adverse effects. Military aircraft produce much louder noise and are flown over certain training areas many more times per year, and yet, were found to have no expected adverse effects on wildlife (Air National Guard 1997). Therefore, it is reasonable to conclude that the aircraft used to shoot feral swine should have far less potential to cause any disturbance to wildlife than military aircraft.

***Eagles*:** Under the Bald and Golden Eagle Act, activities that could result in the "*take*" of Bald Eagles cannot occur unless the United States Fish and Wildlife Service allow those activities to occur through the issuance of a permit. Both purposeful take and non-purposeful take require a permit from the United States Fish and Wildlife Service (see 50 CFR 22.26, 50 CFR 22.27). In those cases where purposeful take could occur or where there is a high likelihood of non-purposeful take occurring, WS would apply for a permit for those activities. The primary risk to eagles from WS WDM activities is the risk of unintentional take of an eagle in a trap or snare set to capture a wolf.

WS SOPs include specific measures to reduce the risk of unintentional capture of an eagle. To date, no eagles have been captured by the Wyoming WS program during WDM activities, although there has been unintentional take of eagles using traps and snares for other types of predator control. Wyoming WS is currently working with the USFWS on a permit for non-purposeful take of eagles during predator damage management activities. In the interim, WS continues to implement protective measures established for eagles in consultation with the USFWS while eagles were federally protected as a threatened species. These measures include: use of pan-tension devices, and placing traps no less than 30 feet from any above ground bait sets. Additionally,

Wyoming WS has added state specific guidance after review of past incidents of unintentional eagle take associated with management of species other than wolves. Typically eagles face and move into the wind or sit in an elevated position facing the wind, watching for potential prey or for the activity of other animals indicating the location of potential food. When scavenging carcasses, they most often land close to the food or fly past it to check it out ahead of circling back downwind and coming back up to land on or near it. Most of the time they don't blindly fly in, their approach will be to come into the wind and land downwind of the food. The distance can be anywhere from several feet to a hundred yards from the food if they are shy about confronting another eagle or other scavengers (e.g., coyotes). Because the typical eagle approaches from downwind of the food anything previously taken out of a snare should be disposed of downwind and crosswind of the trap or snare set, so the set will not be between it and any food, or food scraps. Keeping carcasses downwind keeps the food between the eagle and the set. Eagles take off into the wind, and an eagle with a scrap of food may very well fly straight into the wind and land on a fence post or other object, right above or near the very device that caught the original food. Offsetting the carcass reduces the risk that an eagle will drop food on or near a trap.

Based on the above measures, and WS record of not capturing eagles during WDM activities, risks of inadvertently capturing and injuring or killing and eagle during WDM are very low.

"Disturb" has been defined under 50 CFR 22.3for purposes of implementing the Act as those actions that cause or are likely to cause injury to an eagle, a decrease in productivity, or nest abandonment by substantially interfering with their normal breeding, feeding, or sheltering behavior. WS has reviewed those methods available under the proposed action alternative and the use patterns of those methods. The routine measures that WS conducts would not meet the definition of disturb requiring a permit for the non-purposeful take of eagles. The USFWS states, *"Eagles are unlikely to be disturbed by routine use of roads, homes, or other facilities where such use was present before an eagle pair nesting in a given area. For instance, if eagles build a nest near your existing home, cabin, or place of business you do not need a permit."* (USFWS 2012*b*). Therefore, activities that are species specific and are not of a duration and intensity that would result in disturbance as defined by the Act would not result in non-purposeful take. Activities, such as walking to a site, discharging a firearm, or riding an ATV along a trail, generally represent short-term disturbances to sites where those activities take place. Data presented above indicate that eagles would not be adversely affected by overflights during aerial operations. WS would conduct activities that were located near eagle nests using the National Bald Eagle Management Guidelines (USFWS 2007). The categories that would encompass most of these activities are Category D (Off-road vehicle use), Category F (Non-motorized recreation and human entry), and Category H (Blasting and other loud, intermittent noises). These categories generally call for a buffer of 330 to 660 feet for category D and F, and a ½-mile buffer for category H. WS would take active measures to avoid disturbance of eagle nests by following the National Bald Eagle Management Guidelines. However, other routine activities conducted by WS do not meet the definition of "*disturb*" as defined under 50 CFR 22.3. Those methods and activities would not cause injuries to eagles and would not substantially interfere with the normal breeding, feeding, or sheltering behavior of eagles.

Indirect Impacts

Impact on Biodiversity and trophic cascades:

Indirect Impacts on Grizzly bears: Concerns have been expressed by the public that wolf removals could result in a reduction in the amount of wolf-killed carrion available to grizzly bears, and this carrion may be increasingly important to grizzly bears if global warming contributes to a reduction in other important grizzly bear foods.

Initial discussions with the USFWS on this issue suggest there is little likelihood of any significant indirect effect, based on the limited numbers of wolves removed in grizzly bear range in Wyoming. According to WS MIS data, since the first reintroductions in 1995, Wyoming WS has removed 496 wolves in response to livestock depredations. The GYA grizzly bear population has actually been increasing during the time that wolf removals have occurred, which suggests these removals are not limiting grizzly bear recovery. The majority of Wyoming wolf depredations occur outside of occupied grizzly habitat, so there is likely little, if any, effect on grizzly bear survival related to WS wolf damage management operations.

Due to the low reproductive rate of the grizzly bear (Schwartz et al. 2003) and its status as a threatened species (USFWS 1993), the effects of wolves on carrion availability and cub survival was an important consideration for wolf reintroduction and grizzly bear conservation efforts. Grizzly bears now occupy 37,258 km^2 (Schwartz et al. 2006), 60% more of the GYA than when they were first listed. When grizzly bears in the GYA were listed in 1975, numbers ranged from 136-312 individuals. The most recent estimates (2008-2011) place the GYA grizzly population at 629 – 741[21] bears. Current data suggest that the rate of increase for the population during the last decade (0% to 2% per year) has slowed from the rate observed during the decades of the 1980s and 1990s (4% to 7 % per year), and the population is now stable to slightly increasing (Schwartz et al, 2006a, IGBST 2012). Currently, 84-90% of females with cubs occupy the Primary Conservation Area (PCA) and about 20% of females with cubs have expanded beyond the PCA within the DPS (Schwartz et al. 2006b, M. Haroldson, pers. comm., October 25, 2012). Grizzly bears now occupy 84% of the suitable habitat within the GYA DPS and may ultimately occupy the remainder of the suitable habitat. The GYA DPS now has a viable grizzly population of sufficient numbers and distribution of reproductive individuals to provide a high likelihood that the species will continue to exist and be well distributed throughout this portion of its range for the foreseeable future. The agreement between State and Federal agencies to implement the extensive Conservation Strategy and state management plans ensures that adequate regulatory mechanisms are in place to protect grizzly bears and that the GYA grizzly bear population will not become endangered (http://www.igbconline.org/html/yellowstone.html).

The potential effects of wolves on the region's grizzly bear population were evaluated by Servheen and Knight (1993) and 15 North American gray wolf and wolf-prey scientists prior to the reintroduction (Lime et al. 1994). There was consensus among the 15 panelists that in other locations, such as the Yukon, Alaska and Glacier National Park, wolves and grizzly bears generally coexist well (Lime et al. 1994). It was recognized that in areas where wolves and grizzly bears coexist, interspecific killing by both species occurs (Ballard 1980, 1982, Hayes and Baer 1992) with most agonistic interactions

[21] Reflects two methods for estimating population (USFWS 2011, Haroldson et al. 2013)

involving defense of young or competition for carcasses (Murie 1981, Ballard 1982, Hornbeck and Horejsi 1986, Hayes and Mossop 1987, Kehoe 1995, MacNulty et al. 2001). Opinions regarding the role of wolves in providing protein for grizzly bears were mixed (Lime et al. 1994). Servheen and Knight (1993) predicted that reintroduced wolves could reduce the frequency of winter-killed and disease-killed ungulates for grizzly bears to scavenge, but that grizzly bears would occasionally usurp wolf-killed ungulate carcasses. Servheen and Knight (1993) and Lime et al. (1994) hypothesized that interspecific killing and competition for carcasses would have little or no population level effect on either species. Lime et al. (1994) further added that "this is not surprising considering the historic coexistence of these animals throughout most of their range."

Grizzly bears obtained ungulate meat primarily by preying on and scavenging rut-weakened and rut-killed elk and bison in late summer and fall (Mattson 1997), by scavenging winter-killed elk and bison carcasses in spring (Green et al. 1997) and by preying on elk calves in late spring and early summer (Gunther and Renkin 1990). Female grizzly bears with reliable high-energy foods have been shown to attain larger body size and litter sizes than their counterparts with less reliable food resources. However, grizzly bears, and particularly female bears with cubs, may not be able to take advantage of the carrion during mid-winter due to hibernation. In addition, Gunther and Smith (2004) documented two incidents where wolf packs probably killed grizzly bear cubs. Although neither incident was directly observed, evidence from the carcasses and kill sites suggests that wolves killed both cubs. Both cubs were killed near the carcasses of ungulates that had attracted grizzly bears and wolves. In addition, the distances between canine puncture wounds in the hides of both cubs suggested that they were attacked by more than one animal, consistent with predation behavior by wolf packs (Mech 1970, Paradiso and Nowak 1982), but not by solitary mountain lions (Dixon 1982) or black bears (Jonkel 1978, Pelton 1982).

Foraging theory provides a context to understand and predict the amount of wolf-provisioned carrion available to scavengers. Elk carrion is an important winter food for many scavengers in YNP (Houston 1978). When gray wolves partially consume prey, they subsidize scavengers with a high calorie food. In addition, depending on weather conditions, wolves can change the timing of carrion availability from a more abundant resource at the end of severe winters to a more constant resource throughout the winter (Wilmers and Getz 2005, Wilmers and Post 2006). Carrion abundance before wolf reintroduction was primarily attributed to abiotic factors (severe winters and snow depth) (Gese et al. 1996), but is now primarily provided by wolves (Mech et al. 2001, Wilmers et al. 2003b).

Wilmers et al. (2003b) hypothesize that wolves found in the Lamar Valley of YNP would: 1) increase the abundance, 2) alter the timing, 3) decrease year-to-year variation, and 4) change the variance of carrion available to scavengers. During mild winters, Wilmers et al. (2003b) model predicts that wolves would increase the amount of carrion available to scavengers from February to March. During severe winters, wolf predation would result in a small increase in carrion overall, with a decrease in mid-winter carrion, when conditions were most severe, and a small increase in carrion at the end of winter, when conditions were milder. Wilmers et al. (2003b) also reported that as wolf pack size changes, the amount of carrion available to scavengers also changes. Initially the amount of carrion available to scavengers would increase as wolf numbers increase and kill more but would decline as wolf numbers continue to increase as wolves would consume a higher percentage of their kills. Wolf packs of intermediate size kill at a relatively high

rate but consume only part of the carcass, thereby maximizing the amount of carrion for scavengers in YNP. To the extent wolf removals through depredation control efforts might reduce larger packs to more intermediate sized packs, such wolf removals might contribute to an increase in the availability of wolf-killed carrion. But with the limited number of wolf removals that have occurred and are expected to occur in the GYA, there would likely be little, if any, effect on carrion availability to grizzly bears or other scavengers.

Impacts on Biodiversity and Trophic Cascades:

A trophic cascade is an indirect ecological effect that occurs when one trophic level is modified to an extent that it affects other trophic levels in a food chain or web. In a simple example, predators, their herbivore prey, and plants that provide food for the herbivores are three trophic levels that interact in a food chain. The presence of the predator causes reductions in the size of the prey populations or causes the prey population to alter its use of habitat which, in turn, impacts plant community composition and health. It may also refer to the impact the presence or absence of a larger predator (e.g., wolves) has on another predator (coyotes) that may have different impacts on prey populations. For example, recovery of gray wolf populations has resulted in long-term reductions in densities of coyotes. The presence of coyotes in an area has been shown to limit the density of smaller predators which may make greater use of songbirds and some rodents than coyotes (Levi and Wilmers 2012, Miller et al. 2012). Recovery of wolf populations and associated declines in coyote populations has also been documented to result in an increase in survivorship of pronghorn deer fawns (Berger et al. 2008). In the Midwest, changes in coyote activity were documented to impact white-tailed deer activity and associated impacts on plant community composition (Waser et al. 2014). However, as with most ecosystems, the nature and magnitude of these types of relationships varies. For example, Maron and Pearson (2011) did not detect evidence that the presence of vertebrate predators fundamentally affected primary production or seed survival in a grassland ecosystem.

Some individuals have expressed concern that wolf removals by WS would cause disruptions to trophic cascades by eliminating predators. However, most studies evaluating the impacts of predators on trophic cascades primarily focus on areas where predators were either absent, were intensively and continually controlled over large geographic areas, or were reintroduced after being extirpated which resulted in relatively consistent, long-term shifts in densities or behavior of other predators and prey. As discussed in this EA, WS only conducts WDM when and where it is needed. When direct management of a depredating animal(s) is needed efforts focus on management of the specific depredating animal or local group of animals. Wyoming WS would not strive to eliminate or remove wolves from any area on a long term basis, and no predators or prey would be extirpated from the state or large regions of the state as a result of WS' actions. As discussed in detail in Section 4.3.1.2, impacts are generally only temporary, and in relatively small or isolated geographic areas compared with population levels of target species.

While wolves have been federally protected as an XN population under the ESA, the wolf population in Wyoming increased despite cumulative impacts of all factors including removals for WDM. The total range of occupied wolf habitat in the state has been relatively stable for years (Section 2.2.1) although the density of packs within the range has varied. Wolves do not occupy all lands within potential wolf range and general

distribution of packs is patchy (Fig. 1-1). Wolf removals for WDM may result in reductions in pack size or removals of individual packs but these impacts are short-term and localized. In Alberta, vacant wolf territories were refilled in 1-2 years (Bjorge and Gunson 1985). Time frames for territories to become re-colonized may be longer in areas where wolf populations are small and still recovering than areas with larger recovering wolf populations and saturated habitat (Brainerd et al. 2008). As noted in Section 2.2.1, much of the suitable wolf habitat in the state has been occupied and we believe that information on recolonization in large recovering and saturated populations is applicable to the situation in Wyoming where WS conducts WDM. Therefore, while wolves are listed as an XN population, localized reductions could occur but they would not be of sufficient duration or magnitude to result in substantial shifts in ecosystem function. Based on this information, while wolves are listed as an XN population, the current program/proposed action will not adversely impact the ecological benefits of wolves in Wyoming or result in long-term large scale adverse effects on trophic cascades and biodiversity.

As discussed in Section 4.3.1.2, when wolves are delisted and under state management, wolves may be taken by entities other than WS for damage management or during licensed hunting as regulated and monitored by the WGFD. Population decreases are possible depending on state management objectives, so long as the population remains above the minimum levels required to ensure long-term population recovery established by the USFWS. Long-term population reductions, if they occur, could result in loss of ecosystem benefits in local areas where packs no longer occur. However, these impacts are not attributable to WS actions or under the control of WS or this EA and would occur with or without a WDM program conducted by WS, especially given that the majority of take and associated impacts on the population would be related to licensed harvest. As discussed in Section 4.3.1.2, due to the inter-related nature of hunting, private WDM efforts and WS actions, lethal removal of wolves by WS may decrease under this alternative. Consequently, given that, independent of other efforts, WS actions do not cause declines in the state wolf population, that WS take may decline under this scenario, and that WS actions are incorporated into the cumulative impact monitoring of the state when working to achieve their population management goals, implementation of this alternative would not have a substantial cumulative impact on the environmental status quo under this alternative.

Global Climate Change/Greenhouse Gas Emissions: The State of the Climate in 2012 report indicates that since 1976, every year has been warmer than the long-term average (Blunden and Arndt 2013). Global surface temperatures in 2012 were among the top 10 warmest years on record with the largest average temperature differences in the United States, Canada, southern Europe, western Russia, and the Russian Far East (Osborne and Lindsey, 2013). Impacts of this change will vary throughout the United States, but some areas will experience air and water temperature increases, alterations in precipitation, and increased severe weather events. The distribution and abundance of a plant or animal species is often dictated by temperature and precipitation. According to the EPA (2013), as temperatures continue to increase, the habitat ranges of many species are moving into northern latitudes and higher altitudes. Species adapted to cold climates may struggle to adjust to changing climate conditions (e.g., less snowfall, range expansions of other species).

APHIS recognizes that climate change is an ongoing concern and may result in changes in species range and abundance. Climate change is also anticipated to impact agricultural

practices. The combination of these two factors over time is likely to lead to changes in the scope and nature of wildlife-human conflicts in the state. Because these types of changes are an ongoing process, the EA has developed a dynamic system including mitigations and standard operating procedures, and built in measures which allow the agencies to monitor for and adjust to impacts of ongoing changes in the affected environment (Section 3.6). APHIS-WS will monitor activities conducted under this analysis in context of the issues analyzed in detail to determine if the need for action and associated impacts remain within parameters established and analyzed EA and will supplement the analysis and/or modify program actions in accordance with applicable local, state and federal regulations including the NEPA. Established SOPs also include reporting all take to the USFWS and WGFD annually as appropriate for review of project-specific and cumulative impacts on wildlife populations. Coordination with agencies that have management authority for the long-term wellbeing of native wildlife populations and review of available data on wildlife population sized and population trends enables the program to check for adverse cumulative impacts on wildlife populations, including actions by WS that could jeopardize the long-term viability of WS actions on wildlife populations. Monitoring will include review of federally-listed threatened and endangered species and consultation with the USFWS as appropriate to avoid adverse impacts on threatened and endangered species. As with any changes in need for action, Wyoming WS will supplement the analysis and/or modify program actions in accordance with applicable local, state and federal regulations including the NEPA as needed to address substantive changes in wildlife populations and associated impacts of the WDM program. In this way, we believe the proposed action accounts for is responsive to ongoing changes in the cumulative impacts of actions conducted in Wyoming in accordance with the NEPA.

Wyoming WS WDM actions have the potential to produce criteria pollutants (pollutants for which maximum allowable emission levels and concentrations are enforced by state agencies) while working in the office, during travel from office to field, travel in the field (vehicles or ATV), and from aircraft activities. The WS program reviewed greenhouse gas emissions for the entire national WS program (USDA 2015) including the ongoing PDM program in Montana. The analysis estimated impacts of vehicle, aircraft, office, and ATV use for FY13 and potential new vehicle purchases that could be associated with a proposed national feral swine damage management program. The review concluded that the range of Carbon Dioxide Equivalents (includes CO2, NOx CO and SOx) for the entire national program would be below the CEQ's suggested reference point of 25,000 MT/year for actions requiring detailed review of impacts on greenhouse gas emissions. The Wyoming WS program activities likely to result from the proposed action would have a negligible cumulative effect on atmospheric conditions including the global climate.

In summary, given the protective measures discussed above and in the Chapter 3 SOPs, direct, indirect and cumulative risks to non-target wildlife from the current program have been very low and are not of sufficient magnitude to have a substantive impact on non-target species populations. WS is consulting with the USFWS regarding impacts to federally-listed species. Based on available information, the current program will have no effect on or may affect but is unlikely to adversely affect the federally listed threatened, endangered, candidate and proposed species in the state with the possible exception of grizzly bear and lynx. There is a risk the current program may result in unintentional take of Canada lynx or grizzly bear, but if appropriate terms and conditions and reasonable and prudent measures established by the USFWS are

implemented, the current program will not jeopardize or have a significant impact on Canada lynx or grizzly bear populations.

4.3.2 Alternative 2 - WS Nonlethal Wolf Conflict Management Only

4.3.2.1 Ability of alternative to meet management objectives and efficacy of methods

Description of the efficacy of particular WDM methods including the nonlethal methods that WS could implement under this alternative is the same a noted in Section 4.3.1.1. Although nonlethal methods can be effective, efficacy can be short-term (e.g., frightening devices), limited to only a specific set of circumstances (e.g., fencing), or not effective in all situations. Lethal removal of wolves may be the only practical approach to resolving incidents of wolf predation on livestock (Mech 1995, Bangs et al. 2009). Under Alternative 2, WS would not use any lethal removal, and WS nonlethal efforts would not be as effective in reducing or preventing wolf predation on livestock as a fully integrated nonlethal and lethal WDM program.

As with the current program, some wolf depredation problems would be addressed through implementation of nonlethal methods. Overall use of nonlethal methods may increase due to increased WS advocacy for the methods. Given that WS already recommends and assists producers with nonlethal methods where practical and effective, the overall change in use of nonlethal methods is expected to be limited. Depending on cooperator perceptions of a nonlethal only WS program, WS recommendation of nonlethal methods could potentially decrease under this alternative. 75-80% of Wyoming WS' funding for WDM is from cooperators. If these individuals feel that they cannot get adequate assistance from WS without access to a fully integrated nonlethal and lethal program, they may transfer funds for these activities to private entities or a different state or federal agency that can provide an integrated program. If this is the case, overall funding for the Wyoming WS, and associated WS involvement in nonlethal WDM could decline substantially under this alternative which could decrease all WS involvement in WDM.

Given the limitations to the efficacy of nonlethal methods as documented for Alternative 1, livestock producers would likely seek alternative methods for implementing legally available lethal control methods in the absence of assistance with lethal methods by WS. The overall efficacy of this Alternative might depend largely on whether the USFWS or WGFD, as appropriate, were able to establish an equally prompt and effective wolf conflict management program in the absence of WS lethal management. At least in the short-term while alternative systems are established, livestock losses to wolves would likely increase under Alternative 2 because it would be difficult for livestock producers and/or the USFWS or WGFD personnel to devote the required time, resources, and expertise to adequately addressing depredation problems. Once wolves are delisted, WGFD may try to use increased hunting in chronic problem areas to reduce depredations. Use of hunting to address depredations is not as targeted as situation specific WDM actions by WS and could result in greater take of wolves and may not always be as effective as a WS program.

Analysis in Section 4.3.2.2 indicates this alternative would not jeopardize the long-term viability of the state or regional wolf population, although total take of wolves for WDM

would vary depending on the skill of the individuals conducting WDM and the extent to which livestock producers seek alternative sources of lethal WDM. Similarly risks to non-target species would vary depending on the skills and training of the individuals conducting the damage management action, but are not expected to jeopardize the long-term sustainability of non-target species populations. Once wolves are removed from the federal list of T&E species, there will likely be an increase in WDM actions conducted by private entities. Many of these entities may not consult with the USFWS regarding measures to reduce risks to T&E species in the same manner as a state or federal agency, so risks associated with their actions may be greater than for Alternative 1.

Under this alternative, lethal WDM methods would be implemented by entities other than WS. The training these individual have in the use of lethal WDM methods would be variable and may lead to increased risk of adverse environmental impacts associated with unsafe or illegal use of WDM methods. All entities are expected to comply with applicable state, federal and tribal regulations, but enforcement and coordination would be increasingly difficult if the number of entities involved in providing WDM assistance and services increases under this alternative. Similarly, as described under Alternative 1, reporting and monitoring of the impacts of WDM activities may be more difficult and limited when non-WS entities are conducting lethal WDM.

In summary, WDM activities are likely to be less effective than under Alternative 1. Overall efficacy of this alternative would be variable depending on the entities conducting legally-available lethal wolf removal and would be similar to or less effective than an integrated nonlethal and lethal program conducted by WS under Alternative 1. Ability of this alternative to achieve the remaining management objectives would be more uncertain and more difficult under this Alternative than Alternative 2 but better than for Alternative 3.

4.3.2.2 Effects on the wolf population in Wyoming

Under this Alternative, WS would not conduct any lethal wolf conflict management and would have no impact on the wolf population in Wyoming. While federal protected under the ESA, USFWS rules allow all Wyoming landowners and livestock producers to haze, harass or kill a wolf that is molesting or attacking livestock or domestic animals on public or private land, with the provision that all such incidents must be reported to USFWS within 24 hours. Once delisted, Wyoming Game and Fish Statutes require reports be made to WGFD within 72 hours for all wolves killed in the trophy game area to protect livestock and domestic animals. (WGFC 2011, Wyoming Statute 23-3-115, WGFC Chapter 21 Regulations). Additionally, USFWS or WGFD would most likely continue to issue wolf kill permits to landowners and livestock producers who have experienced confirmed wolf predation on their private property or their Federal or State grazing leases. As with Alternative 1, when wolves are delisted, WGFD can also exercise its own authority to remove wolves in those cases where wolves have been documented to be contributing to a decline in ungulate populations in a specific management area and WGFD could authorize wolf take through regulated public hunting and trapping seasons for wolves. As discussed under Sections 4.4.1.1 and 4.4.2.1, under the adaptive management approach being followed by the USFWS and WGFD, if wolf removal is needed, but not available from WS, livestock producers could still obtain authorization to use lethal WDM methods from the USFWS or WGFD as appropriate. When wolves are delisted, wolf hunting opportunities for the public might be expanded by offering opportunities for hunts in areas where wolves have been or are currently

killing livestock. This type of approach might not be as effective in targeting individual depredating wolves and packs and addressing damage problems as lethal management efforts conducted by WS under Alternatives 1 or 2, but it could eventually result in just as many or more wolves being removed from the population.

Under the current listed status of wolves, Alternative 2 would may result in a lower or similar cumulative impact on Wyoming's wolf population than Alternative 1. Wolf management is currently conducted under the provisions of the 2008 10j rules and wolves could still be killed by livestock producers when witnessed attacking or harassing livestock, and, if authorized by USFWS or WGFD, producers would likely still exercise the option of removing wolves (without WS assistance) to address impacts on livestock. USFWS or WGFD might also conduct wolf removal efforts on their own in response to complaints of predation on livestock. Once delisted, cumulative impact on the wolf population could be similar to or greater than Alternative 1 because WGFD would have the option of providing for a hunting season to reduce the wolf population or focus harvest in conflict areas. Use of hunting seasons to address conflicts is less targeted and specific to depredating individuals and packs and may result in higher levels of take to achieve similar level of damage management. The combination of no wolf removals by WS and no wolf removals through a public hunting season would likely result in an increase in Wyoming's wolf population and increased wolf damage, rather than the decrease desired by WGFC (2011). Frustration on the part of livestock producers and hunters due to actual or perceived impacts from a growing wolf population could lead to some degree of illegal wolf killing, but it would not likely be enough to compensate for the lack of removals by WS and a regulated public harvest.

4.3.2.3 Effects on public and pet health and safety

We anticipate that the USFWS and WGFD, as appropriate, would place the highest staff priority on responding to issues of risk to human health and safety and would not delegate such responses to personnel who lack the training and experience to effectively address these concerns. Consequently, risks to human health and safety from wolves would be similar under this Alternative as under the other Alternatives.

Under Alternative 2 there would be no lethal wolf conflict management conducted by WS, so the already low level of potential risk to the public and pets associated with any WS efforts would be greatly reduced. However, there may be some limited use of foothold traps associated with live-capture of wolves (e.g., to attach radio collars needed for monitoring wolf movements and to activate RAG boxes). However, the risk to the public and domestic animals from wolf predation could increase. Entities other than WS can and are using aerial hunting in Wyoming to reduce some types of predation on livestock (e.g., coyote predation) and are likely to seek authorization to use for WDM in the absence of aerial shooting by WS. However overall access to this method is likely to be lower than with the WS program, and use of traps and snares for WDM may increase. These methods have a low but greater risk of capturing nontarget species including pets than shooting. Non-WS aerial shooting operations may not have access to the training of WS personnel or use the safety policies and procedures discussed for WS under Alternative 1. Consequently, overall risks to personnel conducing aerial shooting may be higher under this alternative. Risk to public and pets from lethal WDM methods would also depend on the experience and training of the individuals using the lethal methods. Not all individuals may have the same training and access to equipment as WS, so risks are likely to be similar to or slightly greater than Alternative 1. In some cases, frustration

with continued depredations might lead some individuals to consider use of illegal toxicants[22] or trapping methods to effect wolf removals, and this could present a greater risk of harm to people's pets. Although illegal toxicant use would present a risk to non-target animals, including pets, the motivation to use toxicants can be great, because a variety of potentially useful agricultural pesticides are readily available at relatively low cost, and would be easy to deploy (Allen et al. 1996).

Although no lethal management would be conducted by WS, the USFWS or WGFD could still authorize its personnel or private individuals to use foot-hold traps and snares to take depredating wolves, and there would be some risk that pets might be unintentionally captured. WS posts warning signs to alert members of the public about deployment of capture devices, but those types of notices would not necessarily be posted by private individuals conducting trapping efforts.

4.3.2.4 Humaneness and animal welfare aspects of the methods to be used

Because WS would not be conducting any lethal conflict management of wolves under Alternative 2, some people would consider WS' actions under this Alternative more humane than under Alternatives 1 or 2. Although WS would be limited to using only nonlethal methods, a variety of lethal methods would most likely be employed by livestock owners and their agents to address wolf depredations, and the USFWS or WGFD, as appropriate, could implement lethal control methods or authorize members of the public to take wolves to address depredation issues. If the entities conducting the lethal wolf management lack the training, experience and resources of WS personnel, there may be a greater risk of unnecessary injury or pain from less than optimal application of some techniques. As noted in section 4.3.2.3, use of aerial shooting may decline under this alternative and overall use of traps and snares may increase. Traps and snares may be considered less humane than shooting because of the time the animal spends captured in the device prior to being euthanized. It is conceivable, and perhaps even likely, that in some cases, there may be frustrated attempts to remove wolves through the illegal use of a readily available variety of agricultural pesticides and other chemicals or through illegal trapping methods. Depending on the illegal toxicant or trapping methods used, death might occur over a protracted period of time as compared to other methods, such as shooting (Allen et al. 1996).

4.3.2.5 Impacts to stakeholders, including aesthetics of wildlife

The impacts of this Alternative to stakeholders would be variable depending on their values regarding wildlife and relationship to the problem. Individuals directly impacted by wolf depredation are likely to be less tolerant of wolves than individuals whose property and pets are not at risk. Under Alternative 2 WS would limit assistance to only nonlethal methods, but the USFWS or WGFD, or other entities, as appropriate, could conceivably provide assistance with lethal control in response to confirmed wolf depredations. If stakeholders experiencing wolf damage receive quick and effective service from WS, USFWS or WGFD, they would likely be more accepting of wolves and the program. However, if depredation complaints are not readily addressed, stakeholders experiencing wolf damage would likely oppose this Alternative.

[22] In 2006, a rural resident from central Idaho pled guilty to illegally placing poisoned meatballs on the Salmon-Challis National Forest in an effort to kill wolves. Three pet dogs were poisoned as a result of his actions.

As with Alternative 1, once delisted WGFD could conduct wolf removals to protect ungulates (but without WS assistance) under this Alternative, if authorized by the USFWS, and different members of the public would be opposed to or supportive of this management action, depending on their particular values and interests. As with Alternatives 1, there would continue to be opportunities to see and hear wolves, or experience other evidence of their presence, particularly if individuals seek out areas where the USFWS or WGFD, or private property owners have not recently conducted wolf removal efforts. Members of the public could contact their local USFWS or WGFD office to inquire about the best opportunities for wolf viewing.

4.3.2.6 Effects on non-target species populations, including State and Federally listed Threatened or Endangered (T&E) species

Under this Alternative, WS would not conduct any lethal wolf conflict management. Shooting is virtually 100% selective for the target species, so discontinuing use of this method would have little impact on risks to non-target species. WS use of snares and aircraft would cease or be substantially reduced as would risks associated with these methods. Foothold traps are the primary method used for nonlethal capture of wolves, so limited use of this method would continue. There might be increased attempts to use methods such as shock collars and RAG devices by WS[23] which would require live-capturing the wolves, but overall use of foothold traps would decline. WS use and recommendation of frightening devices, fladry and other nonlethal methods may increase. These methods may result in minor noise disturbance of non-target animals. Fladry may also impact movement patterns of non-target species. Overall risks of lethal take of non-target species from WS actions would decline from already low levels, and risks of disturbance of non-target species would increase slightly

Although there would be less use of lethal methods by WS, use of lethal methods by WGFD and others would still be permitted and would likely increase under this alternative (See section 4.4.3.1). Use of lethal WDM methods by personnel from WGFD is likely to have similar impacts as described for WS under Alternative 1. However, use of lethal WDM methods by private citizens would have similar or greater risks than a program by WS because the individuals may not have the same training or be required to adhere to some of the provisions for the protection of non-target species that would be used by WS.

Given the above information, cumulative impacts of this alternative on non-target species are likely to be similar to or slightly higher than under the Alternatives 1 and 2.

4.3.3 Alternative 3 - No Wolf Conflict Management by WS in Wyoming

4.3.3.1 Ability of alternative to meet management objectives and efficacy of methods

Under this Alternative, WS would have no role in WDM in Wyoming. The degree to which implementation of Alternative 3 would be effective in addressing wolf predation on livestock and/or wild ungulates would probably depend on how effective the USFWS

[23] Under the current program, WS already gives preference to nonlethal methods where practical and effective. Increases in use of this method would be minor unless there are attempts to try nonlethal methods in situations where they would otherwise have been considered less practical or effective than lethal methods.

or WGFD as appropriate, was in carrying out or authorizing another entity to conduct a wolf conflict management similar to the one that WS has historically conducted. It is conceivable that the USFWS or WGFD or some other entity designated by the USFWS or WGFD, as appropriate, might eventually attain the resources and expertise to similarly conduct wolf conflict management as effectively as, or more effectively than, WS. But in the meantime, implementation of both lethal and nonlethal methods by other entities would likely not be as effective as when carried out with the assistance of WS. An example would be the use of the RAG electronic frightening device to deter wolves from livestock pastures. These devices are complex to maintain and operate effectively, and each unit costs several thousand dollars. Aerial shooting would be another example of a management method that is highly effective, but requires specialized training and equipment to be conducted safely and effectively.

Frustration with wolf management and levels of wolf conflict may be highest for this Alternative, especially initially, before some other entity besides WS begins effectively providing assistance with wolf conflict problems. Control efforts by untrained individuals with a lack of knowledge about control methods and wolf biology and behavior are less likely to target specific depredating wolf packs or individuals, and less likely to be effective in resolving problems (Mech 1995).

Analysis in Section 4.3.3.2 indicates this alternative would not jeopardize the long-term viability of the state or regional wolf population, although total take of wolves for WDM would vary depending on the skill of the individuals conducting WDM and the extent to which the WGFD uses hunting to address depredation problems (when wolves are delisted). Similarly risks to non-target species would vary depending on the skills and training of the individuals conducting the damage management action. Once wolves are removed from the federal list of T&E species, there will likely be an increase in WDM actions conducted by private entities. Many of these entities may not consult with the USFWS regarding measures to reduce risks to T&E species in the same manner as a state or federal agency, so risks associated with their actions may be greater than for Alternative 1 and, in the absence of assistance with any WDM from trained professionals from WS, may also be higher than for Alternative 2.

The training these individual have in the use of WDM methods would be variable and may lead to increased risk of adverse environmental impacts associated with unsafe or illegal use of WDM methods. All entities are expected to comply with applicable state, federal and tribal regulations, but enforcement and coordination would be increasingly difficult if the number of entities involved in providing WDM assistance and services increases under this alternative. Similarly, as described under Alternative 1, reporting and monitoring of the impacts of WDM activities may be more difficult and limited when non-WS entities are conducting lethal WDM.

In summary, overall efficacy of this alternative would be variable depending on the entities conducting WDM and would be similar to or less effective than an integrated nonlethal and lethal program conducted by WS under Alternative 1. Ability of this alternative to achieve the remaining management objectives would be more uncertain and more difficult under this alternative than for Alternatives 2 and 3.

4.3.3.2 Effects on the wolf population in Wyoming

The impact on Wyoming's wolf population as a result of implementing Alternative 3 would likely be similar to the impacts associated with implementation of Alternative 2, because under both of these Alternatives, there would be no wolves removed by WS. All of the non-WS take of wolves discussed under Section 4.4.3.1 would similarly be as likely to occur under Alternative 3. As long as wolves remain listed under the ESA, Alternative 3 would likely have a lower or similar cumulative impact on Wyoming's wolf population than Alternatives 1, for the same reasons as discussed in Section 4.3.2.2. However, it is possible that, in the absence of a readily available WS program assisting with nonlethal methods, overall use of lethal methods may be higher than under Alternatives 1 or 2. If/when wolves are delisted again, Alternative 3 would likely result in cumulative impacts on Wyoming's wolf population similar to or greater than would occur under Alternative 1.

4.3.3.3 Effects on public and pet health and safety

We anticipate that the USFWS and WGFD, as appropriate, would place the highest staff priority on responding to issues of risk to human health and safety and would not delegate such responses to personnel who lack the training and experience to effectively address these concerns. Consequently, risks to human health and safety from wolves would be similar under this Alternative as under the other Alternatives.

It is reasonable to assume that whatever wolf conflict management program the USFWS or WGFD implement in the absence of WS, there would be an increase in the number of individuals attempting to resolve wolf conflict problems who lack the training and experience of USFWS, WGFD and WS personnel. There would likely be more trapping and shooting permits issued to landowners who had lost livestock to wolf depredation. Less experienced individuals may require more time to resolve a problem, which would result in an increase in the number of traps and snares in use. As discussed for Alternative 2, trap and snare use may also increase because of anticipated decreases in use of aerial shooting. Private individuals who would be authorized to conduct wolf control through shooting and trapping permits are not required to follow all Federal policies as are WS personnel, which could lead to increased risks to pets and human safety. Aerial hunting is also unlikely to be conducted by individuals with access to the same safety training and safety requirements as WS personnel, so risks to individuals conducting WDM may also be higher under this alternative. The overall result of these changes could be an increase in the number of pets that are captured in equipment placed for wolves.

4.3.3.4 Humaneness and animal welfare aspects of the methods to be used

This Alternative might be considered more humane by many people who are opposed to lethal conflict management methods employed by WS because WS would no longer use such methods, but lethal management of wolves would most likely continue regardless of whether WS was involved. USFWS or WGFD, as appropriate, would likely use traps and snares to capture and euthanize depredating wolves and to radio collar wolves for population monitoring and nonlethal wolf conflict management techniques that require a radio-collar on one or more wolves. When capturing wolves for nonlethal (population monitoring) or lethal management efforts, wolves would be humanely captured by experienced personnel using the best methods available. There would likely be a greater

dependence on private landowners who would be issued trapping and shooting permits. These individuals would likely be less trained and experienced than USFWS, WGFD or WS personnel, and might not employ the most appropriate tools and methods. Due to the anticipated decrease in use of aerial shooting expected under this alternative, use of traps and snares is likely to be greater than under Alternative 1. These methods are generally considered less humane than shooting. Once delisted, WGFD may also issue permits to reduce wolf populations in areas with persistent conflicts. Although individuals may oppose all use of lethal methods, hunting is less selective for specific depredating individuals and packs and would be considered less humane than a professional PDM program.

Some property owners may take illegal action against localized populations of wolves out of frustration when continued damage occurs in the absence of a quick and effective wolf conflict management program. Some illegal methods, like poisons, may be less humane than methods used by experienced agency personnel. Animal welfare aspects in terms of pain and suffering of some livestock and pets would likely be worse under this Alternative because overall efficacy in addressing damage problems would likely be lower than with Alternatives 1, 2 or 3.

4.3.3.5 Impacts to stakeholders, including aesthetics of wildlife

Like Alternative 2, some stakeholders who are opposed to WS use of lethal conflict management methods may view this Alternative favorably, while others who are impacted by wolf damage would likely view this Alternative unfavorably, particularly if they felt they would be receiving less assistance or less effective assistance from Federal or State agencies to help address wolf conflict problems. USFWS or WGFD, as appropriate, would most likely continue to provide assistance with wolf conflicts, but the strain on USFWS and WGFD resources and staff and costs to other programs would be greatest under this Alternative. If USFWS or WGFD had to redirect resources from other program areas to make more resources available to address wolf conflicts, that could have a negative impact on members of the public who depend on WGFD to provide abundant fish and wildlife, whether for consumptive or non-consumptive use. In addition to an increase in the number of permits issued to landowners, it is likely that USFWS or WGFD would seek other individuals to use as designated agents who could respond to problems. It may be difficult for USFWS or WGFD to obtain and retain individuals with the training and experience of WS. Consequently, problems may not be resolved as effectively or efficiently as with Alternatives 1and 2. Ranchers and pet owners with wolf depredation would likely be more frustrated because of the lack of quick response to losses. Individuals who feel their aesthetic enjoyment is compromised by the knowledge that wolves could be killed for wolf conflict management may still be dissatisfied under this Alternative because lethal control would still be conducted, albeit by sources other than WS.

While wolves remain listed under the ESA, this Alternative is not anticipated to result in a decline in wolf abundance in Wyoming or the NRM and any difference in wolf viewing opportunities is likely to be negligible. When wolves are delisted, wolf abundance would be expected to decline in response to public harvest of wolves as provided for by WGFC (2011), but this would be expected to occur with delisted wolves regardless of whether WS was involved in wolf conflict management. Opportunities to view, hear and aesthetically enjoy wolves would continue under Alternative 3 as they would under all the other Alternatives.

4.3.3.6 Effects on non-target species populations, including State and Federally listed Threatened or Endangered (T&E) species

No operational WS activities would be conducted pursuant to this alternative so there would be no risks to non-target or T/E species from WS. Depending on the federal status of wolves, the WGFD and private citizens would still conduct lethal WDM activities. The WGFD or their designated agents would conduct wolf trapping activities for population monitoring purposes and lethal and nonlethal WDM. WGFD actions are anticipated to have impacts and risks to non-target species similar to those of WS. The WGFD may have difficulty obtaining and retaining designated agents with the same level of training, experience and access to research and WDM resources as WS. If designated agents lack the training and resources of WS staff, there may be greater risks to T&E species.

Because of limits on WGFD staff and resources, once wolves are delisted, this alternative would likely result in the WGFD placing increased emphasis on use of landowner permits. Private citizens who are not trained in WDM and do not have to comply with all regulations pertaining to WDM would likely have a greater impact on non-target and T/E species than WS. Also, private citizens would likely not report all non-target species captured which would complicate monitoring and management of impacts on non-target species. Consequently, cumulative risks to non-target species would be greatest for this alternative.

4.4 SUMMARY OF IMPACTS

Table 4-3 briefly summarizes the potential impacts of each Alternative against each of the issues that were analyzed in detail. The anticipated impacts on Wyoming's wolf population from the various Alternatives would differ to some degree depending on whether wolves remain listed and under USFWS management, or are returned to State management under their previously delisted status. None of the four Alternatives would be expected to adversely affect Wyoming's wolf population, regardless of listing status, because the state would be required to have a management plan in place that provides adequate protections to ensure long-term viability and health of the state wolf population prior to delisting. People opposed to lethal control of wolves may be opposed to implementation of Alternative 1, but as discussed in the EA, lethal control of wolves is expected to occur regardless of whether WS is involved.

Table 4-3. Summary of Impacts of Alternatives.			
	Alternative 1 - Continue the Current Wolf Conflict Management Program (No Action/Proposed Action)	**Alternative 2 – WS Nonlethal Wolf Conflict Management Only**	**Alternative 3 – No WS Wolf Conflict Management by WS in Wyoming**
Effects on Wyoming's wolf population (*while listed*)	Low, since public harvest seasons would not be an option. Wyoming's wolf population would likely continue to increase to carrying capacity, rather than be reduced.	Effects on the wolf population would be slightly lower than under Alternative 1.	Similar to Alternative 2.
Effects on Wyoming 's wolf population (*if delisted*)	Moderate, when considered in the context of WGFC (2011), which could include a hunted population. WGFD would still maintain a viable, sustainable wolf population	Impacts to the Wyoming wolf population would likely be somewhat less than under Alternative 1, until WGFD provided other forms of lethal wolf removal to replace WS wolf removals.	Cumulative impact on Wyoming's wolf population would likely be similar to impacts under Alternative 2.
Effectiveness of lethal and nonlethal control efforts in reducing wolf predation on livestock and/or wild ungulates	The current integrated, adaptive program's effectiveness is good for protection of livestock, but the current program does not include efforts to protect ungulates.	Lower effectiveness for WS efforts than under Alternative 1, but effectiveness would increase as other non-WS entities became proficient in lethal control to address wolf problems.	Similar to Alternative 2.
Effects on public and pet health and safety	Low risks to the public and peoples' pets.	Probably greater risks than under Alternative 1.	Similar to Alternative 2.
Humaneness and animal welfare aspects of the methods to be used	Management methods are employed as humanely as practical. There would continue to be trade-offs between the welfare of wolves and the welfare of domestic animals attacked by wolves.	Possible increased likelihood that frustrated private individuals would employ less humane methods, such as illegal toxicants or trapping methods, especially after wolves removed from protection under the ESA.	Similar to Alternative 2.
Impact to stakeholders, including aesthetics of wildlife	Impacts would be variable and mixed because of differing philosophical, aesthetic, and personal attitudes, values, and opinions.	Variable and mixed, as with Alternatives 1, but impacts to livestock producers would likely be worse, at least until WGFD or some other entity became proficient in conducting lethal control to address wolf conflicts.	Similar to Alternative 2.

Non-target Species, Including T&E Species	Low risks to non-target species from WDM and research methods. No adverse impact to T&E or non- target species populations. Risk of illegal action still possible but reduced for this Alternative.	Low risk to non-target species from WDM and research methods by WS. Increased risk to non-target species from use of traps and cable restraints by individuals with less experience that WS. Also individuals with trapping and shooting permits may not comply with same procedures for protecting non-targets as WS. Impacts to non-targets and T/E species greater for this Alternative than Alternative 1.	No effects by WS. Greatest risk to non-target species from use of traps and cable restraints for nonlethal and lethal WDM and wolf population monitoring by individuals with less training and experience than WS. Risks to non-target species from illegal actions likely higher than Alternative 2.

CHAPTER 5: LIST OF PREPARERS, REVIEWERS, AND PERSONS CONSULTED

5.1 PREPARERS

Mike Foster, State Director, USDA/APHIS, WS, Casper, WY – *Writer and Editor*
Craig Acres, Staff Biologist, USDA, APHIS, WS, Casper, WY - *Writer and Editor*
Samuel Crowe (ret.), Assistant State Director, USDA, APHIS, WS, Casper, WY - *Writer and Editor*
David Hayes (ret.), Environmental Coordinator, USDA, APHIS, WS, Billings, MT- *Writer and Editor*
Kimberly Wagner, Ph.D., Staff Wildlife Biologist, USDA, APHIS, WS, Sun Prairie, WI- *Writer and Editor*
Michael Jimenez, Wyoming Wolf Recovery Project Leader, USFWS, Jackson, WY - *Writer and Editor*
Rod Krischke, State Director, USDA, APHIS, WS, Casper, WY - *Writer and Editor*
Michael Pipas, Wildlife Disease Biologist, USDA, APHIS, WS, Casper, WY - *Writer and Editor*

5.2 REVIEWERS/PERSONS CONSULTED

Christopher Wehrli, Regional Environmental Coordinator, USFS, Golden, CO. – *Reviewer/Editor*
Buddy Green, Deputy State Director, Wyoming BLM, Cheyenne, WY – *Reviewer/Editor*
Ufna Soldier Wolf, Tribal Historical Preservation Officer, NA THPO, Ft. Washakie, WY. - *Reviewer/Editor*
Richard L. Curritt, Senior Archaeologist, SHPO, Cheyenne, WY – *Reviewer/Editor*
Justin Williams, Senior Policy Analyst, WY. Dept. of Ag., Cheyenne, WY. – *Reviewer/Editor*
Grant Frost, Senior Wildlife Biologist, WGFD, Cheyenne, WY- *Reviewer/Editor*
Dan Thompson, Large Carnivore Management Section Supervisor, WGFD, Lander, WY – *Reviewer/Editor*
Mark Bruscino (ret.), Large Carnivore Management Section Supervisor, WGFD, Cody, WY – *Reviewer/Editor*
Mark Haroldson, USGS, Northern Rocky Mountain Science Center, Bozeman, MT – *Reviewer/Editor*

APPENDIX A

DEPREDATION INVESTIGATION FORM

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

WILDLIFE SERVICES DEPREDATION INVESTIGATION REPORT

		REPORT NUMBER
		DATE COMPLAINT RECEIVED
SPECIES	NAME OF INVESTIGATOR(S)	DATE INVESTIGATED
NAME AND ADDRESS OF LIVESTOCK OWNER/LEASEE		TELEPHONE NUMBER
		COUNTY

LAND OWNERSHIP ☐ STATE ☐ BLM ☐ TRIBAL ☐ PRIVATE ☐ FS ☐ OTHER (Specify)

TYPE OF LIVESTOCK/PROPERTY ☐ HORSE ☐ BEES ☐ SHEEP ☐ CATTLE ☐ OTHER (Specify)

LOSSES AND/OR PROPERTY DAMAGE (See criteria on reverse side of form)

No. Confirmed	No. Probable	No. Possible/Unknown	No. Other (Specify)

SITE DESCRIPTION/PHYSICAL EVIDENCE PRESENT (i.e., tracks, scat, hair, blood, signs of struggle, scrapes, etc.)

CARCASSES/PROPERTY DAMAGE CHARACTERISTICS (i.e., puncture marks, feeding patterns, measurements between canines, signs of hemorrhage, etc.)	ESTIMATED TIME SINCE PREDATION/DAMAGE OCCURRED (Days/hours)

ACTIONS TAKEN	DATE STARTED	DATE ENDED

NAME OF WS INVESTIGATOR	SIGNATURE	DATE
NAME OF DISTRICT SUPERVISOR	SIGNATURE	DATE
NAME OF STATE REPRESENTATIVE	SIGNATURE	DATE

DISPOSITION OF CARCASS/PARTS

WS FORM 200 (OCT 99) COPY DISTRIBUTION: WHITE - State Office YELLOW - District Supervisor PINK- State GOLDENROD- Investigator

CRITERIA FOR CLASSIFICATION OF REPORTED DEPREDATION INCIDENTS

Reported wolf, bear, or lion depredation incidents should be classified as either **confirmed, probable, possible/unknown**, or **other**, based on the following criteria. *For MIS reporting purposes, "reported" damage may often include incidents described as **probable, possible/unknown,** and/or **other**, if the cooperator first reported these incidents as predation.*

CONFIRMED – Depredation is **confirmed** in those cases where there is reasonable physical evidence that an animal was actually attacked and/or killed by a predator. The primary confirmation factor would ordinarily be the presence of bite marks and associated subcutaneous hemorrhaging and tissue damage, indicating that the attack occurred while the victim was alive, as opposed to simply feeding on an already dead animal. Spacing between canine tooth punctures, feeding pattern on the carcass, fresh tracks, scat, hairs rubbed off on fences or brush, and/or eyewitness accounts of the attack may help identify the specific species or individual responsible for the depredation. Predation might also be confirmed in the absence of bite marks and associated hemorrhaging (*i.e.,* if much of the carcass has already been consumed by the predator or scavengers) if there is other physical evidence to confirm predation on the live animal. This might include blood spilled or sprayed at a nearby attack site or other evidence of an attack or struggle. There may also be nearby remains of other victims for which there is still sufficient evidence to confirm predation, allowing reasonable inference of confirmed predation on the animal that has been largely consumed.

PROBABLE – Having some evidence to suggest possible predation, but lacking sufficient evidence to clearly confirm predation by a particular species, a kill may be classified as **probable** depending on a number of other factors such as: (1) Has there been any recently confirmed predation by the suspected depredating species in the same or nearby area? (2) How recently had the livestock owner or his employees observed the livestock? (3) Is there evidence (telemetry monitoring data, sightings, howling, fresh tracks, etc.) to suggest that the suspected depredating species may have been in the area when the depredation occurred? All of these factors, and possibly others, should be considered in the investigator's best professional judgment.

POSSIBLE/UNKNOWN – Lacking sufficient evidence to classify an incident as either confirmed or probable predation, the **possible/unknown** classification is appropriate if it is unclear what the cause of death may have been. The investigator may or may not have much of a carcass remaining for inspection, or the carcass may have deteriorated so as to be of no use. The investigator would want to consider if the area has been frequented by a predator, or if the habitat is one which the predator is likely to use. Possible predation may include cases where counts show that abnormal numbers of livestock are missing or have disappeared above and beyond past experience, and where other known cases of predation have occurred previously in the area.

OTHER – Cause of livestock deaths should be classified as **other** when it is discovered that the cause of death was not likely caused by the animal originally reported to Wildlife Services during a request for assistance. Examples of **other** may include cases where the cause of death is confirmed or is likely due to predation by some other animal or cause determined at the time of the investigation such as red fox instead of coyote or other causes such as, bloat, poisonous plants, stillborn, disease, lightning strike, vehicle collision, etc. If the specific other cause of death can be determined, it should be written in the space provided for Other.

WS FORM 200 (Reverse)

APPENDIX B

AUTHORITY AND COMPLIANCE

Authority of Federal[24] and State Agencies in Wildlife Damage Management in Wyoming

USDA-APHIS-Wildlife Services

USDA is authorized and directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for USDA is the *Act of March 2, 1931* and the *Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988 (7 USC 426-426c; 46 Stat. 1468)*, as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

"The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."

Since 1931, with the changes in societal values, APHIS, WS policies and programs place greater emphasis on the part of the Act discussing "bringing [damage] under control," rather than "eradication" and "suppression" of wildlife populations. In 1988, Congress strengthened the legislative authority of APHIS, WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."

Under the Act of March 2, 1931, and 7 U.S.C. §§426c, APHIS may carry out these wildlife damage management programs itself, or it may enter into cooperative agreements with states, local jurisdictions, individuals and public and private agencies whereby they may fund and assist in carrying out such programs. Id. These laws do not grant any regulatory authority. Therefore, there are no regulations promulgated under these statutes for wildlife services or animal conflict management activities.

[24] Detailed discussions of the legal authorities and relationships of pertinent Federal wildlife and land management agencies, and key legislation pertinent to wildlife damage management are found in Chapter 1 of USDA 1997.

U. S. Fish and Wildlife Service (USFWS)

The USFWS has the statutory authority to manage Federally listed T&E species through the Endangered Species Act of 1973 (ESA) (16 USC 1531-1543, 87 Stat. 884). Authorization, under Section 10 of the ESA, permits the USFWS to manage T&E species damage in accordance with USFWS's plans and rule making (*i.e.,* Interim Wolf Control Plan, 50 CFR Part 17.84, USFWS 1994, 70 FR 1286, 73 FR 4720, 74 FR 15123, 76 FR 61782) and through MOU and Interagency Agreement. WS is authorized to assist the USFWS in reducing wolf predation to livestock on private and public land in Wyoming.

Wyoming Game and Fish Department

The WGFD has the responsibility to manage all protected and classified wildlife in Wyoming, except federally listed T/E species, regardless of the land class on which the animals are found (Wyoming Statute 23-1-103, 302). By Wyoming statute and policy, the state provides for the conservation of lands, protection of natural resources, wildlife and public lands (Wyoming Statute 11-16-103). WGFD is also authorized to cooperate with WS and the WDA for controlling predatory animals (Wyoming Statute 11-6-104, 107, 108).

The Chapter 56 permit process authorizes the Chief Game Warden or his designee to take (kill) any wildlife in Wyoming when, in his judgment, the taking is necessary due to substantial damage to property or the creation of a human health and safety hazard. This regulation is promulgated by authority of Wyoming Statute 23-1-302(a)(viii)and(xxii).

Wyoming Department of Agriculture (WDA)

The WDA is authorized to enter into Cooperative Agreements with WS and local entities for reducing damage caused by predatory animals or to administer such programs (Wyoming Statute 11-6-104). The WDA is also responsible for the issuance of permits for aerial hunting per the Fish and Wildlife Act of 1956, as amended (Wyoming Statute 11-6-105). The WDA currently has an MOU, Cooperative Agreement, and Work Plan with WS. These documents establish a cooperative relationship between WS and WDA, outline responsibilities, and set forth annual objectives and goals of each agency for resolving wildlife damage management conflicts in Wyoming.

County Predatory Animal Districts and State Predatory Animal Advisory Board

Each county in Wyoming is legislatively designated as a predatory animal district (Wyoming Statute 11-6-201) with the authority to hold property and be a party to suits and contracts. The individual districts have the responsibility to: *"exercise general supervision over the predatory animals that prey upon and destroy livestock, other domestic animals and wild game"* within the boundaries of the county (Wyoming Statute 11-6-205). Therefore, the individual County Predatory Animal Boards determine how predator control is to be conducted within their respective domains, and administer funds collected from the brand inspection fees (and other sources) for that purpose (Wyoming Statute 11-6-210). Some choose to conduct their own programs with little or no Federal involvement. All but two counties within the analysis area have chosen to enter into Cooperative Agreements with WS to provide expertise and operational support in wildlife damage management.

The Wyoming State Predatory Animal Advisory Board is made up of one representative from each County Predatory Animal Board, and provides general coordination, direction, and advice regarding predatory animal control operations across the State.

U.S. Forest Service and Bureau of Land Management

The U. S. Forest Service and Bureau of Land Management have the responsibility for managing Federal lands for multiple uses, including livestock grazing, timber production, recreation and wildlife habitat, while recognizing the State's authority to manage wildlife populations. Both the USFS and BLM recognize the importance of managing wildlife conflicts on lands and resources under their jurisdiction, as integrated with their multiple use responsibilities. For these reasons, both agencies have entered into MOUs with WS to facilitate a cooperative relationship. Copies of these MOUs are available by contacting the WS State Director's Office, P.O. Box 67, Casper, WY 82602.

Wyoming Native American Tribes (Northern Arapahoe and Eastern Shoshone)
Currently, WS has an MOU with the Northern Arapahoe and Eastern Shoshone tribes on the WRR. Any WS activities conducted on tribal lands would only be conducted at the request of the tribe and after appropriate authorizing documents were signed. If WS enters into an agreement with a tribe for conflict management, this EA would be reviewed and supplemented, if appropriate, to ensure compliance with NEPA. Agreements would be signed and NEPA documentation addressed as appropriate before implementing conflict management on reservation lands. Requests for operational assistance to resolve conflicts on private properties within the boundaries of Indian reservations would be coordinated with the tribal government.

Compliance with Federal Laws, Executive Orders and Regulations
WS consults and cooperates with other federal and state agencies as appropriate to ensure that all WS activities are carried out in compliance with all applicable federal laws.

National Environmental Policy Act: All federal actions are subject to NEPA (Public Law 91-190, 42 U.S.C. 4321 et seq.). WS and the USFWS follow CEQ regulations implementing NEPA (40 CFR 1500 et seq.), USDA (7 CFR 1b), and WS follows the APHIS Implementing Guidelines (7 CFR 372) as a part of the decision-making process. These laws, regulations, and guidelines generally outline five broad types of activities to be accomplished as part of any project: public involvement, analysis, documentation, implementation, and monitoring. NEPA also sets forth the requirement that all major federal actions be evaluated in terms of their potential to significantly affect the quality of the human environment for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. Federal activities affecting the physical and biological environment are regulated in part by CEQ through regulations in 40 CFR, Parts 1500-1508. In accordance with CEQ and USDA regulations, APHIS Guidelines Concerning Implementation of NEPA Procedures, as published in the Federal Register (44 CFR 50381-50384) provide guidance to APHIS regarding the NEPA process.

Pursuant to NEPA and CEQ regulations, this EA documents the analysis of a proposed impact resulting from federal actions, informs decision-makers and the public of reasonable alternatives capable of avoiding or minimizing adverse impacts, and serves as a decision-aiding mechanism to ensure that the policies and goals of NEPA are infused into federal agency actions. This EA was prepared by integrating as many of the natural and social sciences as warranted, based on the potential effects of the proposed action. The direct, indirect, and cumulative impacts of the proposed action are analyzed.

Endangered Species Act: Under the ESA, all federal agencies are charged with a responsibility to conserve endangered and threatened species and to utilize their authorities in furtherance of the purposes of the ESA (Sec.2(c)). WS conducts Section 7 consultations with the USFWS to utilize the

expertise of the USFWS to ensure that, "*Any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species* . . ." (Sec.7 (a) (2)). WS conducts formal Section 7 Consultations with the USFWS at the national level (USDI 1992) and consultations with the USFWS at the local level as appropriate (B. Kelly, USFWS Ecological Services letter to R. Krischke, WS, December 19, 2005 and USFWS Interagency Consultation).

Bald and Golden Eagle Protection Act (16 USC 668-668c), as amended

Populations of bald eagles showed periods of steep declines in the lower United States during the early 1900s attributed to the loss of nesting habitat, hunting, poisoning, and pesticide contamination. To curtail declining trends in bald eagles, Congress passed the Bald Eagle Protection Act (16 USC 668) in 1940 prohibiting the take or possession of bald eagles or their parts. The Bald Eagle Protection Act was amended in 1962 to include the golden eagle and is now referred to as the Bald and Golden Eagle Protection Act. Certain populations of bald eagles were listed as "endangered" under the Endangered Species Preservation Act of 1966, which was extended when the modern Endangered Species Act (ESA) was passed in 1973. The "endangered" status was extended to all populations of bald eagles in the lower 48 States, except populations of bald eagles in Minnesota, Wisconsin, Michigan, Washington, and Oregon, which were listed as "threatened" in 1978. As recovery goals for bald eagle populations began to be reached in 1995, all populations of eagles in the lower 48 States were reclassified as "threatened". In 1999, the recovery goals for populations of eagles had been reached or exceeded and the eagle was proposed for removal from the ESA. The bald eagle was officially de-listed from the ESA on June 28, 2007 with the exception of the Sonora Desert bald eagle population. Although officially removed from the protection of the ESA across most of its range, the bald eagle is still afforded protection under the Bald and Golden Eagle Protection Act.

Under the Bald and Golden Eagle Protection Act (16 USC 668-668c), the take of bald eagles is prohibited without a permit from the USFWS. Under the Act, the definition of "take" includes actions that "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb" eagles. The regulations authorize the United States Fish and Wildlife Service to issue permits for the take of bald eagles and golden eagles on a limited basis (see 74 FR 46836-46837, 50 CFR 22.26, 50 CFR 22.27). As necessary, WS would apply for the appropriate permits as required by the Bald and Golden Eagle Protection Act.

National Historical Preservation Act (NHPA) of 1966 as amended: The NHPA and its implementing regulations (CFR 36, 800) require federal agencies to initiate the section 106 process if an agency determines that the agency's actions are undertakings as defined in Sec. 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects to historic properties. If the undertaking is a type of activity that does not have the potential to cause effects to historic properties, assuming such historic properties were present, the agency official has no further obligations under section 106. None of the conflict management methods described in this EA that might be used operationally by WS causes major ground disturbance, any physical destruction or damage to property, any alterations of property, wildlife habitat, or landscapes, nor involves the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

Noise-making methods such as propane exploders, pyrotechnics, or firearms that are used at or in close proximity to historic or cultural sites for the purposes of hazing or removing nuisance predators have the potential for audible effects on the use and enjoyment of a historic property. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage or nuisance problem, which means such use would be to the benefit of the historic property. A built-in mitigating factor for this issue is that virtually all of the methods involved would only have temporary effects on the audible nature of a site and can be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. Site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary in those types of situations.

Native American Graves Protection and Repatriation Act. The Native American Graves Protection and Repatriation Act requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

Environmental Justice and Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Environmental Justice has been defined as the pursuit of equal justice and equal protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires Federal agencies to make Environmental Justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies and activities on minority and low-income persons or populations. A critical goal of Executive Order 12898 is to improve the scientific basis for decision-making by conducting assessments that identify and prioritize environmental health risks and procedures for risk reduction. Environmental Justice is a priority within USDA, APHIS, and WS. APHIS plans to implement Executive Order 12898 principally through its compliance with the provisions of NEPA.

WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898 to ensure Environmental Justice. WS personnel use wildlife conflict management methods in as selective and environmentally conscious a manner as possible. WS assistance is provided on a request basis in cooperation with state and local governments and without discrimination against people who are of low income or in minority populations. The nature of WS' conflict management activities is such that they do not have much, if any, potential to result in disproportionate environmental effects on minority or low-income populations. Therefore, no such adverse or disproportionate environmental impacts to such persons or populations are expected.

Executive Order 13045 - Protection of Children from Environmental Health and Safety Risks. Children may suffer disproportionately from environmental health and safety risks, including their developmental physical and mental status, for many reasons. Because WS makes it a high priority to identify and assess environmental health and safety risks, WS has considered the impacts that alternatives analyzed in this EA might have on children. All WS predator conflict management is conducted using only legally available and approved conflict management methods where it is highly unlikely that children would be adversely affected at all, let alone in any disproportionate way. The Risk Assessment (USDA 1997, Appendix P) concluded that when WS program chemicals and non-chemical methods are used following label directions and in compliance with normally accepted safety practices and WS standard operating procedures, such use has negligible impacts on the environment or on human health and safety, including the health and safety of children.

Executive Order 13186 and MOU between USFWS and WS**:** EO 13186 directs federal agencies to protect migratory birds and strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and minimize the take of migratory birds through enhanced collaboration between WS and the USFWS, in coordination with state, tribal, and local governments. A national-level MOU between the USFWS and WS has been drafted to facilitate the implementation of EO 13186.

Executive Order 13112 - Invasive Species**:** Authorized by former President Clinton, EO 13112 establishes guidance to federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. The EO, in part, states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law: 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations and provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education on invasive species.

The EO also established an Invasive Species Council (Council) whose members include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the EPA. The Council shall be co-chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council oversees: 1) the implementation of this order, 2) that federal agency activities regarding invasive species are coordinated, complementary, cost-efficient, and effective, 3) the development of recommendations for international cooperation in addressing invasive species, 4) the development, in consultation with the CEQ, of guiding principles for federal agencies, 5) the development of a coordinated network among federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health, 6) the establishment of a coordinated, up-to-date information-sharing system and 7) preparation and issuance of a national Invasive Species Management Plan.

APPENDIX C

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APPENDIX D

Review of Effects of Wolf Mortality on Livestock Depredations (Weilgus and Peebles 2014)

Subject: *Effects of Wolf Mortality on Livestock Depredations*

(Wielgus and Peebles, 2014)

Date: October 2, 2015

To: File
From: Michael D. Foster, State Director, and USDA/APHIS/WS Wyoming.

On December 3, 2014, an article titled *Effects of Wolf Mortality on Livestock Depredations* (Wielgus and Peebles, 2014) was published by the journal PLoS ONE. Wildlife Services immediately requested its National Wildlife Research Center (NWRC) scientists to review the article and provide feedback. Seven NWRC research scientists (all PhDs) from a variety of disciplines reviewed the article. Julie Young, PhD, a Supervisory Research Biologist at NWRC, compiled the comments and reported the results of NWRC's analysis via email on December 8, 2014. As detailed in the email, the NWRC reviewers found numerous flaws with the article's data analysis and conclusions.

To further Wildlife Services' evaluation and consideration of the Wielgus and Peebles article, Julie Young was asked to expand upon NWRC's earlier review of the article. The attached memorandum is the culmination of both reviews, and this cover memorandum serves to summarize NWRC's analysis and evaluate the applicability of the Wielgus and Peebles article to wolf damage management in the State of Wyoming.

The NWRC scientists do not recommend use of the Wielgus and Peebles article to support program decisions by Wildlife Services due to serious flaws in the data analysis methods selected and the authors' interpretation of the results. As detailed in the attached memorandum, the article includes poorly associated spatial and temporal scales, fails to consider the concurrent growth of the wolf population throughout the region during the study period, and does not address other data uncertainties.

The NWRC scientists determined that the statistical tests and analyses selected for the article appear misleading. In addition, several peer-reviewed publications cited in the NWRC review questioned the use of these statistics for the authors' specific type of study.

At the spatial level, the authors clumped data for entire states into single data points. This very coarse analysis ignores critical information which occurs at the local level within individual packs and individual depredation scenarios. Due to the territorial nature of wolves, lethally removing a wolf from a pack in one area of the state may reduce livestock depredations in that area but likely would have no effect on wolf depredation events in other areas of the state which are hundreds of miles away.

The temporal scale also is too coarse to draw meaningful conclusions. The authors failed to describe the timing/length of control work (resulting in lethal removal) and when future

depredations occurred. Moreover, because data was combined and analyzed on a calendar year basis, more than 12 months could have passed between the depredation events. For example, an event occurring in January 2012 would be combined into 2012 data, and an event occurring in December 2013 would be combined into 2013 data. Even though these events are nearly 24 months apart, they would have been analyzed in the article as if they were only 12 months apart. Further, any future depredation may not even include any members of the initial pack, which further disassociates the relationship between events.

The conclusions were further confounded because the analysis ignored the effects of nonlethal control, mortality from sport hunting and trapping, and natural mortality, all of which are important variables. Finally, as explained by the NWRC research scientists, "there are many flaws to the Wielgus and Peebles article . . . Until these problems are addressed, using an article such as this to guide wildlife management could lead to faulty decisions."

I agree with NWRC's conclusion that the Wielgus and Peebles article is seriously flawed and could lead to faulty decisions. Moreover, the EA for Gray Wolf Damage Management in Wyoming already references and analyzes scientific articles recognizing the efficacy of lethal control as a tool to address depredation. (*See, e.g.*, EA Section 4.1.4 and response to public comments 11 and 14.). Because the Wielgus and Peebles article contains significant flaws, it does not present credible new information that would be relevant to the environmental concerns presented in the EA.

It is thus my determination that Wielgus and Peebles (2014) does not warrant supplementation of the 2015 EA for Gray Wolf Damage Management in Wyoming.

Attachment: July 8, 2015 Memorandum re: NWRC review of publication by Wielgus and Peebles (2014)

MEMORANDUM

To: Jason Suckow, Western Regional Director, Wildlife Services and Charlie Brown, Eastern Regional Director, Wildlife Services

From: Julie Young, Ph.D., Supervisory Research Wildlife Biologist, Wildlife Services, National Wildlife Research Center

Date: 8 July 2015

Re: NWRC review of publication by Wielgus and Peebles (2014)

This memorandum follows from my December 8, 2014 email to Steve Kendrot, Deputy Director, Operational Support Staff, and National Wildlife Research Center (NWRC) management relaying discussions by NWRC's scientists about scientific flaws in a 2014 journal article authored by R.B. Wielgus and K.A. Peebles (2014) entitled *Effects of Wolf Mortality on Livestock Depredations*. The article was published in the journal *PLoS ONE* on 3 December 2014. The article aims to test the efficacy of wolf removals to reduce livestock depredation in Idaho, Wyoming, and Montana. The authors used data from United States Fish and Wildlife Service's Interagency Annual Reports and found a positive relationship between wolf removals and the number of depredations in the following year, except when more than 25% of wolves were removed. At more than 25%, wolf removals correlated with declining depredations. A large group of NWRC scientists including Drs. Eric Gese, Stewart Breck, Alan Franklin, Kim Pepin, Brad Blackwell, Brian Dorr, and I reviewed the article. For the reasons presented below, we do not recommend the use of this article to support program decisions that rely on the best available science to draw conclusions on the merits of wolf damage management.

Our main concerns are the data analysis methods selected and the interpretation of results. More specifically, the spatial and temporal scales are too coarse to say anything meaningful about the relationship between lethal wolf removals and livestock depredation. We believe that several alternative data analysis techniques are available that would better fit the data. Moreover, the article fails to acknowledge or overlooked data showing the wolf population was increasing throughout the study period and that hunting became legal in many parts of the study area. These factors and other uncertainties in the data were not accounted for and may impact the authors' ultimate interpretation of the results.

<u>Specific Flaws in Data Analysis Methods:</u>

- Spatial Scale – The authors collapsed the data for each state (Idaho, Montana, and Wyoming) into one data point per year. The authors also clumped county data into state data. A basic scatterplot of the relationship between cattle populations and wolf populations at the county-level per year would help readers determine if the authors used a valid spatial scale or if the spatial scale should have remained at the level of county data. If the spatial scale is valid as analyzed, state (WY, ID, MT) could have been included as a random effect. By using state as a random effect, it would have enabled to the authors to draw conclusions about the population from which the observed units (states) were drawn, rather than about the states themselves. Instead, it appears that the authors ignore that removing wolves from one place may reduce livestock depredations in that specific place but would be unlikely to affect other locations in that state. Wolves are typically territorial and removals for depredation are typically specific to a pack or individuals at the specific location where the depredation occurred. If the authors had used a finer spatial scale, the results may have differed.

- Temporal Scale – It is unclear if it was appropriate to use a year lapse in analyzing the effects of wolf removals on depredations. There are no details on the timing of the control activities or on the length of time that passed until depredations occurred again. Because data were analyzed on the calendar year, some control events may have happened more than 12 months before another depredation event was documented and the data still would have been included as occurring in the next (calendar) year. If so, the analysis looked beyond the stated one-year time lag. During the majority of the study period, the wolf population was increasing in all states. We believe a finer temporal scale would likely be more accurate. For example, the authors could have evaluated depredation events within the first one to three months after removals to determine if there were real-time, immediate impacts.

Specific Flaws in Interpretation of Results

- Data analysis – It is highly likely that analyses done using a more appropriate spatio-temporal scale (mentioned above) and using improved analytical techniques to match the data quality would reveal results contrary to the findings reported here.
  - The article only uses control-based removals, as reported in the United States Fish and Wildlife Service's Interagency Annual Reports, and does not address how hunting removals or use of non-lethal methods impact the analysis. For example, in Idaho, one of the state's whose data were part of this article, 329 wolves were killed for harvest versus 73 wolves killed for control during 2012. Since hunting has become legal in some states such as Idaho, it is reasonable to expect more wolves were removed annually via hunting than from control actions. States and individual ranchers differ in the level of non-lethal methods used and how their use affects the decision to lethally remove wolves. The impacts of hunting and use of non-lethal methods on the analysis may be important but are not addressed in this article.
  - The authors do not account for (or mention how they accounted for) data uncertainty, data scales of dependent variables, and model selection uncertainty. It is misleading to present the raw data as fixed. We know these data have uncertainty associated with them, such as the number of livestock reported by National Agricultural Statistics Service, which provides a range of values, yet the authors did not account for data uncertainty and ignored model selection uncertainty by using forward selection regression methods. Model selection uncertainty could have been addressed using AIC weights, which can greatly facilitate the interpretation of the results[1]. Moreover, the dependent variables differed by orders of magnitude (e.g., 10,000s of cattle and sheep versus 100s of wolves), which can introduce scaling issues in the data. This explains why there are orders of magnitude differences in the coefficients. It would have been better to divide the number of cattle by 1,000 or 10,000 to make this variable more in line with the other variables (e.g., sheep counts) in terms of its magnitude.
  - The use of statistics is unclear. First, the authors claim to use forward selection regression methods. These methods are inappropriate for the analysis in this article. There are several peer-reviewed papers on why it is no longer an acceptable practice to use forward selection regression methods for these types of studies[2]. Forward selection regression methods are valid for strictly controlled experiments, where one has a full picture of how model variables relate. This article is not based on controlled experiments. Second, it does not appear that the authors actually used forward selection regression methods. Instead, the authors used negative binomial general linearized models (which actually should be referred to as generalized linear models) with no explanation for why these models were chosen.

Generalized linear models can perform poorly with data not distributed exactly as negative binomial. Given the data set used in this article, normal-based procedures may have been a better choice as they are very robust at handling departures from normality and outperform Poisson regression for data distributed as Poisson. Third, it is unclear how R^2 (coefficient of determination) for the covariate relationships was calculated and where the quadratic fit (a non-linear equation) comes from because there is no mention of fitting a non-linear model. Fourth, the models selected by AIC were not really used for inference. Instead, the authors relied on what seemed to be normal-based regressions with quadratic structures (details were not clear in methods) to make their points afterwards. These models were not included in the published model set. The models presented in Figures 1, 2, and 3 were never included in the model set examined with AIC (e.g., quadratic structures, including variables such as proportion of wolves killed). The proportion of wolves killed variable seemed more meaningful than just numbers killed so that any increase or decrease in wolf population size would have been considered and could have been included in the AIC model set.

- The authors are unable to estimate proportion of variation in data explained by models, which is needed and can be done efficiently using a MLE (maximum-likelihood estimation) framework. AIC is only a relative measure, and AICc (AIC corrected for small sample size) should have at least been used instead. The manner in which AIC was used in this article suggests the authors were not very careful in their approach. For example, the authors state that their main effects for the best AIC models in Table 1 were all significant, yet CATTLE was not significant in any of them (see Table 2). Further, models 12 and 13 were the same as model 10, but with an uninformative interaction; however, the authors spend time discussing all three. Model selection through cross-validation would have been more appropriate to avoid overfitting the data.
- The model needs an offset. As presented, the authors are assuming that there is equal opportunity for depredation in each state in each year. Difference in livestock numbers by state and year need to be accounted for. Along similar lines, the number of wolves removed seems irrelevant in the absence of the total number of wolves on the landscape. For example, it is relevant to know if there were five of 50 wolves removed or five of 50,000.
- The data are likely confounded. For example, the number of breeding pairs does not always correlate with the number of packs (e.g., Idaho in final 5 years of study), which would confound those data. Further, wolf numbers, depredations, and removal numbers are likely to be serially correlated.

- Focus of results – First, the discussion and media coverage of this article have shown bias by focusing solely on the left side of the figures. This side illustrates killing equal or less than 25% of a population may increase subsequent year's depredations. However, one could just as easily focus on the right side of the figures, where removing more than 25% of the wolves does reduce livestock depredation in the subsequent year. Anti-wolf groups could easily point to the right side of the figures as a call to ensure additional wolves are killed each year and be equally justified. Second, the results suggest that more breeding pairs result in more depredation events. Yet, the discussion does not point out the potential conflict between this increase in wolf numbers and the percentage of wolves removed. Third, the authors note an immediate increase in compensatory reproductive output but they also argue that dissolution of pack territories is possible. Because there is a lack of temporal scale associated with the data (e.g., were wolves removed just before

breeding season when compensatory response is unlikely or in summer when a new pack may have had time to establish), it is unclear which point is valid.

Conclusion:

As highlighted here, there are many flaws to the Wielgus and Peebles article that are evident to NWRC scientists. Until these problems are addressed, using an article such as this to guide wildlife management could lead to faulty decisions. The best available science should be used instead.

[1]Explained in Wagenmakers & Farrell (2004) and references therein.

Wagenmakers, E. J., & Farrell, S. (2004). AIC model selection using Akaike weights. Psychonomic Bulletin & Review, 11(1), 192-196.

[2]See Whittingham et al. (2006) and references therein.

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