ENVIRONMENTAL ASSESSMENT

PREDATOR DAMAGE MANAGEMENT IN ARIZONA

Prepared by:

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

in consultation with:

Arizona Department of Agriculture

Arizona Game and Fish Department

Arizona State Land Department

U.S. Fish and Wildlife Service

Bureau of Land Management

U.S. Forest Service

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ACRONYMS USED

ADA	Arizona Department of Agriculture
AGFD	Arizona Game and Fish Department
AGL	Above Ground Level
ANG	Air National Guard
APHIS	Animal and Plant Health Inspection Service
ARS	Arizona Revised Statutes
AUM	Animal Unit Month
BISON-M	Biota Information System of New Mexico
BLM	Bureau of Land Management
BO	Biological Opinion
CDOW	Colorado Division of Wildlife
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CY	Calander Year
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FY	Fiscal Year
GAV	General Aviation
GMU	Game Management Unit
HCN	Hydrogen Cyanide Gas
HHS	Human Health and Safety
IWDM	Integrated Wildlife Damage Management
LRMP	Land and Resource Management Plan
MIS	Management Information System
MOU	Memorandum of Understanding
NASS	National Agriculture Statistics Service
NEPA	National Environmental Policy Act
NF	National Forest
NHPA	National Historical Preservation Act
NMFS	National Marine Fisheries Services
NOAA	National Oceanic and Atmospheric Administration
PDM	Predator Damage Management
RA	Resource Area (BLM)
RMP	Resource Management Plan
ROD	Record of Decision
SMA	Special Management Area
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USC	U.S. Codes
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WA	Wilderness Area
WDM	Wildlife Damage Management
WP	Work Plan
WS	Wildlife Services
WSA	Wilderness Study Area
WT	Work Task

MEASUREMENT ABBREVIATIONS

cc	Cubic centimeter = milliliter
cdBA	Corrected Noise Level in A-weighted Decibels
dBA	A-weighted Decibels
g	gram
kg	kilogram
mg	milligram
ppb	parts per billion
ppm	parts per million

CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

This chapter provides the foundation for:

- Understanding why wildlife damage occurs and the practice of wildlife and predator damage management (PDM);
- Knowing the statutory authorities and roles of federal and state agencies in managing damage caused by predators in Arizona;
- Understanding how WS-Arizona cooperates with and assists private and commercial resource owners and federal, tribal, state and local government agencies in managing predator damage;
- Providing the framework for the scope of this National Environmental Policy Act (NEPA) document, the rationale for preparing an environmental assessment (EA), program goals, and decisions to be made by WS-Arizona;
- Understanding the reasons why private and commercial entities, tribes, and federal, state, and local government agencies request assistance from WS-Arizona;
- Understanding the effectiveness and cost-effectiveness associated with PDM in the United States; and
- The public involvement and notification processes used by WS-Arizona for this EA.

1.1. INTRODUCTION

Across the United States, wildlife habitat has been altered as human populations expanded and land was transformed to meet varying human needs. These changes have often caused increases in conflicts between people and wildlife. Some species of wildlife have adapted and thrived in the presence of people while others have not (Conover 2002). This, in combination with today's economic pressures and heightened awareness of environmental issues has increased the complexity of wildlife management.

While wildlife is a valuable natural resource, some species of wildlife can cause problems with human interests. U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) has personnel with expertise to respond to damage caused by wildlife, including predatory species.

APHIS-WS' activities are conducted to prevent or reduce wildlife damage to agricultural, industrial, and natural resources; property; livestock; and threats to public health and safety on private and public lands in cooperation with federal, State and local agencies, tribes, private organizations, and individuals. The APHIS-WS program uses an Integrated Wildlife Damage Management (IWDM) approach (WS Directive 2.105[1]) in which a combination of methods may be recommended or used sequentially or concurrently to reduce wildlife damage. These methods may include nonlethal methods, such as cultural practices, habitat manipulation, exclusion, or behavioral modification of the offending species. Implementation of IWDM may also require the relocation or lethal control of specific offending animals or the reduction of a local population by lethal means. Program activities are not based on punishing offending animals, but

[1] The APHIS-WS Policy Manual provides guidance for APHIS-WS personnel to conduct wildlife damage management activities through Program Directives. APHIS-WS Directives referenced in this EA can be found in the manual or online (https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/SA_WS_Program_Directives) but will not be referenced in the Literature Cited.

are conducted to reduce damage and risks to human and livestock health and safety, and are implemented as part of the WS Decision Model process for resolving conflicts with wildlife (Slate et al. 1992). Use of the APHIS-WS Decision Model facilitates development of site-specific IWDM strategies for each wildlife/human conflict addressed by APHIS-WS.

This EA identifies the issues analyzed in detail and describes the proposed action and alternatives evaluated in detail, with the rationale why some alternatives are not further considered in detail, as required by the Council on Environmental Quality (CEQ) implementing regulations for NEPA at 40 CFR 1502.14(a). Details of the different wildlife damage management (WDM) methodologies are also included in the EA. The EA also provides the detailed comparative analysis of the direct, indirect, and cumulative impacts of the proposed action and alternatives on the quality of the human environment.

1.1.1. Wildlife Services Program

The resolution of conflicts caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 2016, Reidinger and Miller 2013). USDA APHIS-WS is authorized by Congress to manage a program to reduce human-wildlife conflicts; this Environmental Assessment (EA) evaluates methods by which this authority can be carried out in Arizona. Wildlife damage management is often misunderstood and many individuals consider management options as only lethal. Wildlife damage management is a specialized field within the wildlife management profession and decisions are not predicated solely on biological rationale. Responsible wildlife management requires adherence to professional standards as exemplified by The Wildlife Society (TWS). These objectives are to: 1) develop and promote sound stewardship of wildlife resources and the environments upon which wildlife and humans depend, 2) undertake an active role in preventing human-induced environmental degradation, 3) increase awareness and appreciation of wildlife values, and 4) seek the highest standards in all activities of the wildlife profession (The Wildlife Society 2016). The mission of the Wildlife Damage Management Working Group of The Wildlife Society is to promote better understanding of the challenges of managing human-wildlife conflicts and to provide a forum for TWS members to advance their skills and knowledge of wildlife damage management practices (http://joomla.wildlife.org/WildlifeDamage/).

APHIS-WS' mission (USDA APHIS WS 2009), developed through a strategic planning process (USDA APHIS WS 2009), is "*To provide Federal leadership in managing conflicts with wildlife. WS recognizes that wildlife is an important public resource greatly valued by the American people. 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 negatively affect industrial and natural resources. WS conducts research and provides technical assistance and operational assistance programs to resolve problems that occur when human activity and wildlife conflict with one another*."

The APHIS-WS authorities cited above plus other statutory authorities enable APHIS-WS to enter into cooperative agreements with federal and state agencies, local jurisdictions, individuals, and public and private agencies, organizations, and institutions to reduce the risks of injurious animal species and/or nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases. Therefore, wildlife damage management is not based on punishing animals but as one means of reducing damage, with actions being implemented using the WS Decision Model (Slate et al. 1992, WS Directive 2.201). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated. The need for action is derived from the specific threats to resources or the public.

The WS program in Arizona (WS-Arizona) is a cooperatively-funded, service-oriented program that provides assistance to requesting public and private entities (WS Directives 3.101 and 3.110). WS-Arizona responds to requests for assistance when valued resources are lost, damaged, or threatened by wildlife. Responses can be in the form of technical assistance or operational damage management. The degree of WS-Arizona involvement varies, depending on the complexity of the wildlife problem. WS-Arizona activities are conducted in accordance with applicable federal, tribal, state, and local laws, cooperative agreements, work initiation documents, work plans, Memoranda of Understating (MOUs), and other applicable documents. These documents establish the need for the requested work, legal authorities authorizing the requested work, and the responsibilities of WS-Arizona and its cooperators.

WS-Arizona PDM is conducted in cooperation with other federal, state, and local agencies, as well as private organizations and individuals and recognizes that wildlife is an important public resource greatly valued by the American people. By its very nature, however, wildlife is a highly dynamic and mobile resource that can damage agricultural and industrial resources, pose risks to human health and safety (HHS), and affect other natural resources. The WS-Arizona program carries out its federal responsibility to help solve problems that occur when human activities and wildlife conflict through:

A) Training of wildlife damage management professionals;
B) Developing and improving strategies to reduce economic losses and threats to humans from wildlife;
C) Collecting, evaluating, and disseminating management information;
D) Developing and conducting cooperative wildlife damage management programs;
E) Informing and educating the public on how to reduce wildlife damage; and
F) Providing technical advice and a source for management materials and equipment such as pesticides, cage traps, and pyrotechnics.

The WS Policy Manual outlines the mission of the program and provides guidance for engaging in wildlife damage management activities. WS-Arizona personnel abide by the WS mission and policies. Before wildlife damage management is implemented, an agreement must be signed by WS and the landowner or manager, or a Work Plan must be presented to the land management administrator or agency representative for their review. WS-Arizona cooperates with land and wildlife management agencies when appropriate and as requested to combine efforts to effectively and efficiently resolve wildlife damage problems in compliance with all applicable federal, state, and local laws and MOUs between WS and other agencies. A primary cooperator of the WS-Arizona Program, by legislation, is the Arizona Department of Agriculture (ADA) (Arizona Revised Statutes [ARS] 3-2401). ADA's mission and support of WS-Arizona is primarily focused on the development and protection of agriculture. The relationship and responsibilities between WS-Arizona and ADA are defined in a Memorandum of Understanding (MOU) signed on August 14, 1997. Under the MOU and state regulations, WS-Arizona has the authority to respond to damage requests for agriculture-related resources from predator, furbearer, game and nongame species.

The Arizona Game and Fish Department (AGFD) is another primary cooperator with WS-Arizona for PDM. AGDF has management authority over native and introduced wildlife in Arizona (ARS 17-102). AGFD's authority includes all of the species discussed in the introduction except feral domestic pets (dogs, cats, and ferrets) nor feral livestock. AGFD manages many wildlife species, but species most likely to be involved in PDM include big game (mountain lions and black bears), furbearers (badgers, otters, raccoons, ringtails, and weasels), predators (coyotes, bobcats, foxes, and skunks) and nongame (opossum) under Arizona statutes. WS-Arizona and AGFD have an MOU that was signed on February 27, 1991, which lists responsibilities and authorities as they relate to PDM. Under the MOU, WS-Arizona has the authority to respond to damage requests resulting from mountain lions and black bears, predators, furbearers, and nongame, and provides information on take of these species annually to AGFD.

WS-Arizona obtains any necessary permits to conduct PDM from the USFWS and/or AGFD. National level MOUs were signed between WS and Bureau of Land Management (BLM) in 2012 and between WS and U.S. Forest Service (USFS) in 2017. These MOUs transferred the responsibilities for wildlife damage management and related NEPA compliance from BLM and USFS to WS.

Numerous tribes have lands in Arizona and have jurisdiction over those lands and associated wildlife including the management of predators. AGFD does not regulate wildlife, including predators, on tribal lands nor do they report on any wildlife population or harvest data from tribal lands. WS-Arizona cooperates with several tribes in Arizona and provides PDM for them. WS-Arizona also cooperates with several counties in Arizona as allowed by state law (ARS 3-2405), and focuses most PDM efforts in these areas where funding allows for staffing. The State of Arizona and tribes generally have their own laws regarding feral animal control and WS-Arizona, by policy, complies with those applicable laws when cooperating on PDM efforts.

WS-Arizona may provide wildlife damage assistance as requested for governmental agencies, Tribes, state agencies, counties, organizations, and private individuals.

Further, federal agencies which fund, support, permit, or implement programs and activities are required to take into consideration the environmental consequences of Preferred Alternatives in their decision making process under the National Environmental Policy Act (NEPA). The intent of NEPA is to: 1) facilitate planning; 2) promote interagency coordination; 3) streamline program management; 4) clearly communicate to the public the analysis of individual and cumulative impacts of management alternatives; and 5) evaluate and determine any potentially significant or cumulative effects from the various alternatives for addressing the need for action. Normally, according to APHIS procedures for implementing NEPA, individual wildlife damage management actions could be categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6,000-6,003, 1995). However, this EA was prepared to facilitate planning, interagency coordination, streamline program management, and to communicate with the public the analysis of cumulative impacts. In previous NEPA analyses, the WS program determined that an Environmental Impact Statement (EIS) was not required (WS 1996, 1999a) and that preparation of an EA for WS-Arizona PDM on all land classes in Arizona complied with NEPA, and with CEQ (40 CFR 1500) and APHIS NEPA implementing regulations (7 CFR 372). If a determination is made otherwise through this NEPA analysis, WS-Arizona would complete an EIS.

This EA evaluates ways that APHIS-WS' authority could be carried out to resolve conflicts with predatory mammalian species in Arizona. This EA evaluates alternatives for the WS-Arizona program to minimize mammalian predator damage in Arizona and proposes to continue conducting PDM activities under a programmatic approach in the state. Mammalian predators considered in this EA include 18 native and 3 feral species.

Four additional mammalian predator species that are or potentially could be found in Arizona include the reintroduced populations of the black-footed ferret[2] and Mexican gray wolf, and the endangered native populations of the jaguar and ocelot. All are federally listed threatened and endangered (T&E) species. The U.S. Fish and Wildlife Service (USFWS) has management authority over these species unless USFWS has authorized AGFD responsibility. A MOU between these two agencies outlines which agency has the lead for which species recovery. Currently, AGFD is the lead for reintroduction of black-footed ferrets. These four species could possibly cause conflicts with human endeavors or be encountered during PDM activities targeting the predators already discussed above. The native population of black-footed ferrets is believed to have been extirpated, but a population was reintroduced into northwestern Arizona as a nonessential, experimental population (NEP). The native endangered population of the Mexican gray wolf is believed to be extirpated in Arizona and was reintroduced in eastern Arizona and western New Mexico as a NEP. The endangered jaguar, a rare, but regular wanderer into southeast Arizona, has been photographed in the borderland regions of southeastern Arizona. The ocelot, another endangered species, has recently been documented in southeastern Arizona. WS-Arizona has received requests for assistance with Mexican wolf, jaguar, and ocelot. WS-Arizona had an annual average of 31, 1, and 0 direct control work tasks, respectively, associated with the Mexican wolf, jaguar, and ocelot from FY11 to FY15; most were technical assistance related calls. PDM could be initiated to target these species for problems associated with them, in coordination with USFWS, ADFG and/or other management agencies and under additional NEPA analysis. The black-footed ferret will not likely ever be responsible for damage, but work tasks could be associated with protecting them such as application of an insecticide or a sylvatic plague vaccine to reduce the possibility of a plague outbreak in the Gunnison's prairie dog (*Cynomys gunnisoni*) colony where they live. Any field activities associated with these species would be covered in other National Environmental Policy Act (NEPA) documents and not in this EA.

1.1.2. Background

Across the United States, wildlife habitat has substantially changed as human populations have expanded and land has been transformed to meet varying human needs. These changes often compete with wildlife and have inherently increased the potential for conflicts between wildlife and people. Some species of wildlife have adapted to and thrive in the presence of humans and the habitat changes that have been made. These adapted and thriving species, are often responsible for the majority of conflicting activities between humans and wildlife.

USDA is authorized and directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authorities for the WS program are the Act of March 2, 1931 (46 Stat. 1468; 7 USCA (U.S. Code) 8351-8352) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 USCA 8353). To protect American resources, WS conducts WDM. This EA describes a portion of the larger WDM responsibility, PDM.

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[2] Scientific names for endangered species are given in Tables 7 and 9.

Generally speaking, WDM is defined as the alleviation of damage or other problems caused by wildlife (Leopold 1933, Berryman 1991, The Wildlife Society 1992). WS has a Policy Manual[3] that reflects this mission and provides guidance for engaging in WDM activities. WS uses an Integrated WDM (IWDM) approach including nonlethal strategies such as the modification of the habitat or offending animal's behavior, and control of the offending animal(s) or local population of the offending species with lethal or nonlethal methods (WS Directive 2.105). The goal of the IWDM approach is to stop wildlife damage or reduce it to a tolerable level. Wildlife damage is also reduced via state hunting and trapping seasons that aim to maintain predator populations at sustainable levels. Without hunting and trapping, estimates suggest that the costs associated with wildlife damage would increase from $20 billion to $70 billion in the United States, resulting in the public becoming less tolerant of wildlife (International Association of Fish and Wildlife Agencies 2005).

WS recognizes that native predatory wildlife play a vital role in a healthy ecosystem; however, predatory animals can also cause damage or pose a threat to resources, including HHS. Predators have no intent to do harm but rather they use habitats (*e.g.*, feed, shelter, reproduce) where they can find a niche. If their activities result in lost value of resources or threaten HHS, people often characterize this as damage. When damage exceeds or threatens to exceed an economic threshold or poses a threat to HHS, WS often receives a request for assistance. The threshold triggering a request for assistance is often unique to the individual person requesting assistance and many factors can influence when people request assistance (*e.g.*, economic, social, aesthetics). Therefore, what constitutes damage is often unique to the individual person. What one individual person considers damage, another person may not consider as damage. However, the use of the term "damage" is consistently used to describe situations where the individual person has determined the losses associated with wildlife is actual damage requiring assistance (*i.e.,* has reached an individual threshold). Many people define the term "damage" as economic losses to resources or threats to HHS; however, "damage" could also occur from a loss in the aesthetic value of property and other situations where the behavior of wildlife was no longer tolerable to an individual person. The threat of damage or loss of resources is often sufficient for people to initiate individual actions and the need for damage management could occur from specific threats to resources.

1.1.3. The WS-Arizona Program

PDM has been conducted by WS-Arizona since 1914 in Arizona under different names and agencies to protect agricultural and natural resources, property, and HHS. WS-Arizona responds to wildlife damage complaints from many different types of cooperators ranging from private citizens to other agencies throughout Arizona. The majority of PDM work WS-Arizona conducts is to resolve conflicts between coyotes, mountain lions, skunks, and feral dogs and livestock and HHS. As shown in Table 1, the majority of work tasks in Arizona involve coyote damage management. WS-Arizona did not receive any requests for assistance for the North American river otter (*Lontra canadensis*), from FY11 to FY15, but has provided assistance with capturing and relocating some individuals in the past. In FY2017, WS-Arizona assisted AGFD with managing two North American river otters that were posing a direct threat to human health and safety at Bartlett Lake, Maricopa County, AZ. These river otters were live captured and translocated to AGFD's Adobe Wildlife Facility. Table 1 provides the number

[3] The WS Policy Manual provides guidance for WS personnel to conduct WDM activities through Directives. WS Directives referenced in this EA can be found in the manual, and are specifically referenced as applicable in this EA by WS Directive number. The WS Policy Manual is located at: https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/SA_WS_Program_Directives

of work tasks WS-Arizona conducted for damage caused by the 21 covered by this EA, from FY11 to FY15 (MIS 2016).

AGFD may issue permits to take predators to regulate and control take, except on tribal lands. Tribes may request assistance from WS-Arizona and have authority to allow or permit take of predators on their lands. WS-Arizona may act as an agent for entities requesting assistance with depredations.

Arizona encompasses about 114,006 mi^2 (73 million acres) in 15 counties (Figure 1). Land in the state is comprised of about 27% tribal, 17% BLM (12.2 million acres), 15% USFS (Apache-Sitgreaves National Forest [NF] 2 million acres, Coconino NF 1.8 million acres, Coronado NF 1.7 million acres, Kaibab NF 1.6 million acres, Prescott NF 1.25 million acres, and Tonto NF 2.9 million acres), 14% private, 13% state (9.3 million acres), 10% other federal agency, and less than 1% local government lands. The State is managed under one geographic management unit.

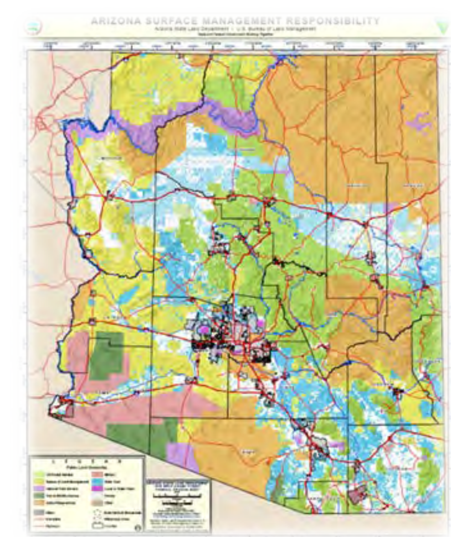

Figure 1. Map of Arizona showing tribal lands, public lands, and counties.

Table 1. Average annual work tasks and value recorded by WS-Arizona in Arizona for those predators, in current general taxonomic order, that WS-Arizona conducted PDM from FY11 to FY15.

Species	Resource Category								TOTAL	
	Agriculture		Property		Human Safety		Natural Resources			
	WTs	Value	WTs	Value	WTs	Value	WTs	Value	WTs	Value
Virginia Opossum			0.2	$0	1	$0			**1.2**	**$0**
Long-tailed Weasel					0.2	$0			**0.2**	**$0**
Feral Domestic Ferret					0.4	$0			**0.4**	**$0**
American Badger	1.6		0.8		1		1		**4.4**	**$0**
Striped Skunk	1.6	$53	12.8		156.6				**171**	**$53**
Hooded Skunk			1.4	$12	43.4	$20			**44.8**	**$32**
Hog-nosed Skunk			0.2		11.4				**11.6**	**$0**
W. Spotted Skunk			0.2		0.4	$20			**0.6**	**$20**
Common Raccoon	1.2	$19	6.8	$195	25.8		6		**39.8**	**$214**
White-nosed Coati			0.6		1.6				**2.2**	**$0**
Ringtail			0.6		1.8				**2.4**	**$0**
Black Bear	14.4	$3,575	0.8	$1,900	24.4		0.2		**39.8**	**$5,475**
Coyote	150	$23,801	15.6	$301	61.8		7.2		**235**	**$24,102**
Feral Dog	48.6	$10,254	1.6	$80	2.706	$200			**52.906**	**$10,534**
Common Gray Fox	0.8		1.2		16.6				**18.6**	**$0**
Kit Fox	0.2				0.4				**0.6**	**$0**
Red Fox					0.2				**0.2**	**$0**
Mountain Lion	203.8	$37,488	0.2		9.2				**213.2**	**$37,488**
Feral Cat	0.2		4.2		39.8				**44.2**	**$0**
Bobcat	4	$83	1		9.4				**14.4**	**$83**
River Otter									**0.0**	**$0**
TOTAL	426	$75,273	48	$2,488	407	$240	14.4	$0	**895**	**$78,001**

WS-Arizona personnel receive requests to conduct PDM throughout the various counties and Districts on private, federal, state, tribal, county, and municipal lands. At a minimum, all requesters are provided with technical assistance (self-help information). Before operational PDM is conducted, *Work Initiation Documents* signed by WS-Arizona and the land owner or administrator or *WS-Arizona Work Plans (WP)* discussed with the land managing agency.

The MOUs that WS-Arizona has with ADA, ASLD, and AGFD outline the cooperative relationship between these agencies and WS-Arizona, and the responsibilities for each agency when responding to PDM requests for the different species they manage. AGFD, ADA, USFWS, and Tribes have management authority over most native predators and WS-Arizona works with these entities to obtain the necessary documentation such as permits needed to conduct PDM. Feral dogs, feral cats, and feral domestic ferrets are managed under the authority of applicable County Boards of Supervisors. WS-Arizona responds to complaints involving feral predators at the request of the appropriate Animal Control Office, County Sheriff, Health Department, Tribal authority, land or wildlife managing agency if the agency wants assistance with a problem. If the agency requests assistance, WS-Arizona gets an agreement or approval to work. WS-Arizona refers complaints involving T&E species to USFWS, unless coordinated otherwise in an MOU or 10j. None of the predators covered in this EA are federally listed T&E species but WS-Arizona, under the direction and guidance of USFWS, may respond to complaints involving predator species under provisions of the Endangered Species Act (ESA) and NEPA documentation.

The analysis in this EA includes a major effort to consider existing data contained in other NEPA and related documents. WS-Arizona completed two EAs for PDM in Arizona on private, tribal and other non-federal lands (WS 1996) and on federal public lands (WS 1999a). This EA combines the analysis of federal public lands with non-federal lands into one comprehensive statewide EA to provide a more uniform approach for PDM throughout the state. Other State WS Programs have used this approach and found that a comprehensive EA provided a more usable working tool for coordination with all cooperating agencies and promotes consistency in PDM activities by WS throughout the state. This EA and its associated final Decision will supersede prior EAs for PDM in Arizona.

This EA includes the following predator species (in order of proportion of take by WS-Arizona (Table 2). All species except for free-ranging/feral dogs, free-ranging/feral cats, and feral domestic ferrets are managed under state law by AGFD.

Table 2. Predator Species Included in Scope of this EA.

Common Name	Scientific Name	Managed By[1,2]
Coyote	*Canis latrans*	AGFD
Feral/Free-ranging/hybrid dog	*Canis familiaris*	Local Officials
Striped skunk	*Mephitis mephitis*	AGFD
Mountain Lion	*Felis concolor*	AGFD
Raccoon	*Procyon lotor*	AGFD
Free-ranging/feral cat	*Felis domesticus*	Local Officials
Hooded skunk	*Mephitis macroura*	AGFD
Black bear	*Ursus americanus*	AGFD
Badger	*Taxidea taxus*	AGFD
Gray Fox	*Urocyon cinereoargenteus*	AGFD
Bobcat	*Lynx rufus*	AGFD
Western Spotted skunk	*Spilogale gracilis*	AGFD
American Hog- Nosed skunk	*Conepatus leuconotus*	AGFD
Kit Fox	*Vulpes macrotis*	AGFD
White-nosed coati	*Nasua narica*	AGFD
Red fox	*Vulpes vulpes*	AGFD
Ringtail	*Bassariscus astutus*	AGFD
Virginia Opossum	*Didelphis virginianus*	AGFD
North American river otter	*Lontra canadensis*	AGFD
Feral domestic ferrets	*Mustela putorius furo*	Local Officials
Long-tailed Weasels	*Mustela frenata*	AGFD

[1] AGFD: Arizona Game and Fish Department

[2] Tribes have management authority of wildlife on their lands.

Potential impacts of WS-Arizona providing assistance to federal and state agencies with Mexican gray wolf (*Canis lupus baileyi*) damage management in Arizona are evaluated independently of this EA (EIS dated 2014). WS-Arizona believes that PDM associated with the Mexican gray wolf (federally-listed per the Endangered Species Act in some portions of the state and state-listed throughout the state), in cooperation with AGFD and the US Fish and Wildlife Service (USFWS), is sufficiently different from the predators included in this EA that its independent evaluation is warranted.

1.1.4. Purpose of EA

APHIS-WS provides Federal professional leadership and expertise to resolve wildlife conflicts to help create a balance that allows people and wildlife to coexist. APHIS-WS recommends and/or implements a cohesive integrated wildlife damage approach, which incorporates biological, economic, environmental, legal and other information into a transparent wildlife damage management decision-making process, and includes many methods for managing wildlife damage, including non-lethal and lethal options. Although non-lethal methods should be considered first, responsible wildlife damage management sometimes requires lethal control to meet cooperators' objectives. In addressing conflicts between wildlife and people, consideration must be given not only to the needs of those directly affected by wildlife damage but also to a range of environmental, sociocultural, economic, and other relevant factors. Federal and state agency and private wildlife managers, including those working for APHIS-WS, must be experienced in evaluating the particular circumstances, determining which predator species are involved, and expertly implementing or recommending the most effective strategy using sustainable methods that balance those considerations.

This environmental assessment (EA) evaluates the impacts of five alternative approaches to PDM in Arizona, including the current program. The purpose of the EA is to assist APHIS-WS to understand the options and the associated comparative impacts of each, and make an informed decision regarding managing the WS-Arizona integrated predator damage management approach to responding to requests for assistance.

Even though the wildlife species can be biologically categorized in many different ways, this EA is focused on species that are considered meat-eating predators, even if some of them eat food other than meat as part of their diet. Therefore, for the purposes of this EA, we will refer to all these species as "predators" and, from this point on in this EA, we will refer to the overall strategies, approaches, and actions taken by WS-Arizona to address predator damage as PDM. If the EA is talking about wildlife damage management in general, it will be called wildlife damage management (WDM). It is important to remember that the WS-Arizona assistance provided to requesters for managing predator damage evaluated in this EA is simply a component of the total WS-Arizona wildlife damage management activities conducted in Arizona. NEPA analysis of other components of the WS-Arizona activities that do not involve predators are evaluated in separate documents.

This EA also provides sufficient analysis of impacts to determine if a Finding of No Significant Impact FONSI) or an environmental impact statement (EIS) is appropriate. The five alternatives considered in this EA vary regarding the degree of WS-Arizona involvement in PDM, the degree of technical assistance and operational assistance (advice, information, education, and/or demonstrations) and of operational field assistance (active management of offending predators), and the degree of lethal and non-lethal methods available for use.

The goal of the WS-Arizona IPDM program, as conducted in the current program in Arizona, is to manage predator damage, threats of damage, and risks to human/pet health and/or safety by responding to all requests for assistance, including technical assistance and/or direct operational assistance, regardless of the source of the request, private or public (Section 1.2.2, and 1.2.3).

WS-Arizona proposes to continue responding to requests for PDM assistance for the protection of livestock; property; human/pet health and safety; and natural resources; as well as collecting disease data for researchers. The EA includes an analysis of the impacts associated with continuing to assist with PDM on all land classes, including federal, tribal, state, county, municipal, airports, and private properties in rural, urban and suburban areas where WS- Arizona personnel have been and may be requested to assist, based on agreements between WS- Arizona and the requesting entity. It also includes analysis of impacts of four other Alternatives of PDM activities in Arizona both involving and not involving WS- Arizona.

The proposed action (Alternative 5; Section 3.1.5), involves WS-Arizona continuing use of all appropriate methods, used singly or in combination, to resolve damage caused by predator species included in this EA. These methods include cultural practices such as shed lambing, herding, and guard animals; habitat and animal and behavior modification such as exclusion, chemical repellents, and hazing with pyrotechnics; and lethal operational actions such as trapping and shooting. In many situations, implementation of non-lethal methods, such as exclusion-type barriers, and some lethal methods, consistent with state law, are the responsibility of the requestor to implement. Resource owners that are given direct PDM assistance by WS-Arizona are encouraged to use reasonable and effective non-lethal management strategies and sound husbandry practices, when and where appropriate, to reduce potential and ongoing conflict situations.

1.1.5. Summary of Preferred Alternative

The Preferred Alternative is to continue current integrated PDM program in Arizona for the protection of livestock, crops, property, HHS, and natural resources, as assessed in this EA. The objective of PDM in the Preferred Alternative would be to minimize loss or the risk of loss to the above resources from predation by responding to all public requests with technical assistance (advice or demonstrations) or operational management. WS-Arizona personnel will provide technical assistance to resource owners on a variety of methods that can be used to resolve problems where it is appropriate for resource owners to resolve these problems themselves. WS-Arizona will also assist resource owners through educational programs on damage identification, prevention, and reduction, and by providing information on PDM methods such as guard dogs or by temporarily loaning equipment, such as cage traps.

Operational support will mostly be provided in situations that require the use of methods and techniques that are challenging or unsuitable for the public to implement, especially those that may involve lethal management measures. Operational efforts often require costly expenditures for supplies and staff hours and, therefore, are most often provided where cooperative funding is available. Resource owners that are provided operational assistance would also be encouraged to use management strategies and sound husbandry practices, when and where appropriate, that could further reduce damage.

The current and proposed program is an IWDM program which encourages the use of all effective and appropriate available legal techniques and methods, used singly or in combination, to meet the needs of the requestors for resolving conflicts with predation. When appropriate, non-lethal methods, such as physical exclusion, habitat modification or harassment, would be recommended or utilized to reduce damage. In other situations, predators could be removed as humanely as practicable using shooting, trapping, registered pesticides and other methods. In determining the damage management strategy, preference would be given to practical and effective non-lethal methods (WS Directive 2.101). However, under the current and proposed program, non-lethal methods may not always be applied as a first response to each damage problem based on the level of risk. The most appropriate response could be a combination of non-lethal and lethal methods or could include instances where lethal methods alone would be the most appropriate strategy (*i.e.,* HHS). All WS-Arizona PDM would be conducted in compliance with applicable federal, state, tribal, and local laws, regulations, WS directives, and would be closely coordinated with all applicable resource management agencies. PDM situations often require professional expertise, an organized management effort, and may include the use of several of the available methods to sufficiently reduce or resolve damage. Using IWDM effectively is the task of WS-Arizona personnel, who are trained professionals and equipped to handle damage situations. Resource factors, including species, location and type of damage, as well as available cost-efficient and legal methods will be analyzed by WS-Arizona personnel before determining the best action to take to reduce or eliminate a conflict with predation (WS Directive 2.101, 2.201).

A wide range of methods is available for resource owners and WS-Arizona personnel to resolve depredation situations. These fall into the following categories: cultural practices (*e.g*., shed lambing and use of guard animals); habitat and behavior modification (*e.g*., exclusion, use of chemical repellents, and hazing with pyrotechnics); and operational actions (*e.g*., trapping, shooting, and use of pesticides). Operational methods used by WS-Arizona personnel may include shooting, calling and shooting, aerial shooting, trapping, snaring, denning, and the use of M-44s, gas cartridges and decoy and tracking/trailing dogs. Operational techniques are primarily used for lethal management actions. PDM would be allowed in Arizona under the Preferred Alternative when and where requested on private and non-private lands where assigned "Work Initiation Document" or work plans are in place. All PDM will comply with applicable federal, state, and local laws and current MOUs between WS-Arizona and the various management agencies. WS-Arizona personnel will communicate with other agency personnel as appropriate.

1.2. NEED FOR ACTION

Two independent government audits, one conducted at the request of Congress, the other based on complaints from the public and animal welfare groups to the US Department of Agriculture (Section 2.3.11.2.1), found that, despite cooperator implementation of non-lethal actions such as fencing and herding, a need exists for APHIS-WS' PDM activities. APHIS-WS management actions for predator damage was determined by these audits to be needed for protecting human safety and health; protection of crops and livestock; protection of other species, including threatened and endangered species, game and furbearer species, and recently reintroduced native species, as determined by the wildlife management agency; and protection of property and other assets.

As stated in Section 1.1.2, in some cases, cooperators likely tolerate some damage and loss until the damage reaches a threshold where the damage becomes an economic, physical, or emotional burden. The appropriate level of tolerance or threshold before using non-lethal and lethal methods differs among cooperators, their economic circumstances, and the extent, type, duration, and chronic nature of damage situations. The level of tolerance would be lower for situations in which human safety or the potential for disease transmission from wildlife to humans is at risk. For example, action must be taken immediately in the case of aircraft striking predators at an airport that can lead to significant property damage and risks to passenger safety, or when a coyote acting aggressively in a residential area might be either habituated to humans or diseased. In cases where the affected entity is concerned with the threat of damage, the entity has often experienced damage in the past and it is reasonably foreseeable to assume that damage will occur again.

The point at which a particular entity affected by predator damage reaches their tolerance threshold and requests assistance is affected by many variable specific to the affected entity. Therefore, it is not possible to set a pre-determined threshold before a need for PDM is determined to exist. WS-Arizona is not required to assess the economic value of a particular loss or threat of loss before taking a PDM action, and WS-Arizona responds regardless of the category of requestor. However, APHIS-WS does use a standard methodology for evaluating the value of a verified loss using national data and other factors, as well as economic values provided by the cooperator at the time of evaluation and service.

WS-Arizona recognizes that increasing numbers of people moving into rural areas or living in urban areas with increasing populations of wildlife are often unfamiliar with wildlife and may become anxious with wildlife encounters, especially encounters with predators. Therefore, WS-Arizona commonly provides technical assistance, including advice, training, and educational materials, to individuals, communities, and groups to better understand how to coexist with wildlife and reduce the potential for conflicts.

Whenever possible, WS-Arizona personnel recommend that cooperators take non-lethal action in lieu of or in addition to direct and sometimes lethal actions taken by WS-Arizona personnel. However, the appropriate strategy for a particular set of circumstances must be determined on a case-by-case basis, using the APHIS-WS Decision Model.

By its very nature, wildlife is a highly dynamic and mobile resource that can damage agricultural and natural resources, property, and pose risks to HHS. The WS program carries out its federal wildlife damage management responsibility (Act of March 2, 1931, as amended, 7 U.S.C. 8351-8352 and the Act of December 22, 1987, 7 U.S.C. 8353) to solve problems that occur when human activities and wildlife conflict, while recognizing that wildlife is an important public resource valued by the American people.

The impacts of wildlife damage within the United States affect a variety of human interests, including HHS, crops and livestock, natural resources, and personal property (Conover et al. 1995). When questioned about the negative impacts of wildlife, 80% of ranchers and farmers reported some type of wildlife damage and 53% said the losses exceeded their tolerance limits (Conover 1998). The impacts of wildlife-related damages are influenced by a number of factors, including regulated hunting and trapping. The International Association of Fish and Wildlife Agencies (2004) estimated that without regulated hunting and trapping, wildlife damage to livestock and poultry would increase 221% to an estimated total of $571 million.

In addition, resolving damage caused by predators requires consideration of both sociological and biological carrying capacities. The wildlife acceptance capacity, or 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. Biological carrying capacity is the land or habitat's ability to support healthy populations of wildlife without degradation to the species' health or their environment during an extended period of time (Decker and Purdy 1988). Those phenomena are especially important because they define the sensitivity of a person or community to a wildlife species. For any given damage situation, people exhibit varying thresholds of tolerance directly and indirectly affected by the species and any associated damage. This damage threshold determines the wildlife acceptance capacity. While the biological carrying capacity of the habitat may support higher populations of wildlife, in many cases the wildlife acceptance capacity is lower or already met. Once the wildlife acceptance capacity is met or exceeded, people begin to implement population or damage management to alleviate damage or address threats to HHS.

Data is limited to information that is collected by WS-Arizona from people who have requested services or information from WS-Arizona. The data does not include requests received or responded to by local, state or other federal agencies or private companies. Consequently, the number of requests for assistance to WS-Arizona does not reflect the full extent of need for action, but does provide an indication that needs exists.

Processes for Verifying Losses and Damage

Conflicts with predators can be in the form of a threat of damage, such as a history of predation of livestock in an area, predators known to be in the area, and/or damage that has or is currently occurring. Damage reported to WS-Arizona, such as predation or injury, is recorded in the APHIS-WS MIS database as "reported" damage. If employees are able to verify that the damage occurred, it is recorded in MIS as "verified" damage (defined as resource or production losses examined by a WS-Arizona personnel during a site visit and determined to have been caused by a specific predator species). Confirmation of the species that caused the damage and the extent of the problem are important steps toward establishing the need for implementing the PDM activities and the methodologies that will be most effective to resolve the problem.

Several factors can increase the complexity of determining whether a depredation event occurred and, if so, which species is responsible for the damage. Responding to a request in a timely manner is critical in order to view the scene and livestock remains before they become degraded or obscured. The "scene" can include evidence of a struggle, hair, scat, tracks, or wounds on an animal, which may be indicative of a particular predator's method of attacking livestock or wild animals. Many factors, including consumption of the remains from a predator or other scavengers, natural decomposition, and local climate variables, can impact the condition of the livestock remains and make it harder for WS-Arizona personnel to determine the predator species responsible.

WS-Arizona personnel carefully examine the surrounding area and often perform a field necropsy to observe or collect evidence, such as bite/claw marks, trauma, and hemorrhaging. Natural causes of death, such as injury, illness, and animal health are also considered during the necropsy.

The location of the dead animal and how it is oriented can indicate the offending species since predator species have typical patterns or ways that they kill their prey. Occasionally there is sufficient evidence to conclude that depredation did occur, but insufficient information to make a determination as to which predator species was involved. For example, there may have been visual signs of a struggle, blood trails, and some tissue remaining that shows sign of hemorrhaging, but not enough tissue left to know which species caused it. The predator and, potentially, scavengers may eat most of the carcass. When insufficient evidence remains, or the carcass or scene is unable to be verified, the loss is considered to be reported and the species most likely to have cause the damage is recorded in the MIS database. Employees use their experience and the information available to make the best determination of the species involved in the depredation, when possible, and take action as warranted and in accordance with APHIS-WS policy and state and federal law.

In most cases, when addressing livestock predation, WS-Arizona field personnel do not attempt to locate every depredated carcass reported by ranchers, but attempt to verify sufficient levels of damage to establish the need to take action and develop the appropriate strategy using the WS Decision Model (APHIS-WS Directive 2.201). Therefore, in many cases, damage reported by WS-Arizona does not actually reflect the total number of livestock or other resource affected, but provides an index of the annual damage occurring and sufficient information to develop the management strategy. Since producers experiencing loss may or may not contact WS-Arizona to report their losses or to request assistance, even fewer instances of depredation are documented. Producers often try to resolve the damage themselves or may request the assistance from other entities, such as commercial companies permitted by AGFD and listed on their website (Section 1.6.1).

Work tasks and the value of damage are an indication of need, but the requests that have been received by WS-Arizona likely represents only a portion of the actual need. For example, Connolly (1992) determined that only a fraction of the total predation attributable to coyotes is reported to or confirmed by WS and that based on scientific studies and recent livestock loss surveys generated by the National Agriculture Statistics Service (NASS), WS only confirms about 19% of the total adult sheep and 23% of the lambs actually killed by predators. WS-Arizona Specialists do not attempt to locate every livestock kill reported by ranchers, but rather make attempts to verify losses to determine if a predator problem exists that requires PDM actions and what the appropriate methods would be using WS Decision Model (Slate et al. 1992). Therefore, WS-Arizona's loss reports do not actually reflect the total number of livestock or other resource lost in the state, but provides an index of the annual losses. Also, some people are unaware of the WS-Arizona Program and may try to resolve problems themselves without assistance, or possibly with assistance from an ADFG licensed pest control operator, or AGFD may choose to handle certain depredation problems caused by furbearers or game animals without requesting WS-Arizona assistance. The total number of requests for assistance reflected in damage occurrences has remained fairly stable since prior PDM EAs were written (WS 1996, 1999a).

From FY11 to FY15, WS-Arizona performed an annual average of 895 work tasks from the public and other agencies to resolve problems associated with mammalian predators (Table 1). The work tasks that are associated with each species are a good indication of the need that people or agencies request from WS-Arizona for species. Coyotes (26%), feral dogs (6%), mountain lions (24%), striped skunks (19%), feral cats (5%), hooded skunks (5%), black bears (4%), raccoons (4%), gray foxes (2%), and bobcats (2%) accounted for 97% of the average annual work tasks from FY11 to FY15 that WS-Arizona conducted with the remaining 10 species accounting for 3% (Table 1) (MIS 2016). The total dollar value of the resources damaged can generally give an indication that need exists for PDM, but is not usually the best indicator of need. The value can be variable depending on the number of damage incidents from a particular predator, its ability and tendency to inflict damage, and the value of resources being damaged. For example, one black bear may kill 10 sheep in just one night or it may kill a thoroughbred foal, resulting in thousands of dollars damage for just one incident, whereas, a skunk may kill 10 chickens. From FY11 to FY15, the value of annual damage caused by all predators mostly reflected mountain lion, coyotes, feral/free roaming dog, and black bear damage, annually averaging 48%, 31%, 13%, and 7% accounting for 99% of the value of damage (MIS 2016). The value of damage caused by predators also reflects the predators and sites where WS-Arizona responds to damage requests. Finally, differences can be noted between species, primarily because larger predator species often cause much more damage with a higher value in one incident than predator species that are smaller (*i.e.*, black bears and dogs vs. striped skunks and feral cats). Fluctuations in damage value often reflect decreased or increased field effort, value of the resource damaged, and population fluctuations. WS-Arizona expects few, if any, requests for assistance for several species including opossums, kit and red foxes, long-tailed weasels, feral ferrets, and river otters in any year. While responses to such limited and rare-occurrence requests are normally categorically excluded under NEPA, WS-Arizona has chosen to cover these species and others with very few requests within the scope of this EA.

1.2.1. Predator Damage to Agricultural Resources

During 2001, crop and livestock losses from wildlife in the United States totaled $944 million, with field crop losses totaling $619 million, livestock and poultry losses totaling $178 million, and losses of vegetables, fruits, and nuts totaling $146 million. Those losses include destruction of or damage to crops in the field and death or injury to livestock. For example, raccoons were found to be responsible for 6%, 3%, and 6% of the total damage to field crops, livestock and poultry, and vegetables, fruits, and nuts, respectively, in the United States (NASS 2002). As shown in Table 1, of the WS-Arizona work tasks associated with predator damage from FY11 through FY15, 48% of the occurrences were related to agricultural resources and 45% for human safety. Annually on average, WS-Arizona had 895 work tasks with damage valued at $78,001 annually in Arizona (Table 1) (MIS 2016).

In 2012, agriculture generated $3.7 billion in annual sales from farm and ranch commodities in Arizona (NASS 2012). Crop production, mostly wheat and corn, accounted for 56% of the annual sales. Livestock production, primarily cattle, sheep, swine, and poultry, accounted for about 44% of total farm commodity cash receipts and are considered a primary agricultural industry sector in the state. Cattle, sheep, swine, and other livestock production contribute substantially to local economies. At the end of 2015, Arizona livestock inventories included 911,000 cattle and calves, 181,000 sheep and lambs, 92,000 equine and 72,000 goats (NASS 2016). In addition, other hoofed livestock, poultry, rabbits, ratites (ostriches and emus), and exotic livestock are produced in Arizona and contribute significantly to production and the economy. Cattle production in Arizona has been declining as was evident in the inventories between 2007 at 1.00 million head and 2012 at 0.91 million. However, sheep and goats have been increasing (sheep went from 100,000 in 2005 to 181,000 in 2012 and goats from 42,000 in 2007 to 72,000 in 2012 (NASS 2016). The number of AUMs (animal unit months) allotted on BLM and USFS lands has been declining in many areas of the United States and this has had a negative impact on livestock production. A study determined that a reduction in AUMs in Nevada had about a 9% negative economic effect annually (Pearce et al. 1999) during the 1990s. This could have affected the number of cattle in Arizona.

1.2.1.1. Livestock Predation

Need for PDM to Protect Livestock

Predators are responsible for preying upon a wide variety of livestock, including cattle, sheep, goats, swine, horses, and poultry. Sheep, goats, cattle (especially calves), and poultry are highly susceptible to predation throughout the year (Henne 1975, Nass 1977, Tigner and Larson 1977, Nass 1980, O'Gara et al. 1983, Bodenchuk et al. 2002). For example, cattle, calves, sheep, and goats are especially vulnerable to predation during calving, lambing, and kidding seasons in the late winter and spring (Sacks et al. 1999, Bodenchuk et al. 2002, Shwiff and Bodenchuck 2004).

Not all producers suffer losses to predators; however, for those individual producers that do, those losses can be economically difficult and burdensome, and may cause small producers that are affected to experience years of negative profits (Fritts et al. 1992, Mack et al. 1992, Shelton 2004, Rashford et al 2010). Losses are not evenly distributed among producers, and may be concentrated on some properties where predator territories overlap livestock occurrence and predators learn to deviate from their natural prey base to domestic livestock as an alternative food source (Shelton and Wade 1979, Shelton 2004). Therefore, predation can disproportionately affect certain properties and further increase a single producer's economic burden (NASS 1977, Howard and Shaw 1978, Nass 1980, O'Gara et al. 1983, Bodenchuk et al. 2002, Shelton 2004, Rashford et al. 2010). Shwiff and Bodenchuk (2004) state that profit margins in livestock production do not allow a 20% loss rate, and the absence of PDM, such losses would likely result in the loss of the livestock enterprise. Without effective methods of reducing predation rates such as those used by APHIS-WS, economic losses due to predation continue to increase (Nass 1977, Howard and Shaw 1978, Nass 1980, O'Gara et al. 1983, Bodenchuk et al. 2002).

Contribution of Livestock to Arizona's Economy

Agriculture is extremely important to Arizona's economy. Kerna and Frisvold (2014) state:

> "The contribution of Arizona agriculture to the state economy extends beyond the commodities directly produced on farms and ranches. Several industries provide critical support for agricultural production, basing their own economic activity on Arizona agriculture. First, there are industries in Arizona that almost exclusively provide goods and services as inputs to agricultural production. These agricultural service and input-supply industries, such as pest management consultants, fertilizer manufacturers, and farm equipment manufacturers, provide jobs and wages for local residents and contribute to the overall economic activity of the state."

Arizona is known for its contribution to national production of many specialty crops, livestock is an important component of Arizona agriculture. There are about 73 million acres in Arizona, of which about 56.2 million (75%) are operating private farms and ranches (Kerna and Frisvold 2014). According to the 2012 Census of Agriculture, Arizona has 20,005 farms and ranches spanning across the state of Arizona. The most prevalent type of agricultural operation in Arizona is operations specialized in Animal aquaculture and other animal production with 5,506 operations followed by Sheep and goat farming with 4,593 operations and beef cattle ranching and feedlots with 4,215 operations in Arizona (Kerna and Frisvold 2014).

Capital assets (land, buildings, and machinery) managed by Arizona farmers and ranchers are valued at $18.1 billion (USDA, 2014: Tables 46 and 47). Land and buildings account for $16.8 billion of this total, with an average value of nearly $850,000 per farm.

In the 2011 production year, the agribusiness system directly and indirectly contributed to approximately $17.1 billion in economic output to the Arizona economy (valued in today's 2014 dollars). Livestock production accounted for an additional $1.9 billion and agricultural support services, largely farm labor contracting and other on-farm agricultural support services, accounted for an additional $0.7 billion.

The beef industry in the state of Arizona is comprised of the beef cattle ranching sector with estimated output (sales) of $816 million, the animal processing sector with output (sales) of about $389 million, and the leather and hide tanning and finishing sector with output (sales) of $7.3 million (Kerna et al. 2014). Total direct output from the industry is more than $1.2 billion. The direct effects of the beef industry also include more than $168 million in value added (the local equivalent of gross domestic product, GDP.), $101 million in labor income (proprietor's income plus employee compensation), and 5,411 jobs (part- and full-time jobs) (Kerna et al. 2014).

Economic activity of the beef industry also has multiplier effects, generating additional jobs and sales in other sectors of the state economy. Indirect effects account for beef industry purchases of inputs, while induced effects account for proprietor and employee spending from their incomes. These multiplier effects provide additional stimulus to the state economy. Accounting for these multiplier effects, the total contribution of the beef industry to the Arizona economy is $1.7 billion in output, $431 million in value added, and about $240 million in labor income (Kerna et al. 2014).

Kerna et al. (2014) state that sales of cattle accounted for 18.8% of total Arizona agricultural sales, placing it as the 3rd highest agricultural commodity sold. For 2011, vegetable, melons, potatoes, and sweet potatoes agricultural commodity in sales in Arizona, comprising 25% of all the commodities, with total livestock making up 40.4% of all the agricultural commodity sales.

Successful PDM includes focusing on effective methods and strategies to prevent losses from occurring by protecting the livestock at risk. It is much easier to assess the level of damage or loss once it occurs and much harder to measure the value of what is being protected by implementing preventative PDM. One way to assess the value of what is being protected is to measure the quantity of the resource with the direct market value of those resources.

USDA (2014) reported estimates of livestock inventories in Arizona, including 911,334 head of cattle and 180,551 head of sheep and lambs in 2012. Not all resource owners request assistance of WS-Arizona. However, WS-Arizona estimates that it provides PDM activities which provide protection in FY 2015 for a minimum of 3,902 cattle, worth an estimated $5,559,854, and 20,425 sheep and lambs worth an estimated $2,058,172 (MIS 2017).

Studies on the Numbers of Livestock Losses Due to Predators

Livestock losses can come from a variety of sources, including disease, weather conditions, market price fluctuations, and predation (Blejwas et al. 2002). Producers routinely address disease concerns through responsive and preventative veterinary care and weather concerns through husbandry practices. Business practices address concerns with market fluctuations. These concerns must be dealt with by producers as part of their business operation. However, this EA addresses livestock losses through predation and in the context of APHIS-WS statutorily authorized activities and appropriations and, therefore, focuses on this issue.

Rates of loss of different types of livestock in the presence and absence of PDM can vary widely. It is difficult to compare the findings of studies because of different study methodologies, locations, circumstances, survey methods, whether losses are reported or confirmed, lack of finding all animals depredated, and variables that cannot be controlled during the studies, such as weather and disease. However, these findings can be an indicator of levels of losses with and without PDM activities:

Losses in the absence of direct PDM activities have been estimated to include:

- o Adult sheep losses ranged from 1.4% to 8.4%, lamb losses ranged from 6.3% to 29.3% (Shwiff and Bodenchuk 2004);
- o Adult doe goat losses were 49% and kids 64% (Guthrey and Beasom 1978);
- o Lambs ranged from 12% to 29% and ewes 1% to 8% when producers were compensated for losses in lieu of PDM (Knowlton et al. 1988);
- o Adult sheep 5.7% (range 1.4% to 8.1%), lambs 17.5% (range 6.3% to 29.3%), and calves (3%) (Bodenchuk et al. 2002);
- o Total sheep flock ranged from 3.8% in California to almost 100% of lambs in a South Texas study (Shelton and Wade 1979);
- o Adult sheep and lambs can range from 8.3% to 29.3%, respectively (Henne 1975, Munoz 1977, O'Gara et al. 1983);
- o Lambs could be as high as 22.3% (McConnell 1995 in: Houben et al. 2004).

- Losses with direct PDM activities in place:
  - o Adult sheep 1.6%, lambs 6%, goats and kids 12%, and calves 0.8% (Bodenchuk et al. 2002);
  - o Lambs 1% to 6% (Knowlton et al. 1988);

- Lamb losses can be as low as 0.7% (Nass 1977, Tigner and Larson 1977, Howard and Shaw 1978, Wagner and Conover 1999, Houben et al. 2004);

The proportion of lamb loss to coyote predation was reduced from 2.8% to less than 1% on grazing allotments in which coyotes were removed 3 to 6 months before summer sheep grazing (Wagner and Conover 1999).

National Livestock Losses to Predators

Nationally, sheep loss due to predators represented 39% of the total loss of sheep and lambs from all types of mortality, accounting for 247,200 animals killed, valued at $20.5 million. Of these losses to predators, 91.1% of them occurred from known predator species, whereas 8.9% occurred from unknown species (NASS 2010; Table 3).

Since the 2009 NASS survey did not contain the specific breakdown of losses by predator species at the national scale, the 2004 NASS survey is used here. NASS is the National Agricultural Statistics Survey section of the US Department of Agriculture. It conducts the most comprehensive surveys of the status of agriculture in the US. The results of NASS surveys used in this EA are those that are pertinent to Arizona, either nationally or statewide, and that are the most recent.

Table 3. The percentage of total losses attributed to specific predator species and the associated amount of damage in terms of head of cattle-calves (NASS 2010) and sheep-lambs (NASS 2004) and dollars lost for each.

	% Total Predator Loss		Number of Head		Value ($)	
Predator Species	**Cattle/ Calves**	**Sheep/ Lambs**	**Cattle/ Calves**	**Sheep/ Lambs**	**Cattle/ Calves**	**Sheep/ Lambs**
Coyotes	53.1	60.5	116,700	135,600	48,185,000	10,707,000
Dogs	9.9	13.3	21,800	29,800	10,067,000	2,807,000
Mountain Lion/ Bobcats	8.6	10.6	18,900	23,800	9,221,000	1,915,000
Bears	1.3	3.8	2,800	8,500	1,415,000	769,000
Other[1]	27.1	11.8	59,700	26,500	29,587,000	2,099,000

[1] Includes livestock losses when predator species was unknown or unverified.

These losses occurred despite sheep operators spending $9.8 million on non-lethal methods comprised of fencing (52.5%), night penning (32.9%), guard dogs (31.8%), and shed lambing (30.8%) in 2004 (NASS 2005) and cattle operators $188.5 million on non-lethal methods such as guard animals (36.9%); exclusion fencing (32.8%); frequent checking (32.1%); and culling older livestock to reduce predation or other risks (28.9%) in 2010 (NASS 2011). The survey did not include information on any lethal management that might have been occurring simultaneously.

Predation Levels by Predator Species

Of the predators that kill livestock, coyotes are responsible for the highest percentage (Knowlton et al. 1999, Shelton 2004, NASS 2005, NASS 2006, NASS 2010, NASS 2011). In a study of sheep predation on rangelands in Utah (Palmer et al. 2010), coyotes accounted for the majority of lamb losses at 67%, with fewer losses attributed to mountain lions (31%) and black bears (2%). Other predators that cause measurable predation on cattle, calves, sheep and lambs are black bear, mountain lion, red fox and feral or free-roaming dogs. While predation by black bears and mountain lions is not as frequent as coyote predation, the damage caused by these species can negatively impact producers (NASS 2005, 2009, 2010; MIS 2016).

Although, in general, mountain lion predation is lower than that of coyotes, mountain lions can occasionally be responsible for large sheep and lamb loss events, sometimes called "*surplus killing*." This occurs when a single predator, for unknown reasons, only consumes selected tissues or parts of many animals or the carcasses are not fed on at all (Shaw 1987). For example, mountain lions commonly kill up to 30 sheep, but normally only feed on one or two (McKinney 1996). Wade and Bowns (1982) found over 100 sheep killed by a mountain lion in one incident. Bodenchuk (2011) reported a mountain lion in Utah killed 102 head of livestock in one night. Mountain lions may also frighten an entire flock of sheep as they attack, resulting in a mass stampede which sometimes results in many animals suffocating as they pile up on top of each other in a confined area, such as along the bottom of a drainage or in a corral.

Mountain lions may also frighten an entire flock of sheep as they attack, resulting in a mass stampede, which sometimes results in many animals suffocating as they pile up on top of each other in a confined area, such as along the bottom of a drainage or in corrals. In one case in Oregon, a confirmed coyote(s) attack on a sheep flock caused a mass stampede of a flock of sheep, which broke through a fence where they then dispersed onto the adjacent railroad track. Subsequently, 117 sheep were killed and 25 injured by a train collision before the flock was corralled back into the pasture. The incident resulted in a loss of $40,950 (MIS 2009).

Livestock Losses to Predators in Arizona

WS-Arizona responds to requests from resource owners that had or are experiencing some type of conflict with a predator. Damage reported to WS-Arizona, by resource owners, such as predation or injury to livestock, is recorded in the APHIS-WS MIS database as "reported" damage. If WS-Arizona employees are able to verify that the damage occurred, it is recorded in MIS as "verified" damage, defined as resource or production losses examined by a WS-Arizona employee during a site visit and determined to have been caused by a specific predator species. For more details on methods of field evaluation by WS-Arizona personnel, see Section 3.1.5.3.

In Arizona, from FY11 to FY15, predators that predated cattle, calves, sheep, lambs, goats, and other large livestock were coyotes, mountain lions, feral dogs, and black bears. Coyotes are typically the predator causing the most predation problems. Bears and lions can cause substantial losses, especially where they have multiple killings. Feral or free ranging dogs are also responsible for considerable predation on livestock and wildlife, and it is not uncommon to find multiple kills from them. Other carnivores such as bobcats, gray fox, raccoons, and striped skunks will prey on livestock, primarily young lambs, kid goats, and domestic fowl, but only found to kill poultry from FY05 to FY15. During requests for assistance received by WS-Arizona, cooperators often report or WS-Arizona verifies through site visits, damage associated with various species of predators.

Between FY11 and FY15, WS-Arizona received reports or verified predator livestock losses, including animals injured or killed, annually averaging 192 animals valued at about $75,398 (Table 4). The species involved were coyotes, mountain lions, feral dogs, bobcats, black bears, striped skunks, and raccoons. Several more species were responsible for concern. Annual average livestock losses from FY11 to FY15 included 89 adult cattle and calves, 50 adult sheep and lambs, 39 various poultry, ratites and rabbits, 11 goats and other livestock (Table 4). Of the $75,398 average annual livestock losses, coyotes were responsible for 43%, mountain lions 31%, feral dogs 13%, bobcats 5%, black bears 3%, raccoons 3% and striped skunk 2%. Many of the other predators in Arizona covered by this EA can also kill or injure livestock, but WS-Arizona did not record any losses associated with those predators, except feral cats, between FY05 and FY15.

Requests for Assistance with Predator Damage in Arizona

Requests for assistance are an indication of the level of need for PDM work to be conducted by WS-Arizona, but these requests likely represent only a portion of the actual need. For example, Connolly (1992) determined that only a fraction of the total predation attributable to coyotes was reported to or verified by APHIS-WS nationally. Connolly (1992) also stated that, based on scientific studies and livestock loss surveys generated by NASS, APHIS-WS only documents about 19% of the total adult sheep and 23% of the lambs actually killed by predators. WS-Arizona captures information in the MIS database specific to the number of events or requests for service; however, WS-Arizona personnel record the species and resource(s) that are in conflict in each work entry (Work Task). A Work Task is defined as a single visit to a property or contact by WS-Arizona personnel to provide technical assistance, to conduct a wildlife damage field evaluation/assessment/investigation, or to continue work on a PDM activity/project in progress. The number of work tasks serves as an index of the intensity of effort needed by WS-Arizona personnel to address incidents involving the species in

Table 4. The annual average number of livestock killed or injured by predators in Arizona and their value for FY11 to FY15 with the order given by number of livestock killed.

Species	FY11		FY12		FY13		FY14		FY 2015		Average	
	#	$ Value $	#	$ Value $	#	$ Value $	#	$ Value $	#	S Value $	#	$ Value $
Cattle/Calves												
Coyotes	35	19,200	27	20,000	37	27,491	21	17,375	7	2,839	25	17,381
Feral Dog	9	6,400	3	2,785	8	6,360	8	4,701	9	19,081	7	7,865
Mtn. Lion	53	36,800	62	41,540	61	47,501	47	37,795	34	13,791	51	35,485
Black Bear	7	4,500	8	5,218	5	4,003	4	3,142	1	406	5	3,454
Subtotal	**104**	**$66,900**	**100**	**$69,543**	**111**	**$85,355**	**80**	**$63,013**	**51**	**$36,117**	**89**	**64,186**
Sheep/Lambs												
Coyotes	108	12,446	55	8,370	36	4,327	1	128	0	0	40	5,054
Feral Dog	5	450	4	490	0	0	0	0	0	0	2	188
Mtn. Lion	34	3,060	1	100	5	278	0	0	0	0	8	688
Black Bear	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	**147**	**$15,956**	**60**	**$8,960**	**41**	**$4,605**	**1**	**$128**	**$0**	**$0**	**50**	**5,930**
Other Hoofed Stock - Goats, Swine, Horses, Llamas, Exotics												
Bobcat	1	150	0	0	0	0	0	0	8	1,640	2	358
Coyotes	0	0	1	250	0	0	8	2,150	11	1,597	4	799
Feral Dog	0	0	4	350	1	116	13	8,463	0	0	4	1,786
Mtn. Lion	1	100	1	500	2	1,519	2	3,240	0	0	1	1,072
Black Bear	1	200	0	0	0	0	0	0	0	0	0	40
Subtotal	**3**	**$450**	**6**	**$1,100**	**3**	**$1,635**	**0**	**0**	**19**	**3237**	**11**	**4,055**
Poultry, Ratites, Rabbits												
Bobcat	25	250	17	15	0	0	0	0	0	0	8	53
Coyotes	5	125	11	400	0	0	43	1,256	2	600	12	476
Raccoons	0	0	5	47	0	0	0	0	10	20	3	13
Striped Skunk	0	0	15	141	0	0	5	125	0	0	4	53
Feral Dog	56	480	0	0	0	0	0	0	0	0	11	96
Subtotal	**86**	**$855**	**48**	**$603**	**0**	**0**	**48**	**$1,381**	**$12**	**$620**	**39**	**692**
Other Animals - Pets/Companion Animals, Guard Animals, Zoo Animals												
Coyotes	0	0	0	0	2	1,000	1	300	2	205	1	301
Feral Dog	0	0	0	0	0	0	0	0	2	200	0	40
Raccoons	0	0	1	600	0	0	0	0	10	373	2	195
Subtotal	0	0	1	600	2	1000	1	300	14	778	4	536
Total	**340**	**$84,161**	**215**	**$80,806**	**157**	**$92,595**	**130**	**$64,822**	**$96**	**$40,752**	**192**	**$75,398**

question. Reports of these conflicts do not represent the number of individual landowner requests for service, but rather the number of responses by WS-Arizona for those types of resource/species combinations. This information can describe the frequency of responses to requests for assistance.

At the time of providing a response to an individual request for service, WS-Arizona may provide a requester with information, demonstrations, recommendations for strategies that the landowner may implement (technical assistance), and/or direct assistance in which the WS-Arizona employee takes direct action to address the predator situation. As an individual situation may involve one or more predators causing damage to more than on resource, the conflict data recorded for the field visit cannot be used to determine the number of unique requests for assistance for each predator and/or livestock animal.

Predators are responsible for preying upon a wide variety of livestock including cattle, sheep, goats, swine, exotic pen-raised game, other hoofed-stock, and poultry. For example, cattle and calves are vulnerable to predation, especially during calving (Bodenchuk et al. 2002). Sheep, goats, and poultry are highly susceptible to predation throughout the year (Henne 1975, Nass 1977, Tigner and Larson 1977, Nass 1980, O'Gara et al. 1983, Bodenchuk et al. 2002). In a 2-year study of goat production in South Texas, Guthery and Beasom (1978) reported predators, primarily coyotes, killed 33 to 95% of the known kid crop on pastures with no PDM. Overall, predation rates on goats in studies of goat losses in the absence of management exceeded 50% (Bodenchuk et. al. 2002). During short-term fencing tests conducted in Texas, Shelton and Wade (1979) reported that predators killed all of the kids and lambs within the study area. Livestock losses due to predation can cause economic hardships to farmers and ranchers, and without effective ways to reduce predation rates, economic losses from predation can increase (Nass 1977, Howard and Shaw 1978, Nass 1980, Howard and Booth 1981, O'Gara et al. 1983, Bodenchuk et al. 2002). Not all producers suffer losses to predators; however, for those producers that do suffer livestock losses caused by predators, those losses can be economically burdensome (Baker et al. 2008).

Of the predators that kill livestock, coyotes are typically responsible for the highest percentage (Knowlton et al. 1999, Shelton 2004, NASS 2005, NASS 2006, NASS 2011). In a study of sheep predation on rangelands in Utah, coyotes accounted for 67% of depredated lambs, followed by mountain lion predation at 31%, and black bear predation at 2% (Palmer et al. 2010). Palmer et al. (2010) replicated a study from the 1970s to determine how predation rates on sheep may have changed over time. Overall, fewer lambs were lost to all causes than during the 1970s (5.8% compared with 9.5%, respectively); however, the proportion of losses to predators did not change substantially. Predators were responsible for 87% of the total lamb losses compared with 83% in the 1970s (Palmer et al. 2010). Coyotes accounted for 93% of all predator-killed lambs and ewes on nine sheep bands in shed lambing operations in southern Idaho and 25% of those sheep killed by coyotes were not fed upon (Nass 1977). DeLorenzo and Howard (1977) found that coyotes were the predominant predator on sheep during a study in Colorado with 43% of the lambs killed by coyotes not fed upon. Similarly, coyotes were also the primary predator on sheep during a Wyoming study and essentially the only predator in winter (Tigner and Larson 1977). A positive correlation often exists between predator concentrations and livestock losses due to predation (Shelton and Klindt 1974, Pearson and Caroline 1981, Nunley 1995). When predator concentrations increase, predation loss can be a major factor in cattle, sheep, and goat production.

Nationally, 247,200 sheep/lambs were lost to predation in 2009, representing a loss of $20.5 million to ranchers and farmers (NASS 2010). Of this national total, 3,500 lambs and 2,000 adult sheep were lost to predators in Arizona, valued at $58,000 and $165,000 respectively (NASS 2010). NASS (2010) did not discuss the predators responsible for damage in 2009. However, NASS (2005) found that of the 2,000 ewes and lambs killed by predators, coyotes were responsible for 55%, dogs 30%, mountain lions 10%, and bobcats 5%. In 2010, cattle producers reported cattle and calf losses from animal predation totaled 219,900 head in the United States (NASS 2011). Animal predation represented 5.5% of the total cattle and calf losses reported by livestock producers in 2010 totaling

$98.5 million in economic losses. Livestock producers identified coyotes as the primary predator of livestock, including all mammalian and avian predators, with 53.1% of cattle and calf losses attributed to coyotes. Of the predators identified as causing losses to cattle in 2010, coyotes (53.1%), dogs (9.9%), mountain lions/bobcats (8.6%), bears (1.3%), and other predators and unknown causes (27.1%) (NASS 2011). Of the calf loss, coyotes, dogs, mountain lions/bobcats, and bears were responsible for 57%, 10%, 8% and 1% of the losses, respectively, with other and unknown predators responsible for the other 24% (NASS 2011). Nationally, losses to goats were 155,000 valued at 16.0 million in 2004 (NASS 2005). Economic losses associated with predation on livestock often occur despite efforts by livestock producers to reduce predation rates.

Livestock producers often incur indirect costs associated with livestock predation in addition to the direct loss from animals killed by predators, such as the implementation of methods to reduce predation rates (Jahnke et al. 1987). Producers spent nearly $188.5 million dollars on nonlethal methods to reduce cattle and calf losses from predation by animals in 2010 (NASS 2011). The nonlethal method used most by livestock producers in the United States was guard animals (36.9% of producers). Producers also reported using exclusion fencing, frequent checking, and culling as other methods employed to reduce predation (NASS 2011). Arizona cattle producers used nonlethal methods to reduce predator damage including herding (82%), night penning (53%), frequent checks (47%), guard animals (27%), exclusion fencing (9%), culling (5%), carrion removal (1%), and other nonlethal methods (2%), to reduce predation (NASS 2011). Sheep producers also used nonlethal methods. Nationally, the nonlethal methods used most by sheep producers were fencing (52.5%), night penning (32.9%), guard dogs (31.8%), and lamb sheds (30.8%) (NASS 2005). In Arizona, nonlethal methods used included guard dogs (86.5%), fencing (40.1%), lamb sheds (32.2%), night penning (27.8%), frequent checks (27.1%), change bedding (22.9%), culling (15.0%), herding (11.6%), carrion removal (4.2%), frightening tactics (2.4%), guard donkeys (2.4%), guard llamas (1.2%). And other techniques (1.2%) (NASS 2005).

The value of damage caused by predators that is documented by WS-Arizona is often related to the number of requests for assistance received for a particular species. However, differences can be noted between species, primarily because larger species often cause much more damage with a higher value in a single incident than species that are smaller. Damage reported to or verified by WS-Arizona fluctuates annually, especially the value of the damage occurring. Fluctuations in the damage value often reflect decreased or increased field effort, value of the resource damaged, and population fluctuations. In Arizona, mountain lions, coyotes, and feral dogs inflicted the most damage in value and were responsible for the most number of livestock predated (Table 5) and the most work tasks associated with them (97% of work tasks from FY11 to FY15) at 43%, 36%, and 10%, respectively (Table 5). The monetary losses from livestock predation reflects losses that have occurred and that have been reported to or verified by WS-Arizona, but does not include all livestock losses that occurred in Arizona since not all livestock lost to predators are reported to WS-Arizona. In Arizona, coyotes, raccoons, badgers, and gray foxes were reported as having work tasks associated for causing damage to natural resources in Arizona. However, only 11 work tasks were reported and no dollar damage was reported. The value of damaged (i.e. predated, injured, damaged) natural resources is difficult to determine unless physical evidence of loss can be identified and a value attributed to the loss. In Arizona, the loss of all natural resources to predators has not been reported to WS-Arizona and WS-Arizona has not attributed a loss to those natural resources where work has been performed.

Table 5. Number of work tasks (WTs) and loss values for resources associated with predator conflicts with agricultural resources, property, and HHS that WS-Arizona Specialists recorded for FY11 to FY15.

SPECIES	Agriculture				Property				HHS				Natural Resources	
	Livestock		Crops/Feed		Animals		General		Transportation		General			
	WTs	Value $	WTs	Value $	WTs	Value $	WTs	Value $	WTs	Value $	WTs	Value $	WTs	Value $
Virginia Opossum							0.2	$0			1	$0		
Long-tailed Weasel											0.2	$0		
Feral Ferret											0.4	$0		
American Badger	1.6	$0					0.8	$0			1	$0	1	$0
Striped Skunk	1.6	$53			1.6	$0	11.2	$0	0.2	$0	156.2	$0		
Hooded Skunk							1.4	$12			43.4	$20		
Hog-nosed Skunk							0.2	$0			11.4	$0		
W. Spotted Skunk							0.2	$20			13	$0		
Raccoon	1	$9	0.2	$10	5	$195	1.8	$0	0	0	25.8	$0	1.2	$0
White-nosed Coati					0.2	$0	0.4	$0	1.6	0				
Ringtail							0.6	$0			1.8	$0		
Black Bear	14.6	$3,575					0.8	$1,900			24.4	$0		
Coyote	150	$23,801	0.2	$0	9	$301	6.6	$0	8	$0	53.8	$0	7.8	$0
Feral Dog	48.6	$10,254			0.2	$40	1.4	$40	0.8	$0	269.8	$200		
Gray Fox	0.8	$0	0	$0	1.2	$0					16.6	$0	0.6	$0
Kit Fox	0.2	$0									0.4	$0		
Red Fox											0.2	$0		
Mountain Lion	203.8	$37,488			0.2	0					9.2	$0		
Feral Cat					4	$0	0.4	$0		$39	0.6			
Bobcat	3.6	80			1.4	$3	0.2	0	9.2	0	0.2	$0		
TOTAL	**426**	**$75,260**	**0**	**$10**	**23**	**$539**	**26**	**$1,972**	**20**	**$39**	**629**	**$220**	**11**	**$0**

Proportion of WS-Arizona Livestock Conflict Work That Occurs on Public and Private Lands

Arizona comprises nearly 73 million acres, with approximately 42% under the jurisdiction of federal agencies (USFS 15%, BLM 17%, other 10%). Private lands comprise approximately 18%, state lands approximately 13%, tribal lands approximately 27%, and local and other lands approximately 1%. In Arizona, lands under agreement as of July 2016 included 9.6 million acres: tribal lands (13.2%), 4.2 million acres of private lands (5.8%), 1.9 million acres of USFS lands (2.6%), 2.8 million acres of BLM lands (3.8%), 1.9 million acres of state lands (2.6%), 1.0 million acres of county/city lands (1.4%), and 0.2 million acres (0.3%) of other lands (USFWS, military, Bureau of Reclamation, and other public lands).

As of July 2016, WS-Arizona had 580 active cooperative agreements in place on approximately 10.9 million acres or about 15% of the state's land area. Even though 580 active agreements are in place on approximately 15% of the lands in Arizona, WS-Arizona does not conduct PDM activities on every property under agreement each year. For example, from FY11 to FY15, WS-Arizona had predator damage on properties under active cooperative agreements annually averaging a total of 10.8 million acres (14.8% of the land in Arizona and 98.6% of the lands under agreement) with 80% of this on county or city lands, 6% on tribal lands, 4.42% private lands, 3.29% state lands, 1.59% USFS lands, 0.14% military lands, and < 0.009% other lands (other federal and county/city lands). WS-Arizona took target predators off fewer lands than stated here. WS-Arizona does not work continuously throughout the year on these properties and generally spends only a few hours or days on any specific property during the year resolving damage problems.

Additionally, WS-Arizona PDM is typically only conducted on a small portion of a property under agreement. For example, if an entire property under a WS-Arizona agreement contains 6,400 acres but the WS-Arizona personnel determines there is only a need to work in a particular small area where damage occurred, it is possible that the area would cover no more than 1 mi^2 or 640 acres. Under that scenario, PDM is conducted on only one-tenth of the land under agreement. Therefore, WS-Arizona PDM actions only occur on a small fraction of the land area in the state and would impact only a small proportion of the predator populations. WS-Arizona does not anticipate that the percentage of lands under agreement would increase substantially, beyond current levels, over the next 5 to 10 years.

The loss of livestock in Arizona does not provide an indicator of the effectiveness of PDM provided by WS-Arizona. The primary measure of success of a PDM program is the number of livestock saved from predation. Although it is impossible to accurately determine the specific amount of livestock PDM saves from predation, it can be estimated. Scientific studies have revealed that in areas without some level of PDM, losses of adult sheep and lambs to predators can be as high as 8.4% and 29.3%, respectively of the total number of head (Henne 1975, Munoz 1977, O'Gara et al. 1983). Conversely, other studies have indicated that sheep and lamb losses are significantly lower where PDM is applied (Nass 1977, Tigner and Larson 1977, Howard and Shaw 1978, Howard and Booth 1981).

Most requests for PDM assistance that WS-Arizona receives are to protect livestock on private lands. Lands with better agricultural value, and hence, more livestock production, were more likely to be bought or claimed by settlers when the West was settled and, thus, were more likely to enter into private ownership. As a result, many of the properties claimed were in valleys with easier terrain to manage, more productive soils, and waterways that could be used to grow crops and water livestock.

Under land settlement laws, not all land was claimed, and Congress eventually took control of the remaining lands with much of it becoming National Forests and National Grasslands managed by the USFS and public lands administered by the BLM. Because private lands often have easier terrain for agricultural activities and more productive conditions, they tend to be used for lambing, calving, and kidding grounds. Private lands are more prone to predation problems since newborn and young livestock are more vulnerable than adults. Of the cattle and sheep losses in FY11 to FY15, 38.6% of the numbers killed or injured were on private lands. Cattle and sheep losses on National Forest System (NFS) lands was 17.8%, 17.4% on BLM lands, and 25.2% on other lands (i.e. Tribal and State lands) (Table 5) (MIS 2016). Public lands administered by BLM, lands managed by the USFS, and other non-private lands in Arizona are used to graze primarily cows and some sheep as is reflected in loss data in Table 5 (MIS 2016). There was no other livestock reported to WS-Arizona as being killed on BLM or USFS lands.

1.2.1.2. Disease Threats to the Agricultural Resources/Livestock

In addition to direct livestock losses from predators, such as predation and injury, livestock producers are often concerned about the transmission of diseases from wildlife to livestock, primarily the spread of rabies. For example, rabid animals can inadvertently bite livestock which could become infected with rabies from species such as skunks, raccoons, and fox. Horses, cows, and llamas have become rabid in Arizona due to bites from vector species (Maricopa County Department of Public Health 2012). If exposure to the rabies virus is not identified early and treated, rabies is usually fatal. Another disease is becoming more prevalent. In review by Charleston (1994), he documented that feral cats transmitted *Toxoplasma gondii* to sheep and goats in New Zealand, including the aborting of fetuses by ewes. Dubey et al. (1995) found cats to be 68.3% positive for seroprevalence of *T. gondii* on swine farms in Illinois and the major reservoir for this disease. Indirect losses due to disease transmission are typically minor, but the potential losses could be high if a major outbreak occurred. Several other diseases can be spread from predators to livestock. These are a concern to producers. WS-Arizona periodically assists State and County Health Departments in monitoring disease prevalence by taking blood samples from animals captured or killed for other projects. Disease monitoring efforts do not result in additional predator mortality. From FY11 to FY15, WS-Arizona collected an annual average of 1,547 samples from predators for rabies, plague, and tularemia (MIS 2016).

1.2.1.3. Other Agriculture Resources

Predators within the scope of this EA in Arizona cause conflicts with livestock, comprising slightly more than 37.5% of WS-Arizona's responses to conflicts (based on Work Tasks recorded). The remaining nearly 63% of responses were for conflicts between predators and other human health and safety (57.1%), and property damage (4.3%) and natural resource protection (1%)

Direct or indirect damage to other agricultural commodities include commercial forestry products, fruit and nut crops, field crops, range and pasture, and beehives. Field crops are damaged by coyotes, feral/free-roaming dogs, badgers, skunks, and raccoons. Fruit, nut crops, vineyards, and beehives have also been damaged by bears. Black bears are omnivores and farm and fruit crops can be attractive, readily-available, high calorie sources of food, especially in the fall. Bears often damage the fruit trees by breaking branches to access the fruit, which can be a total loss or significant loss in production. Bears can also damage commercial timber stands by stripping the bark and eating the tissue underneath.

Predators such as foxes and badgers can burrow in improved or planted pasture, inhibiting the use of planting and mowing equipment and damaging the equipment. Predators also damage buildings and structures (including homes, sheds, barns, coops, etc.), trying to gain access for food or other resources, and undermining the structure's foundation. Bears, coyotes, skunks, and badgers damage irrigation pipe systems. These and other predators burrow into dikes and dams, damaging barriers and liners. Skunks, raccoons, coyotes, and Virginia opossums destroy gardens, lawns, or turf farms. They live under homes, destroying insulation and other components and creating health concerns with feces.

Although damage to other agricultural resources and property has occurred and could continue to occur, damage or the threat of damage to those resources occurs less frequently in Arizona compared to damage to livestock. Responses by WS-Arizona to damage to other agriculture resources from predators from FY11 to FY15 accounted for an average of 4 work tasks annually for damage to other agricultural resources valued at an average of $536 (Table 5) (MIS 2016).

1.2.2. Need for PDM for Protection of Property

Predators impact property including pets and zoo animals in Arizona. Typically this damage is less than the damage to livestock, yet it can be very significant to affected individuals.

1.2.2.1. Pets and Zoo Animals

Human encroachment into wildlife habitat and wildlife encroaching into human residential and other human-altered areas, often in response to available food, including pets, increase the likelihood of human-wildlife interactions. Those species that people are likely to encounter are those most likely to adapt to and thrive in human-altered habitats due to the ready availability of food, water, and shelter inadvertently provided by residents. These habitat alterations may include landscaping vegetation, artificial pools, pet food, presence of pets (leashed or unleashed), garbage, piles of waste debris, and woodpiles, for example. Many people enjoy wildlife to the point of purchasing food specifically for feeding wildlife despite laws prohibiting this in Arizona.

ARS §13-2927 states a person commits unlawful feeding of wildlife by intentionally, knowingly or recklessly feeding, attracting or otherwise enticing wildlife into an area. The constant presence of human-created refuse, readily-available water supplies, and abundant prey populations found in areas of human development often increase the survival rates and biological carrying capacity of wildlife species that are adaptable to those habitats. Often the only limiting factor of some wildlife populations living near human development is disease, which readily spreads among concentrated populations of wildlife congregated into small areas capitalizing on the unlimited amount of food, water, and shelter found within those human-altered habitats, and mortality due to collisions with vehicles on roadways.

As wildlife adapts to using human-altered habitats and societal views have led humans to ignore and in some ways encourage wildlife to live within our midst, many animals have lost their fear of people and become habituated to people, vehicles, and developed areas. With their natural fear of humans gone, some individual animals may exhibit bold and even dominant behavior toward humans. If people respond by backing away, the animal becomes further emboldened. Animal behavior may then either appear to be or actually become aggressive, with aggressive posturing, a general lack of caution toward people, and/or other abnormal behavior. In addition to habituation, disease may also cause these behaviors, resulting in calls for assistance. Overall, attacks by wildlife on people are very rare in Arizona and nationwide.

Pets and zoo animals can be injured or killed by predators. This is especially common in suburban areas where certain predators adapt well and flourish in the new habitat provided. Coyotes have long been known for their adaptability and living in suburban neighborhoods. They are especially aggressive towards dogs during the breeding season and will attack and kill them, even those being walked on a leash. In Arizona, Coyotes caused the most frequent problems for pet owners in Arizona from FY11 to FY15 averaging 9 work tasks and $301 of value annually (MIS 2016). Javelina often feed in suburban environments attracting mountain lions, which are not averse to taking pets. Coyotes, javelina, raccoons, and bobcats become accustomed to human smells and, over time, can lose much of their fear of humans and will, subsequently, kill and eat pets. The potential for predators to spread of diseases such as rabies is another possible issue when predators are in close proximity to pets or zoo animals. In all, WS-Arizona had 23 annual work tasks associated with pets and zoo animals such as raccoons preying on zoo animals (Table 5) (MIS 2016).

1.2.2.2. Other Property

WS-Arizona responds to requests from airports, landowners, and other property owners to alleviate property damage from predators. Examples include coyotes damaging aircraft from being struck running across runways (which can also be considered a HHS threat), black bears breaking in and destroying the interiors of homes or other structures; raccoons and skunks burrowing into or under homes to den; skunks and raccoons gaining access into a home through a pet door to eat pet food; and badgers, skunks, or raccoons causing damage to landscaping, gardens, or golf courses from feeding activities. From FY11 to FY15, WS-Arizona reported predator damage or threats to a variety of property in an average of 49 incidents per year (Table 5) (MIS 2016). While Table 5 lists the predators that caused property damage, any of the other predators discussed in this EA have the potential to cause property damage.

1.2.3. Human Health and Safety

WS-Arizona also conducts PDM to reduce HHS concerns for the public. HHS concerns can include human attacks from mountain lions, black bears, and coyotes that result in injuries or death; disease threats from rabies and plague outbreaks where predators act as reservoirs; odor and noise nuisances from skunks, opossums, and raccoons in attics and under houses; and aircraft strike hazards from coyotes and feral/free-roaming dogs crossing runways at airports or airbases. WS-Arizona generally recommends exclusion methods to reduce HHS concerns, but the animals present are often removed.

1.2.3.1. Protection of Human Safety from Predator Conflicts

Although wildlife attacking people occurs rarely, the number of attacks appears to be on the increase, especially near human residential areas. Timm and Baker (2007) defined a single “attack” as an incident in which physical contact between a coyote and one or more humans occurred at a single location at a point in time. Their database found 111 incidents (except for one) in California, occurring since the early 1970s, resulting in injuries to 136 individuals (87 adults and 49 children). An additional 62 incidents involved coyotes aggressively approaching or stalking adults or children, in which no physical contact occurred.

Timm et al. (2004) reported that coyotes attacking people have increased in California, and further study by Timm and Baker (2007) found the problem possibly increasing in other states, including at least 76 attack incidents from 18 states outside of California and 17 attacks in four Canadian provinces. The study found that urban sprawl of residential developments has reduced the amount of buffer habitat between wild lands and suburban communities. Additionally, recent reductions in coyote control efforts due to public concern may have led to increased attacks on people by allowing for a larger coyote population size near suburban areas and by lessening coyotes' fear of humans which is normally reinforced by lethal control methods (Timm et al. 2004). In addition, coyote attacks on pets are apparently beginning or are occurring in increasing numbers of suburban areas throughout North America (Timm and Baker 2007).

Timm and Baker (2007) find that conflicts with coyotes occur when the animal has become habituated to the residential area, learning to tolerate at a distance, then becoming more "tame" through positive reinforcement such as availability of food, including through intentional feeding. Most often, habituation and subsequent problems arise because people attracted the coyote to the area by giving it access to food. After emboldened coyotes have become accustomed to a being provided with food, the abrupt removal of the food source may result in increased aggression or attacks on pets, children, and adults (Timm et al. 2004). While coyote attacks on humans are very rare in Arizona, AGFD receives many complaints from the public related to urban coyotes, many of which are related to people feeding wildlife, which increases the threat coyotes pose to human health and safety (Carrillo et al. 2007).

Highly publicized coyote attacks, including a fatal attack on a 19-year old woman in Nova Scotia (Canadian Broadcast Company 2009), have only heightened people's awareness of the potential threat of such encounters. In the Chicago metropolitan area, newspaper articles related to human-coyote conflicts have increased over twenty-fold since the 1990's (White and Gehrt 2009). In July 2015, four coyote attacks on children were reported in Irvine, California within a month (Heck 2015, CDFW 2015). While bites or deaths caused by coyotes are generally reported by the media as 'attacks', White and Gehrt (2009) found that some reports of coyote scratches or neighborhood sightings have been reported as 'attacks.'

Timm et al. (2004) conducted a study on the best and most sustainable method to resolve issues with urban coyotes after several human-coyote conflicts were documented. The study concluded that the use of foothold traps to capture and euthanize a few coyotes is most effective (Timm et al. 2004). Prior to this study, traps were shown to be effective at removing coyotes from Glendale, California, shortly after a child was killed in his yard. City and county officials trapped 55 coyotes in an 80-day period from within one-half mile of the site of the attack, an unusually high number for such a small area (Howell 1982).

Black bears may easily adapt to living in close proximity to humans, especially with the presence of subsidized food, and may lose their fear of humans. Most threatening conflicts with bears in Oregon occur in rural and urban residential areas and recreational areas such as campgrounds involving the presence of easy human-provided food, typically garbage cans, bird feeders, feed storage sheds, or food kept in automobiles (Herrero and Fleck 1990). Access to readily available and nutrient dense human foods may almost double the reproductive potential of black bears (Rogers 1987).

Potential dangerous mountain lion behaviors include aggressive actions such as charging or snarling, or loss of wariness of humans as displayed by reported sightings during the day in areas with permanent structures used by humans. Although rare, mountain lion attacks on humans in the western United States and British Columbia have increased in the last two decades (Beier 1992, Cougar Management Guidelines Working Group 2005), primarily due to increased mountain lion populations, reduced hunting, and increased human use of mountain lion habitats (Beier 1992). Additional reports find that mountain lions will stay in human areas longer if they have food, water, and shelter available (Shepard et al. 2014). Fitzhugh et al. (2003) report there were 16 fatal and 92 non-fatal attacks on humans since 1890 in the United States and Canada but of those, seven fatal and 38 non-fatal attacks occurred since 1991. For example, since California's Wildlife Protection Act of 1990 gave mountain lions special status in the state resulting in a prohibition on regulated hunting, there have been three fatal and ten nonfatal attacks verified by California Department of Fish and Wildlife (https://www.wildlife.ca.gov/Conservation/Mammals/Mountain-Lion/Attacks).

Mountain lions have attacked several individuals in Arizona since 2000 with no fatalities: in 2000, a 4 year old girl was dragged into the brush by a mountain lion near Bartlett Lake and survived; in 2004, a 10 year old boy was attacked by a mountain lion on the Tonto National Forest; an adult man was attacked in Graham County in August of 2006; in 2010, a 30 year old man near Walker, Arizona was attacked by a mountain lion; and in a 2013 case, an 18 year old male hiker trying to escape a mountain lion fell off a cliff and dislocated his shoulder and broke an arm. Since 2000, there have been 3 fatal mountain lion attacks in North America: a 30 year old female in 2001 near Canmore, Alberta; a 35 year old male in Orange County, California in 2004; and a 55 year old male in 2008 near Pinos Altos, New Mexico. This follows 7 individuals who were killed by mountain lions during the 1990s.

In 2006, Arizona received 66 black bear complaints of which 7 were encounters and 6 were attacks on humans (Spencer et al. 2007). In the last decade, Arizona has had several black bear attacks or aggressive situations with one human fatality in 2011. In 1996, a 16 year old girl was attacked and severely injured on Mt. Lemmon outside of Tucson, Arizona. In 2011, a 61-year old woman was attacked in Pinetop, Arizona, and died due to bite injuries. There have been 5 additional black bear caused fatalities in North America since 2010. Coyotes contribute to numerous bite cases in Arizona. From 1997 through 2005, the AGFD reported 11 human-coyote incidents. The worst occurrence of bite incidents occurred during 2006 when 8 individuals were bitten by coyotes in a 13 day span (Carrillo et al. 2007). Since that time, bite cases continue including one incident wherein three adult individuals were bitten during a 24 hour period in 2012 in Peoria. In several of these cases, WS-Arizona provided assistance to capture the offending animals as requested by the AGFD. Although predator attacks on people are rare, WS-Arizona in Arizona could receive additional requests for assistance if such attacks occur.

1.2.3.2. Threat of Disease Transmission from Predators

Zoonosis (i.e., wildlife diseases transmissible to people) are a major concern of cooperators when requesting assistance with managing threats from mammals. Pathogen transmission occurs through direct contact between infected and uninfected hosts, including host contact with a pathogen-contaminated environment or food product. Indirect transmission of pathogens, such as through an intermediate host or vector species such as mosquitos and biting flies, is another possible transmission pathway. Once a pathogen transmits to a new host species, such as livestock or pets, secondary cases of infection to the rest of the herd or humans can occur. Pets and livestock often encounter and interact with wild mammals, which can increase the opportunity of transmission of pathogens to humans. Diseases of wildlife, livestock, pets, and humans can be caused by viral, bacterial, or parasitic pathogen species. WS-Arizona uses technical assistance to actively attempt to educate the public about the risks associated with pathogen transmission from wildlife to humans and pets.

The transmission of pathogens from wildlife to humans is neither well documented nor well understood for most infectious zoonosis, and can be complicated by the potential for multiple sources of infection. Unless otherwise noted, the pathogens listed in this section are not currently monitored in predator populations by WS-Arizona, but may be undetected or may be introduced to these populations in the future. While these zoonosis are known to circulate in other predator populations outside of Arizona, not all of these pathogens have documented detections in Arizona predator populations. WS-Arizona currently conducts sampling for diseases that can be transmitted to humans and pets in Arizona, as part of the WS-National Wildlife Disease Program. WS-Arizona remains available to assist AGFD or the Department of Health with active or passive sampling, as requested. Currently, WS-Arizona conducts rabies testing in cooperation with the Department of Health and at the the request of AGFD. In addition, WS-Arizona conducts active disease sampling to benefit endangered black-footed ferrets for AGFD.

Individuals or property owners that request assistance with disease threats are frequently concerned about potential disease risks but are unaware of the types of diseases that can be transmitted by those animals. In those types of situations, assistance is requested because of a perceived risk to HHS associated with wild animals living in close association with people, from animals acting out of character by roving in human-inhabited areas during daylight, or from animals showing no fear when people are present. In many circumstances when HHS concerns are the primary reason for requesting assistance there may have been no actual cases of transmission of disease to humans by predators. Thus, the risk of disease transmission would be the primary reason for requesting HHS assistance from WS-Arizona.

The most common disease concern expressed by individuals requesting assistance is the threat of rabies transmission to people, pets, and companion animals. Rabies is an acute, fatal viral disease of mammals most often transmitted through the bite of a rabid animal that poses an indirect and direct threat to humans. Indirect threats to humans occur from exposure from pets or livestock that have been infected from bites of a rabid animal. Direct threats can occur from handling infected wildlife or from aggressive animal behavior caused by rabies. The disease can be effectively prevented in humans when exposure is identified early and treated. In addition, domestic animals and pets can be vaccinated for rabies. However, the abundant and widely distributed reservoir among wild mammals complicates rabies control. The vast majority of rabies cases reported to the Centers for Disease Control and Prevention (CDC) each year occur in raccoons, skunks (primarily striped skunks), foxes, and bats (Order Chiroptera) (Monroe et al. 2016). In Arizona, bats and skunks are the primary reservoir of rabies. Maps of identified rabid animals and counts by county and animal type are found on the Arizona Department of Health Services website at http://www.azdhs.gov/preparedness/epidemiology-disease-control/rabies/#data-publications-maps. Over the last 100 years, the vector of rabies in the United States has changed dramatically. Since 1980, > 90% of all animal cases reported annually to CDC now occur in wildlife (Monroe et al. 2016). Before 1960, the majority of cases were reported in domestic animals. The principal rabies hosts today are wild carnivores and bats. The number of rabies-related human deaths in the United States has declined from more than 100 annually in the early 1900s to an average of one or three people per year in the 2010s. Modern day prophylaxis, which is the series of vaccine injections given to people who have been potentially or actually exposed, has proven nearly 100% successful in preventing mortality when administered promptly (Monroe 2016). In the United States, human fatalities associated with rabies occur in people who fail to seek timely medical assistance, usually because they were unaware of their exposure to rabies. Although human rabies deaths are rare, the estimated public health costs associated with disease detection, prevention, and control have risen, with costs between $245 and $510 million annually (CDC 2015). Those costs include the vaccination of companion animals, maintenance of rabies laboratories, medical costs such as those incurred for exposure case investigations, rabies post-exposure prophylaxis (PEP), and animal control programs.

Accurate estimates of the aforementioned expenditures are not available. Although the number of PEPs given in the United States each year is unknown, it has been estimated to be as high as 50,000. When rabies becomes epizootic (*i.e*., affecting a large number of animals over a large area) or enzootic (*i.e*., present in an area over time but with a low case frequency) in a region, the number of PEPs in that area often increases. Although the cost varies, a course of rabies immunoglobulin and four doses of vaccine given over a 4-week period typically exceeds $3,000 (CDC 2015). As epizootics spread in wildlife populations, the risk of "*mass*" human exposures requiring treatment of large numbers of people that contact individual rabid domestic animals infected by wild rabid animals increases. One case in New Hampshire involving contact with a single rabid cat of unknown origin that required PEPs for 665 persons (CDC 1995). The total cost of this single incident exceeded $1.5 million with associated costs of rabies immune globulin and vaccine ($1.1 million) and laboratory testing of animals ($4200). The cost for the one animal is nearly 15-fold higher than that ($105,790) associated with rabies post exposure treatment of 70 persons after a single case of rabies which occurred in a feral dog from California in 1981 (CDC 1981).

Rabies presents a HHS threat through potential direct exposure to rabid animals, or indirectly through the exposure of pets that have an encounter with rabid animals. Additionally, the number of pets and livestock examined and vaccinated for rabies, the number of diagnostic tests requested, and the number of post exposure treatments can increase when rabies is present in an area. Human and financial resources allocated to rabies-related human and animal health needs also increase, often at the expense of other important activities and services.

Skunks are an important wildlife host for the rabies virus in North America and are second only to raccoons in being the most commonly reported rabid wildlife species in the United States (Monroe et al 2016). There are three skunk variants of rabies may be found in the upper-Midwest, lower-Midwest and southwest, and California; however, skunks found throughout North America may be infected with different variants of rabies such as the raccoon or bat variants (Leslie et al 2006) Bat-associated Rabies Virus in Skunks https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3291214/. The distribution of rabies in skunks extends from Georgia to Maine east of the Appalachians, Arizona to the Canadian border, and throughout the northern two thirds of California (Majumdar et al. 2005). The fox is one of the four major maintenance hosts for rabies in North America. In the 1950s, rabies in red fox spread throughout Canada, parts of New England, and Alaska. The range has since decreased, but fox rabies persists in Canada, Alaska, and parts of Arizona. Clinical signs of rabies in fox are often manifested as the "*furious*" form of rabies (Majumdar et al. 2005).

Increasing populations of raccoons have been implicated in the outbreak of distemper in certain areas (Majumdar et al. 2005). Distemper has not been identified as transmissible to humans. However, cooperators who feel threatened by the possibility of disease transmission often request assistance after observing sick raccoons on their property. Symptoms of distemper often lead to abnormal behavior in raccoons that are similar to symptoms associated with rabies. Raccoons with distemper often lose their fear of humans and can act aggressively which increases the risk that people, livestock, or companion animals may be bitten. Distemper is also known to occur in coyotes, red fox, and gray fox with symptoms that are similar to those exhibited by animals infected with the rabies virus.

Diseases and parasites affecting feral cats and dogs can have particularly serious implications to HHS given the close association of those animals with humans and companion animals. Of the 374 species of parasites that cause diseases in cats and dogs, 91% are multi-host pathogens (Cleveland et al. 2001), meaning that infection may occur in multiple host species including wildlife, domestic animals, and humans. The topic of feral animals and their impacts on native wildlife and HHS elicits a strong response in numerous professional and societal groups with an interest in the topic. Feral cats and dogs are considered by most professional wildlife groups to be a non-native species that can have detrimental effect to the native ecosystems especially in the presence of a human altered landscape. However, a segment of society views feral animals to be an extension of companion animals that should be cared for and for which affection bonds are often developed especially when societal groups feed and care for individual feral animals. Of special concern are those cats and dogs considered companion animals that are not confined indoors at all times but are allowed to range outside the home for extended periods. If interactions occur between companion animals and feral animals of the same species, companion animals could become exposed to a wide-range of zoonosis that could be brought back into the home where direct contact between the companion animal and people increases the likelihood of disease transmission. Feral animals that are considered companion animals are also likely to affect multiple people if disease transmission occurs since those animals are likely to come in direct contact with several members of families and friends before diagnosis of a disease occurs.

Several known diseases that are infectious to people, including rabies, have been found in feral cats and dogs. Feral cats account for most of the rabies cases in humans from domestic animals and approximately 1/3 of the PEP needed for treatments (Gerhold and Jessup 2012). Feral cats are an important source of zoonotic diseases including rabies, *Toxoplasma gondii*, cutaneous larval migrans, and tularemia. Three flea-associated zoonosis of cats of concern in the US are cat-scratch disease (*Bartonella henselae*), flea-borne typhus, and plague (McElroy et al. 2010). A common zoonosis found in cats is ringworm. Ringworm (*Tinea* spp.) is a contagious fungal disease contracted through direct interactions with an infected person, animal, or soil. Other common zoonosis of cats are pasteurella, salmonella, and numerous parasitic diseases, including roundworms, and tapeworms.

The domestic cat has been found to transmit *Toxoplasma gondii* to animals including livestock and white-tailed deer (*Odocoileus virginianus*) and humans (The Wildlife Society 2014). Cats have been found to be important reservoirs and the only species known to allow for the completion of the life cycle for the protozoan parasite *T. gondii* (Dubey 1973, Teutsch et al. 1979). Both feral and domiciled cats may be infected by this protozoan, but this infection is more common in feral cats.

According to the Global Mammal Parasite Database (Nunn and Altizer 2005), 168 of the 358 dog pathogens identified by Cleaveland et al. (2001) are shared between dogs and wild mammals. As a vector species for rabies, dogs have been identified as impacting the endangered Ethiopian wolf

(Randall et al. 2004) and African wild dog populations (Gascoyne et al. 1993). Canine distemper virus infected dogs contributed to the extirpation of what was at the time the last wild population of black-footed ferrets (Williams et al. 1988). Canine parvovirus was identified in the late 1970s as a new disease in dogs (Knobel et al. 2014). Dogs as carriers of canine parvovirus have the ability to affect gray wolves (Mech and Goyal 1993, Mech and Goyal 1995, Mech et al. 1997), and in Arizona, the Mexican wolf. Neospora caninum, a protozoan, has been recognized as an important cause of abortion in cattle (Anderson et al. 2000). The dog is the only species in which sexual development of N. caninum with resultant fecal shedding of oocysts has been demonstrated (McAllister et al. 1998, Lindsay et al. 1999).

Most of the zoonosis known to infect cats and dogs that are infectious to people are not life threatening if diagnosed and treated early. However, certain societal segments are at higher risks if exposed to zoonosis. Women who are pregnant, people receiving chemotherapy for immunologic diseases and organ transplants, and those with weakened immune systems are at increased risk of clinical disease if exposed to toxoplasmosis (AVMA 2004). In 1994, five Florida children were hospitalized with encephalitis that was associated with cat scratch fever (AVMA 2004). The daycare center at the University of Hawaii in Manoa was closed for two weeks in 2002 because of concerns about potential transmission of murine typhus (*Rickettsia typhi*) and flea (*Ctenocephalides felis*) infestations afflicting 84 children and faculty. The fleas at the facility originated from a feral cat colony that had grown from 100 cats to over 1,000, despite a trap, neuter, and release effort (AVMA 2004).

This discussion on zoonosis is intended to briefly address the more common known zoonosis found in the United States for those species specifically addressed in this EA but is not intended to be an exhaustive discussion of all potential zoonosis. The transmission of diseases from wildlife to humans is neither well documented nor well understood for most infectious zoonosis. Determining a vector for a human infected with a disease known to occur in wildlife populations is often complicated by the presence of the known agent across a broad range of naturally occurring sources. For example, a person with salmonella poisoning may have contracted salmonella bacterium from direct contact with an infected pet but may have also contracted the bacterium from eating undercooked meat or from other sources.

Disease transmission directly from wildlife to humans is uncommon. However, the infrequency of such transmission does not diminish the concerns of those individuals requesting assistance that are fearful of exposure to a diseased animal since disease transmissions have been documented. WS-Arizona actively attempts to educate the public about the risks associated with disease transmission from wildlife to humans through technical assistance and by providing technical leaflets on the risks of exposure.

In addition to disease transmission threats, requests are also received for assistance from perceived threats of physical harm from wildlife, especially from predatory wildlife. Human encroachment into wildlife habitat increases the likelihood of human-wildlife interactions. Those species that people are likely to encounter are those most likely to adapt to and thrive in human altered habitat. Several predatory and omnivorous wildlife species thrive in urban habitat due to the availability of food, water, and shelter.

Many people enjoy wildlife to the point of purchasing food specifically for feeding wildlife despite laws prohibiting the act in many areas. The constant presence of human created refuse, readily available water supplies, and abundant rodent populations found in some areas often increases the survival rates and carrying capacity of wildlife species that are adaptable to those habitats. Often the only limiting factor of wildlife species in and around areas inhabited by people is the prevalence of diseases, which can be confounded by the overabundance of wildlife congregated into a small area that can be created by the unlimited amount of food, water, and shelter found within those habitats.

As people are increasingly living with wildlife, the lack of harassing and threatening behavior by people toward many species of wildlife has led to a decline in the fear wildlife have toward people. When wildlife species begin to habituate to the presence of humans and human activity, a loss of apprehension occurs that can lead to threatening behavior toward humans. This threatening behavior continues to increase as human populations expand and the populations of those species that adapt to human activity increase. Threatening behavior can be in the form of aggressive posturing, a general lack of apprehension toward people, or abnormal behavior. Although wildlife attacking people occurs rarely, the number of attacks appears to be on the increase. Timm et al. (2004) reported that coyotes attacking people have increased in California and the recent, highly publicized coyote attacks, including a fatal attack on a 19- year old woman in Nova Scotia (Alexander and Quinn 2011), have only heightened people's awareness of the threat of such encounters. Although attacks on people associated with those species addressed in this EA occurs rarely, requests for assistance to lessen the threat of possible attack do occur from people in Arizona. Often, wildlife exhibiting threatening behavior or a loss of apprehensiveness to the presence of humans is a direct result and indication of an animal inflicted with a disease. So, requests for assistance are caused by both a desire to reduce the threat of disease transmission and from fear of aggressive behavior either from an animal that is less apprehensive of people or induced as a symptom of disease.

WS-Arizona has received requests for assistance in Arizona to reduce public, public health, and pet safety concerns. Public and pet safety concerns may include attacks from coyotes that result in injuries or death (Carrillo et al. 2007), disease threats from rabies (Engeman et al 2003, McCollum et al 2012) and plague outbreaks where predators act as reservoirs (Brown et al 2011, Wong et al 2009), odor and noise nuisances from skunks and raccoons under houses, and aircraft strike hazards from coyotes, feral dogs and cats crossing runways at airports or airbases (DeVault et al. 2011). Typically, the biggest concern of the public is the threat of attack on people by large predators (*e.g.*, black bears, mountain lions, coyotes) despite the rarity of those types of events. Mountain lion attacks on people in the western United States and Canada have increased in the last two decades, primarily due to increasing mountain lion populations and human use of mountain lion habitats (Beier 1991, Beier 1992), but mountain lions will stay in human habitats if it provides shelter, food and water (Shepard et al. 2014). Baker and Timm (1998), after several human-coyote interactions in an area, concluded that the use of foothold traps to capture and euthanize a few coyotes would be the best method to limit interactions and have the most lasting effects. After a coyote in Glendale, California, killed a child, city and county officials trapped 55 coyotes in an 80-day period from within one-half mile of the home, an unusually high number for such a small area (Howell 1982). A recent review revealed that feral dogs cause an average of 6 human fatalities per year in the U.S. Children (32%) and older (55+) adults (47%) were the most susceptible to fatal attacks by feral dogs. The majority of victims were male (63%) which coincides with the majority of dog bite victims being male (Abrahamian 2000).

WS-Arizona assists many residents, especially in urban and suburban areas, such as the Phoenix metropolitan area concerned about coyote attacks on their pets and their apparent loss of fear toward people. Between FY11 and FY15, WS-Arizona received reports of or verified damage or threat occurrences occurring to HHS associated with every species listed in Table 2. Between FY11 and

FY15, people requesting assistance reported to WS-Arizona or WS-Arizona verified 407 damage or threat occurrences involving human safety (MIS 2016). Striped skunks represented over 39% of those damage or threat occurrences, while coyotes represented over 15% (MIS 2016). Predator attacks on people occur very rarely, but could result in requests for assistance under the current program.

The primary threat to transportation, primarily strike threats on airfields, were bobcats and coyotes from FY11 to FY15 with 9 and 8 average annual work tasks (Table 5) (MIS 2016). Identified general threats and nuisance complaints were highest for striped skunks (156), feral dogs (270), coyotes (54), hooded skunk (43), raccoon (26), and black bear (24) from FY11 to FY15 (Table 5) (MIS 2016).

Disease Surveillance and Monitoring

The increasing connectedness of our world and the increasing use intensity of our landscape amplify the potential for spillover of emerging and re-emerging pathogens in wildlife, livestock, pets, and humans. Some pathogens that circulate in wildlife are known to pose threats to livestock, pet, and human health. Threats include both mortality and morbidity, which can manifest in reduced individual growth rate, reduced fecundity, or reduced product yield. An active wildlife disease program provides WS-Arizona and cooperators with valuable information on what wildlife species are being exposed to what pathogens and an index on the level of exposure. Additionally, WS-Arizona's disease program allows for better communication and collaboration with our partners and quicker response time to potential disease outbreaks due to trained personnel solely dedicated to wildlife disease issues.

Detecting changes in the wildlife species exposed to pathogens and/or the level of exposure within a species indicates a change in the pathogen, host, and environment triad. This information is crucial to making disease mitigation and response decisions.

Because WS-Arizona has access to many animals either while still alive or shortly after death as an inherent component of its program, it is often requested to opportunistically collect blood and tissue samples for the AGFD, Arizona Department of Health Services (AZDHS), and the new APHIS-WS National Wildlife Disease Surveillance and Emergency Response Program as an additional part of its field operations. These samples are used to test for diseases such as a plague titer from mammalian blood (primarily from coyotes). Requests for samples have increased substantially, especially because of the new APHIS-WS program. Blood samples for plague can help the AGFD and county health departments identify plague "hot spots" within Arizona, which would assist county health departments with information to provide public notification regarding the risk of plague contact in identified areas.

Disease surveillance and monitoring as a component of existing PDM activities reduces cost by eliminating a redundancy of effort in capturing predators to obtain samples. Further, under this opportunistic sampling method, only those predators captured as part of PDM activities are sampled for pathogens, thus eliminating the additive wildlife mortality that would be incurred if the PDM and wildlife disease programs were separate.

Public awareness and HHS risks associated with zoonosis (*i.e.*, diseases of animals that can be transmitted to humans) have increased in recent years. Several zoonotic diseases associated with predators are addressed in this EA. Those zoonotic diseases remain a concern and continue to pose threats to HHS where people encounter predators. WS-Arizona has received requests to assist with reducing damage and threats associated with several predator species in Arizona and could conduct or assist with disease monitoring or surveillance for any of the predators addressed in this EA. WS-Arizona' primary involvement in the risk reduction of zoonotic diseases would be to aid other federal, tribal, state, and local government and research entities monitor for the presence or absence of diseases in wildlife and advice on risk reduction methods. These data can be used to predict potential HHS risks and aid agencies in directing management efforts. Most disease sampling occurs ancillary to other wildlife damage management activities (*i.e.*, disease sampling occurs after wildlife have been captured or lethally removed for other purposes) (Table 6. For example, WS-Arizona could sample predators lethally removed by hunters, private trappers or during other damage management programs to survey for diseases. In the unlikely event of a disease outbreak or an imminent realistic threat of an outbreak, WS-Arizona could also be asked to conduct localized wildlife population reduction or removal of captive wildlife to prevent spread of disease.

Table 6. Zoonotic diseases opportunistically sampled by Wildlife Services Arizona during fiscal year 2011-2015.

Zoonotic Diseases Sampled by Fiscal Year					
Zoonotic Disease	**2011**	**2012**	**2013**	**2014**	**2015**
Canine Heartworm	4	1	0	0	0
Plague	583	697	458	467	431
Rabies	898	625	265	399	291
Tularemia	583	697	458	467	431
Total	2068	2020	1181	1333	1153

1.2.4. Natural Resources

Predation is one of many mortality factors that influences wildlife populations. Predation by native predators on native prey species is part of the function of a healthy ecosystem, and the health of a predator population is integrally linked to health of its prey base. However, high predation rates, especially on prey populations with few individuals and/or under resource constraints that are cumulatively impacted by human-induced environmental changes (habitat loss, recovery from extirpation, disease caused by concentration, etc.), can reduce the size and sustainability of populations, especially if they have low reproductive rates.

AGFD mission is to conserve Arizona's diverse wildlife resources and manage for safe, compatible outdoor recreation opportunities for current and future generations (AGFD 2017a). AGFD has identified that, under some circumstances, predators can cause additive constraints on the ability of some sensitive or vulnerable game species to reproduce and have healthy populations. AGFD may request WS-Arizona, as well as commercial and volunteer agents for assistance to protect species under their jurisdiction.

In the past, AGFD has requested PDM services from WS-Arizona to reduce predation to local populations of pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), and mule deer (*Odocoileus hemionus*), especially on spring ranges for pronghorn and deer (predation on fawns), and, where needed, for vulnerable bighorn sheep populations. WS-Arizona has also assisted the USFWS and AGFD in supporting management of the federally endangered Mexican wolf *(Canis lupus baileyi)* and black-footed ferret (*Mustela nigripes*).

Predator damage to natural resources sometimes results in requests for assistance involving T&E species, sensitive species, and game species protection. PDM for wildlife protection can be very effective when predation has been identified as a limiting factor. WS-Arizona works with agencies that have management responsibilities for wildlife species that are impacted by predation. WS-Arizona assists with identifying and providing the level of PDM assistance needed. When PDM actions are requested by USFWS or another federal agency, the responsibility for NEPA compliance rests with that agency. WS-Arizona, however, could agree to meet the responsibility for NEPA compliance at the request of the federal agency requesting assistance from WS-Arizona. These situations are handled on a case-by-case basis.

Feral dogs may impact threatened and endangered wildlife species. APHIS-WS records from 1998 through 2006 contain reported losses of the following threatened and endangered species due to feral dog predation: Atwater's prairie chickens (*Tympanuchus cupido attwateri*) in Texas; black-footed ferrets in Arizona; Hawaiian coot (*Fulica americana alai*), Hawaiian duck (*Anas wyvilliana*), Hawaiian goose(*Branta sandvicensis*), Hawaiian moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian stilt (*Himantopus mexicanus knudseni*) in Hawaii; Mississippi sandhill crane (*Grus canadensis canadensis*) in Mississippi; and the western snowy plover (*Charadrius alexandrinus nivosus*), salt marsh harvest mouse (*Reithrodontomys raviventris*), and Mojave Desert tortoise (*Gopherus agassizii*) in California (Bergman et al. 2009).

From FY11 to FY15, WS-Arizona conducted an average of 11 annual work tasks associated with natural resource protection projects. Specific examples of these types of projects include:

- Coyote PDM from FY11 to FY15 for the protection of the endangered black-footed ferret reintroduced in north central Arizona.
- Coyote PDM from FY11 to FY15 for the protection of pronghorn (*Antilocapra americana*) and mule deer.
- Raccoon management for the protection of fish at tribal run hatcheries from FY11 to FY15 including protection of apache trout (*Oncorhynchus apache*).

The relationships between predators and species that are considered to be natural resources have been studied in detail. These complex relationships impact how predators need to be managed. For deer, bighorn sheep, antelope, nesting upland game birds, waterfowl, and shorebirds, relationships to some of the primary predators discussed in this EA are discussed in more detail below.

1.2.4.1. Deer, Bighorn Sheep, and Antelope.

Under certain conditions, predators considered in this EA, primarily coyotes and mountain lions, can have an adverse impact on deer, elk, bighorn sheep, and pronghorn populations, and this predation is of concern during periods when the population is vulnerable, such as fawning, calving, and lambing (Pimlott 1970, USFWS 1978, Hamlin et al. 1984, Neff et al. 1985, Shaw 1981). Connolly (1978) reviewed 68 studies of predation on wild ungulate populations and concluded that in 31 cases, predation by coyotes had an influence on white-tailed deer, mule deer, pronghorn, and bighorn sheep populations. Hamlin et al. (1984) observed that a minimum of 90% summer mortality of deer fawns was a result of coyote predation. Pojar and Bowden (2004) found, for mule deer fawns in Colorado in areas with habitat similar to that in Oregon, that 75% of predation mortality occurred by July 31. Other authors also observed that coyotes were responsible for the majority of deer fawn mortality during the first few weeks of life (Knowlton 1964, White 1967). One study in the central Sierra Nevada in California found that predation was the largest cause of deer fawn loss, resulting in the death of 50% of all fawns during the first 12 months of life. In this instance, mountain lions were the main predator, with coyotes accounting for 27% of predation (Neal 1990). Teer et al. (1991) concluded from work conducted at the Welder Wildlife Refuge, Texas, that coyotes take a large portion of the fawns each year during the first few weeks of life. Another Texas study (Beasom 1974) found that predators were responsible for 74% and 61% of the fawn mortality for two consecutive years. Garner (1976), Garner et al. (1976), and Bartush (1978) found annual losses of deer fawns in Oklahoma to be about 88%, with coyotes responsible for about 88% to 97% of the mortality. Trainer et al. (1981) reported that heavy mortality of mule deer fawns during early summer and late fall and winter in the Steens Mountains in Oregon, primarily from coyote predation, was limiting the ability of the population to maintain or increase population levels.

Determining if predation, nutrition, weather or other factors are limiting growth of a population are complex. Additionally, Monteith *et al.* (2014) summarized that evidence of mortality is often used to justify predator management to increase ungulate populations which underscores the need to correctly interpret the consequences of mortality. Factors limiting growth of ungulate populations are difficult to understand because they are numerous, interacting and subject to variability (Bishop *et al*. 2009). Early debates about ungulate populations were based on competing hypotheses of population effects caused by food limitations and predation (Peek 1980). It is now recognized, as the base of knowledge has grown from further research, that food limitations and predation simultaneously affect ungulates population dynamics (Sinclair and Krebs 2002). Further, the interactions between nutrition and predation are likely mediated by weather (Hopcraft *et al*. 2010). That being said, predation can affect a prey population only if mortality is at least partially additive to mortality from other causes (Caughley 1976). Multiple studies have identified three conditions that must be met to ascertain predators are effecting an ungulate population (Forrester and Wittmer 2013, Hurley *et al*. 2011, Theberge and Guthier 1985). The conditions that must be met to consider predation may be affecting an ungulate population are 1) the ungulate population is below carrying capacity, 2) mortality is a primary factor influencing change in prey abundance and 3) predation is the major cause of mortality.

Coming to an agreement about the role of predation in shaping the growth of a local ungulate population is complex due to the interaction of environmental variables that influence potential population growth rate and density (Hurley *et al*. 2009). Moreover, determining if mortality is additive or compensatory, the role of alternate prey, whether the predator prey interactions are influenced by multiple predators or multiple prey species and whether the cause of mortality is proximate or ultimate complicates agency decision making, and understanding by the public and numerous constituencies with an interest in wildlife. Compensatory mortality is the additional risk of death that caused a reduction in other forms of mortality so the overall mortality either does not change or is less than it would be if additive. Additive mortality is the additional risk of death does not cause a reduction in other forms of mortality but increases the overall mortality (Bartmann *et al*. 1992).

Predation and malnutrition/disease mortality in ungulate populations, especially mule deer, can be high and the most abundant causes of death (Forrester and Wittmer 2013, Hurley *et al*. 2011, Bishop *et al*. 2009). In fact, predation is the largest proximate cause of mortality in both adult female and fawn mule deer in all studies reviewed by Forrester and Wittmer (2013). Yet, many of these studies found mortality was compensatory and other forms of mortality (i.e., nutrition, weather) were the ultimate cause of death (Forrester and Wittmer 2013). Determining if predation was the primary factor causing a population decline and the ultimate cause of death is more complicated in multiple predator, multiple prey systems (Leblond *et al*. 2016, Latham *et al*. 2013,) Monteith *et al*. (2014) proposed a methodology requiring a short term research project to determine if predation or nutrition were the cause of mule deer population declines, whether predation mortality was additive or compensatory or if habitat improvement and/or deer density reduction would improve population growth. Bishop *et al*. (2009) reached similar conclusion about determining if mortality was additive or compensatory. To illustrate the point of complex interpretations of data, Hurley *et al*. (2011) study of mule deer populations in southeastern Idaho found evidence of compensatory mortality from coyotes and inconsistent effects of predator management on mule population metrics. The study found decreased mortality of 6-month old fawns and adult does with increased lion removal which could lead readers to conclude predator management had a benefit. However, the magnitude and frequency of weather caused mortality overwhelms the effects of predators regulating mule deer populations in southeastern Idaho. The greatest potential for population growth in southeastern Idaho was likely from improving habitat to improve nutrition for mule deer. However, Hurley *et al*. (2011) postulated that coyote removal may have the possibility of success but was contingent on lagomorph and small mammal population levels measured in April.

Managing ungulate populations requires wildlife agencies to examine many factors to understand why a population may have declined and to guide management efforts to increase a population. Populations can be affected by climate variation, predation, habitat (nutrition) or the relationship to carrying capacity (Bishop *et al*. 2009). While wildlife and land management agencies can manipulate predation or habitat to attempt to reach population management goals, climate and weather operate independently of agency actions. Predation is often seen by concerned citizens and sometimes biologists as the cause of an ungulate population decline, but the complexities of interpreting predation and habitat data findings that are modified by variable weather and climate which often lead to calls for predator management when other management prescriptions may be likely to meet management goals (Ballard *et al*. 2001).

Predation was found to be the leading cause of pronghorn fawn loss, accounting for 91% of the mortalities that occurred during a 1981-82 study in southeastern Oregon (Trainer et al. 1983), with coyotes comprising 60% of that mortality. In addition, a coyote reduction study in southeastern Oregon documented that, in 1985, 1986 and 1987, an estimated reduction of 24%, 48%, and 58% of the spring coyote population in the study area resulted in an increase in fawns from 4 fawns/100 does in 1984 to 34, 71, and 84 fawns/100 does in 1985, 1986, and 1987, respectively (Willis et al. 1993). Other authors observed that coyotes were responsible for the majority of fawn mortality during the first few weeks of life (Knowlton 1964, White 1967). Reductions of local coyote and other predator populations have been shown to result in increasing fawn survival of white-tailed deer (Guthery and Beasom 1977, Stout 1982, Knowlton and Stoddart 1992) and pronghorn (Arrington and Edwards 1951, Smith et al. 1986, Wakeling et al. 2015).

Teer et al. (1991) documented that coyote diets contain nearly 90% deer during May and June. They concluded from work done at the Welder Wildlife Refuge, Texas, that coyotes take a large portion of the fawns each year during the first few weeks of life. Remains of 4 to 8 week old fawns were also common in coyote scats (feces) in studies from Steele (1969), Cook et al. (1971), Holle (1977), Litvaitis (1978), Litvaitis and Shaw (1980). Mule deer fawn survival was significantly increased and more consistent inside a predator-free enclosure in Arizona (LeCount 1977, Smith and LeCount 1976, Carrera et al. 2015). Hamlin et al. (1984) observed that a minimum of 90% summer mortality of fawns was a result of coyote predation.

Carrera et al. (2015) observed that differences in diet quality of mule deer may be related to trade-offs incurred through predation risk, where mule deer inside the enclosure are maximizing their energy intake without the burden of predator avoidance and vigilance.

Guthery and Beasom (1977) demonstrated that after coyote damage management, deer fawn production was more than 70% greater after the first year, and 43% greater after the second year in their southern Texas study area. Another Texas study (Beasom 1974a, 1974b) found that predators were responsible for 74% and 61% of the fawn mortality for two consecutive years. Stout (1982) increased deer production on three areas in Oklahoma by 262%, 92% and 167% the first summer following coyote damage management, an average increase of 154% for the three areas. Garner (1976), Garner et al. (1976) and Bartush (1978) found annual losses of deer fawns in Oklahoma to be about 88% with coyotes responsible for 88% to 97% of the mortality. Knowlton and Stoddart (1992) reviewed deer productivity data from the Welder Wildlife Refuge following coyote reduction. Deer densities tripled compared with those outside the enclosure, but without harvest management, ultimately returned to original densities due primarily to malnutrition and parasitism.

Predation is the primary source of mortality on adult pronghorn (Yoakum 1978). Coyotes (Canis latrans; Einarsen, 1948; Yoakum, 1978), mountain lions (Ockenfels 1994), bobcats (Einarsen 1948; Yoakum 1978), and dogs (Mitchell 1980) are some of the main predators. Jones (1949) believed that coyote predation was the main limiting factor of pronghorn in Texas. A six-year radio telemetry study of pronghorn in western Utah showed that 83% of all fawn mortality was attributed to predators (Beale and Smith 1973). In Arizona, Arrington and Edwards (1951) showed that intensive coyote damage management was followed by an increase in pronghorn to the point where antelope were once again huntable, whereas on areas without coyote damage management this increase was not noted. Similar observations of improved pronghorn fawn survival and population increase following damage management have been reported by Riter (1941), Udy (1953) and Smith et al. (1986). Major losses of pronghorn fawns to predators have been reported from additional radio telemetry studies (Beale 1978, Barrett 1978, Bodie 1978, Von Gunten 1978, Hailey 1979, Neff and Woolsey 1979, and Tucker and Garner 1980). Mountain lions can have a major effect on adult pronghorns where their home ranges intersect in rugged terrain (Engstrom and Maxwell 1988, Canon and Bryant 1992, Ockenfel 1994).

Coyote damage management on Anderson Mesa, Arizona increased the herd from 115 animals to 350 in three years, and peaking at 481 animals in 1971 (Neff et al. 1985). After coyote damage management was stopped, the pronghorn fawn survival dropped to only 14 and 7 fawns per 100 does in 1973 and 1979, respectively. Initiation of another coyote damage management program began with the reduction of an estimated 22% of the coyote population in 1981, 28% in 1982, and 29% in 1983. Pronghorn populations on Anderson Mesa, during 1983, showed a population of 1,008 antelope, exceeding 1,000 animals for the first time since 1960. Fawn production increased from a low of 7 fawns per 100 does in 1979 to 69 and 67 fawns per 100 does in 1982 and 1983, respectively. After a five-year study, Neff and Woolsey (1979, 1980) determined that coyote predation on pronghorn fawns was the primary factor causing fawn mortality and low pronghorn densities on Anderson Mesa, Arizona. Smith et al. (1986) noted that controlling coyote predation on pronghorn fawns could result in 100% annual increases in population size, and that coyote removal was a cost-effective strategy in pronghorn management.

Bighorn sheep are susceptible to predation, especially where their populations have reached precariously low numbers (Mooring et al 2004). Mountain lions are the primary predator of bighorns, but coyotes and bobcats will also take them. Mooring et al. (2004) found that in New Mexico, rams had the highest predation rates and thought it was mostly from mountain lions. It has been thought that the rams use habitat conducive to predation by lions, they have poor post-rut body condition, and are more easily stalked because their curls block more of their rear vision (Harrison and Hebert 1989, Schaefer et al. 2000, Mooring et al. 2004). However, other studies found that lambs (Ross et al. 1997) and females (Krausman et al. 1989) were taken more by mountain lions in proportion to their population; other studies found that predation rates reflected the proportion of sex and age class in the population (Hayes et al. 2000) or a particular lion's predation habits (Ross et al. 1997). Concern has arisen in New Mexico for certain populations of bighorn sheep and where they were listed as state endangered; similar problems could arise in Arizona, but populations currently appear stable (Biota Information System of New Mexico (BISON-M 2015) with the exception of Kofa National Wildlife Refuge where mountain lions are a recent arrival. USFWS (2009) completed an EA that has a range of responses to protect the bighorn at different population levels. Mountain lion predation has hampered desert bighorn sheep translocation efforts in Arizona, Colorado, New Mexico, Texas, and Utah, USA (Krausman et al. 1999, Rominger et al. 2004, McKinney et al 2006). Hunter and depredation harvests of mountain lions should be conducted to enhance conservation and translocations of bighorn sheep (McKinney et al. 2006). Management intervention of mountain lion predation on a case-by-case basis might benefit translocations of desert bighorn sheep in areas where habitat might be potentially unsuitable, or where populations of mule deer intrinsically are low or have undergone substantial decline (Douglas and Leslie 1999, Kamler et al. 2002, Rominger et al. 2004, McKinney et al. 2006). In FY07, WS-Arizona responded to 26 requests for the protection of bighorn sheep from mountain lion predation in Arizona, but none since.

The above cases show that coyote predation had a significant influence on white-tailed deer (*Odocoileus virginianus*), mule deer, pronghorn and bighorn sheep populations. Ballard et al. (2001) reviewed published predator-deer relationship studies, including many of those above, since the mid-1970s and found that predators (coyote, mountain lion, and wolf) could cause significant mortality, but PDM may or may not result in higher populations and increased harvest levels for hunters. They found that PDM benefitted big game mostly when herds were well below forage carrying capacity, predation was identified to be a limiting factor, PDM efforts sufficiently reduced the predator population, PDM efforts were timed correctly (prior to fawning and denning), and PDM was focused on a small scale (<259 mi^2). Conversely, PDM was not effective when the above conditions were not met. In addition, Ballard et al. (2001) suggested that the experimental design of research being conducted on PDM to benefit deer needed to be improved because it was unclear in several studies if PDM had a significant effect protecting deer herds. The most convincing evidence of deer population increases as a result of PDM were from studies conducted in small enclosures (< 15 mi^2) because predator populations were much easier to regulate in smaller areas.

Black bears can have a significant impact on neonatal elk calves (Zager and Beecham 2006, Yarkovich et al. 2011). Black bears prey upon neonatal ungulates, < 1 month old, taking up to 90%

of the offspring annually. Black bear predation appears to be additive at low ungulate densities and may become compensatory as prey density approaches carrying capacity (Zager and Beecham 2006). In areas of low ungulate population option could include population management (Zager and Beecham 2006) or bear relocation programs (Yarkovich et al 2011).

Wehausen (1996) reported several instances where mountain lion predation on bighorn sheep populations reduced population growth rates, resulting in the cessation of the bighorn sheep restoration program into new habitat. Mountain lions in California were reported to be a threat to the native Sierra Nevada bighorn sheep population directly through predation and indirectly with their presence by keeping bighorn sheep out of critical winter range. These in part were factors that lead to a 1999 emergency listing under the ESA (64 FR 19300, followed in 2000 by a final listing (65 FR 20)) because the small bighorn sheep population was in danger of extinction. The state determined that the combination of selective mountain lion control on bighorn sheep winter ranges may have contributed to increased use of formerly-restricted winter range (USFWS 2008). Kamler et al. (2002) suggested mountain lion predation was responsible for the decline in bighorn sheep populations in most areas of Arizona; these declines were most likely linked to overall declines in mule deer populations which resulted in mountain lion taking bighorn sheep as alternate prey. Rominger et al. (2004) similarly reported that mountain lions limited expansion of a transplanted population of bighorn sheep in New Mexico. Hayes et al. (2000) proposed that mountain lion predation on bighorn sheep may be impeding recovery of a federally-listed endangered bighorn sheep population in the Peninsular Ranges of California.

Bergman et al (2009) reports of dog predation on elk (*Cervus elaphus*), white-tailed deer, mule deer (*Odocoileus hemionus*), and pronghorn (*Antilocapra americana*). Additional wildlife species affected include colonial waterbirds and wild turkeys (*Meleagris gallopavo*). Clearly, under some circumstances, PDM can be an important tool in maintaining specific wildlife management objectives. PDM activities to protect big game species in Arizona to reduce excessive predation is a decision that will primarily rest with the Tribes or AGFD, and WS-Arizona would assist them at their request.

1.2.4.2. Nesting Upland Gamebirds, Waterfowl, and Shorebirds

Clearly, under some circumstances, managing predation can be an important tool in maintaining specific wildlife management objectives. Managing game species in Arizona is the responsibility of the USFWS, Tribes, and/or AGFD and any decision to managing predation to benefit local game populations would be the responsibility of the USFWS, Tribes and/or AGFD dependent on species and geographic location. However, WS-Arizona could provide assistance if requested by the USFWS, Tribes, or AGFD. A major goal of the WS-Arizona would be to provide protection and conduct actions in areas where data suggests that managing predators would likely be effective and successful as suggested by Ballard et al. (2001).

WS-Arizona has not received requests from the USFWS, Tribes, AZGFD, or other agencies to provide protection for certain species of nesting upland gamebirds, waterfowl, and shorebirds from predators. A number of PDM projects are conducted by WS in other parts of the United States to protect nesting birds that are federally listed T&E species. Two federally listed endangered species in Arizona could potentially be impacted by predators: the masked bobwhite and Yuma clapper rail. Predation has been found to be a limiting factor for at least close relatives of each of these species, but loss of habitat appears to be the leading cause of endangerment for both species. WS-Arizona does not have authority over habitat management but may make recommendations for habitat management to minimize predator conflicts (e.g. vegetation thinning or enhancement to reduce or enhance cover for predator species and/or prey) However, the authority to conduct habitat management belongs to the State and federal land management agencies. Captive-reared masked bobwhites are commonly predated, mostly by avian predators. WS nationally does have programs to protect other upland game birds and clapper rails. WS has conducted PDM for Attwater's greater prairie-chickens (*Tympanuchus cupido attwateri*) in Texas (USFWS 1998b) where skunk, coyote and other species predation were identified as a limiting factor in their recovery. Additional support may be given to these species should it be determined by an agency with management authority over such species that predation from predators has limited their viability. PDM projects for nesting birds are typically of short duration and limited to just prior to and during the critical nesting periods when the eggs, chicks, and nesting birds are most vulnerable. PDM activities for nesting birds are typically focused on a few species of mammalian predators notorious for robbing nests of eggs and nestlings such as raccoons, skunks, and coyotes.

Sage-grouse (*Centrocercus spp.*) populations have declined throughout the western United States over the last several decades due to a variety of environmental factors (Connelly and Braun 1997). Sage-grouse populations occupying habitats that are highly fragmented or in poor ecological condition may exhibit relatively low nest success, low juvenile recruitment, and poor adult survival that may be related to increased predation (Gregg 1991). The primary source of sage-grouse nest failure has been identified as predation, accounting for an average of 94% of the nest loss (Moynahan et al. 2007). Coates et al (2008) identified common ravens (*Corves corax*) and American badgers as the top predators of sage-grouse nests. Coyotes, bobcats, and long-tailed weasels have also been identified as nest sage-grouse nest predators (Lockyer et al. 2013). Populations of some of the most important prairie grouse predators have increased dramatically over the last 100 years (see analysis related to coyote and red fox in Chapter 4), and even in areas of good habitat, predator populations can be so abundant that habitat alone may not suffice to allow grouse populations to increase (Bergerud 1988). Schroeder and Baydack (2001) suggested that as habitats become more fragmented and populations of prairie grouse become more threatened, it becomes more important to consider PDM as a potential management tool. Because damaged sagebrush habitats may take 15-30 years to recover, a predator management strategy that effectively increases nest success and juvenile survival may be useful in offsetting some of the negative effects of poor habitat. This approach might also allow a more rapid recovery of grouse populations following habitat recovery. After 3 years of monitoring the movement, survival and reproduction of reintroduced sharp-tailed grouse (*Tympanuchus phasianellus*) in northeastern Nevada, Coates and Delehanty (2001) recommended that future reintroductions of sharp-tailed grouse be preceded by 2 months of PDM to increase survival of released birds. In a survey of United States public attitudes regarding predators and their management to enhance avian recruitment, Messmer et al. (1999) found that given information suggesting predators are among the threats to a declining bird population, the public generally supported using PDM for the protection of bird populations.

Batterson and Morse (1948) documented heavy predation on sage-grouse nests in northeastern Oregon, and, while the greatest limiting factor was common raven (*Corvus corax*) predation, it was documented that coyotes and badgers also contributed to nest predation. Keister and Willis (1986) suggested that the major factor in determining sage-grouse population levels in their study area in southeastern Oregon was loss of nests and chicks during the first 3 weeks after hatching. Coyotes and ravens were suspected as the primary nest predators. A coyote removal project was implemented on their study area, and sage-grouse productivity increased dramatically from 0.13 chicks/hen to 2.45 chicks/hen in just 3 years. Willis et al. (1993) analyzed data on sage-grouse and predator populations, weather, and habitat from an area of Oregon that had some of the best sage-grouse habitat in the state. The only meaningful relationship they found was a significant negative correlation between coyote abundance and the number of sage-grouse chicks produced per hen. They concluded that fluctuation in predator abundance was probably the single most important factor affecting annual productivity of sage-grouse in their study area. Presnall and Wood (1953) documented an example illustrating the potential of coyotes as predators on sage-grouse. In tracking a coyote approximately 5 miles to its den in northern Colorado, they found evidence along the way that the coyote had killed three adult greater sage-grouse (*Centrocercus urophasianus*) and destroyed a sage-grouse nest. Examination of the stomach contents from an adult female coyote removed the next day revealed parts of an adult sage-grouse hen plus six whole newly-hatched sage-grouse chicks. The area around the den was littered with sage-grouse bones and feathers. No other prey remains were found around the den, and it appeared that the pups had been raised largely upon sage-grouse.

Burkepile et al. (2001) radio-marked 31 sage-grouse chicks from 13 broods in 1999 and 44 chicks from 15 broods in 2000. Survival estimates for 1999 and 2000 were only 15% and 18%, respectively. Predators were responsible for 90% of the mortality in 1999 and 100% of the mortality in 2000. Red fox were believed to be one of the primary chick predators, but predation was also confirmed by unidentified avian and other mammalian predators as well. Bunnell and Flinders (1999) also documented significant predation by red fox on sage-grouse in their study area in Utah, and recently revised sage-grouse management guidelines (Connelly et al. 2000) suggest that red fox populations should be discouraged in sage-grouse habitats. To the extent that red fox, coyotes, and other predators which prey on chicks are also preying on eggs, reducing the populations of these predators from sage-grouse nesting and early brood-rearing areas has the potential to benefit both nesting success and chick survival.

Dumke and Pils (1973) reported that ring-necked pheasant (*Phasianus colchicus*) hens were especially prone to predation during their nest incubation period. Trautman et al. (1974) examined the effects of predator removal on pheasant populations in South Dakota by monitoring pheasant populations in similar 100 mi^2 areas with and without PDM. They examined two variations of predator removal, one targeting only red fox for 5 years, and the other targeting badger, raccoon, striped skunks and red fox for 5 years. They found pheasant densities were 19% and 132% higher in predator removal areas than in non-removal areas during fox removal and multiple predator species removal, respectively. Chesness et al. (1968) examined the effects of predator removal on pheasant populations in paired treatment and non-treatment areas in Minnesota over 3 years by targeting primarily nest predators, including skunks, raccoons, and crows. They reported a 36% hatching success in predator removal areas versus a 16% hatching success in non-removal areas, as well as higher clutch sizes and chick production in predator removal areas. Nohrenberg (1999) investigated the effects of limited predator removal on pheasant populations on his study areas in southern Idaho and found consistently higher pheasant survival and productivity in predator removal areas as compared to similar non-removal areas.

Predation of wild turkeys had a considerable effect on female turkey survival in Wisconsin, with predators responsible for 78% of all moralities throughout the study and 87.5% of all mortalities that occurred in spring (Pollentier et al. 2014). Wild turkey nests predation in Texas suffers high predation rates exceeding 65%, which may limit recruitment (Locke et al. 2012). Peyton et al. (2014) reported 60% of the losses of Merriam's wild turkeys during the winter was due to predation by mountain lions and bobcats. Thomas (1989) and Speake (1985) reported that predators were responsible for more than 40% of nest failures of wild turkeys (*Meleagris gallopavo*) in New Hampshire and Alabama, respectively. Everett et al. (1980) reported that predators destroyed 7 of 8 nests on his study area in northern Alabama. Lewis (1973) and Speake et al. (1985) reported that predation was also the leading cause of mortality in turkey poults, and Kurzejeski et al. (1987) reported in a radio-telemetry study that predation was the leading cause of mortality in hens. Wakeling (1991) reported that the leading natural cause of mortality among older turkeys was coyote predation, with the highest mortality rate for adult females occurring in winter. Niedzielski and Bowman (2014) concurred that coyotes were the number one predator of female wild turkeys in research they conducted in the northern end of their range. Other researchers report that hen predation is also high in spring when hens are nesting and caring for poults (Speake et al. 1985, Kurzejeski et al. 1987, Wakeling 1991). Williams et al. (1980) reported a 59% hatching success for turkeys prior to a predator poisoning campaign, versus a 72% hatching success following a predator poisoning campaign.

Seasonal predator reduction through trapping has proven useful for improving nest success for upland nesting ducks (Duebbert and Kantrud 1974, Duebbert and Lokemoen 1980, Garrettson and Rohwer 2001, Pieron and Rohwer 2010, Pieron et al. 2013). Numerous studies reported that nesting success was greater at predator-reduced sites than in non-predator reduced areas (Garrettson and Rohwer 2001, Rohwer et al. 2004, Chodachek and Chamberlain 2006, Pearse and Lester 2007, Pieron and Rohwer 2010) and the above levels predicted by population models to be necessary for population maintenance (Cowardin and Johnson 1979, Cowardin et al. 1985). The mortality of breeding females and ducklings which are also critical components of production (Klett et al. 1988, Hoekman et al. 2002), and predator management can increase duckling survival (Zimmer 1996, Pearse and Ratti 2004; but see Amundson and Arnold 2011) and hen survival during the brood rearing period (Pearse and Ratti 2004). However, most mortality of adult female mallards occurred during the nesting season (Devries et al. 2003), especially as a result of predation by red fox (*Vulpes vulpes*); Sargeant et al. 1984), so one would expect additional increases in adult female survival when predator control efforts caused notable reductions in fox densities (Garrettson and Rohwer 2001).

In a study of waterfowl nesting success in Canada, researchers found that eggs in most nests were lost to predators such as red foxes, coyotes, striped skunks, raccoons, Franklin's ground squirrels (*Spermophilus. franklinii*), badgers, black-billed magpies (*Pica pica*) and American crows (*Corvus brachyrhynchos*) (Johnson et al. 1988). Cowardin et al. (1985) determined that predation was by far the most important cause of nest failure in mallards (*Anas platyrhynchos*) on their study area. Various studies have shown the skunk and raccoon to be a major waterfowl nest predator resulting in poor nesting success (Keith 1961, Urban 1970, Bandy 1965). On the Sterling Wildlife Management area in southern Idaho, striped skunks, red fox and black-billed magpies were documented as common predators of nesting ducks, with magpie predation identified as the most significant factor limiting waterfowl production (Gazda and Connelly 1993).

In documenting the effects of red fox predation on waterfowl in North Dakota (Sargeant 1978, Sargeant et al. 1984), the researchers concluded that reducing high levels of predation was necessary to increase waterfowl production. Balser et al. (1968) determined that PDM resulted in 60% greater production in waterfowl in areas with damage management as compared to areas without damage management. He also recommended that when conducting PDM, the entire complex of potential predators should be targeted or compensatory predation may occur by a species not under control, a phenomena also observed by Greenwood (1986). Rohwer et al. (1997) documented a 52% nesting success for upland nesting ducks in an area receiving PDM, versus only a 6% nesting success in a similar non-treatment area. Garrettson and Rohwer (2001) likewise documented dramatically higher duck nesting success in areas where predators were removed during the nesting season as compared to areas where no predators were removed, and noted that the annual nature of predator removal allowed for greater management flexibility than most habitat management efforts.

Production of sandhill cranes (*Grus canadensis*) at Malheur National Wildlife Refuge in southeastern Oregon was severely limited by predation from coyotes, ravens, raccoons, and mink. PDM for these species on the refuge resulted in increased colt survival (from 1 crane colt surviving to 60) as well as increased production of other waterfowl (USFWS 1989, 1990, 1991, 1994). Several other predators can damage nesting waterfowl, primarily their eggs, such as skunks and foxes. Typically the goal of PDM is to suppress these populations during the nesting season to increase their production.

1.2.4.3. Other Species

WS-Arizona may be requested to help protect other species not specifically discussed in this section. If a management agency finds that a particular species has been impacted by predation, WS-Arizona could assist in determining if PDM efforts could help protect the species and conduct PDM at the request of the managing agency. Species being given protection often are T&E species. One example of a T&E species that was reintroduced in Arizona that has been given protection from predators, especially prior to their reintroduction, was the black-footed ferret. In the first reintroduction effort by USFWS, 34 of 39 reintroduced ferrets were killed by predators. As a result of the impact of predation, PDM is now conducted at any site where ferrets are going to be reintroduced. Similar efforts to protect other species in the future could take place if a need is identified and WS-Arizona assistance is requested.

Feral and free-ranging cats can be present in very high densities, which can potentially lead to devastating effects on native animals. Scientists estimate that nationwide cats kill 1.3–4.0 billion birds and 6.3–22.3 billion mammals, 228 to 871 million reptiles and between 86 and 320 million amphibians annually (Loss et al. 2013). Cats have been listed among the 100 worst non-native invasive species in the world (Lowe et al. 2000). The American Bird Conservancy (ABC) states that "*cats often kill common* [bird] *species such as cardinals, blue jays, and house wrens, as well as rare and endangered species such as piping plovers, Florida scrub-jays, and California least terns*" (ABC 2011). Some feral and free-ranging cats kill more than 100 animals each year. For example, at a wildlife experiment station, a roaming, well-fed cat killed more than 1,600 animals over 18 months, primarily small mammals (ABC 2011). Researchers at the University of Wisconsin coupled their four-year cat predation study with the data from other studies, and estimated that rural feral and free-ranging cats kill at least 7.8 million and perhaps as many as 217 million birds a year in Wisconsin (Coleman et al. 1997). In some parts of Wisconsin, feral and free ranging cat densities reached 114 cats per square mile, outnumbering all similar-sized native predators (Coleman et al. 1997). Churcher and Lawton (1989) observed 77 well fed free-ranging cats in a British village for one year. Churcher and Lawton (1989) estimated that 30% to 50% of a cat's catch were birds and that the cats had adversely affected house sparrow populations within the village. Based on information acquired in the study, Churcher and Lawton (1989) estimated that more than 20 million birds are killed by cats in Britain each year with more than 70 million animals overall being taken by cats annually.

The diet of feral and free-ranging cats varies depending on availability, abundance, and geographic location. In a survey of New Zealand scientific literature, Fitzgerald (1990) concluded that prey selection of feral and free-ranging cats is dependent on availability. Fitzgerald (1990) found that cats on the mainland fed most heavily on mammals; whereas, cats on islands fed almost exclusively on birds (particularly seabirds). Feral and free-ranging cats are known to prey on birds as large as mallard ducks (Figley and VanDruff 1982) and young brown pelicans (Anderson et al. 1989) along with mammals as large as hares and rabbits. Many cat populations rely heavily on humans either for handouts and/or for garbage. Pearson (1971) found that cats were serious predators of California voles and that the greatest pressure on voles occurred when vole numbers were lowest. Liberg (1984) found that cats in southern Sweden fed predominantly on native mammals. Prey use was based more on availability than abundance. Langham (1990) found that mammals made up 74% of diets of New Zealand farmland feral cats, while 24% were birds. Cats fed most heavily on the most abundant species and groups. A study on a southern Illinois farmstead concluded that well-fed cats preferred microtine rodents; however, they also consumed birds (George 1974). Microtine rodents are particularly susceptible to over harvest by cats and other predators (Pearson 1964). Coman and Brunner (1972) found that small mammals were the primary food item for feral cats in Victoria, Australia. Prey selection was directly related to proximity of cats to human habitation. Pearson (1964) found rodents composed a large portion of a cat's diet. Some people view the predation of rodents by cats as beneficial, but native small mammals are important to maintaining biologically diverse ecosystems. Field mice and shrews are also important prey for birds such as great horned owls and red-tailed hawks.

Reptiles are thought to provide an important food source to cats when birds and mammals are less abundant, and in some situations, cats have been observed to prey on threatened species of reptiles. Domesticated cats have been identified as significant nest and/or hatchling predators of sea turtles. A study on the Aldabra Atoll, Seychelles found feral cats had an adverse effect on green turtle hatchlings. Seabrook (1989) found a positive correlation in cat activity and green turtle nesting at Aldabra Atoll. Cats are known to have contributed to the near extirpation of the West Indian rock iguana (*Cyclura carinata*) on Pine Cay in the Caicos Islands (Iverson 1978).

Research in Hawaii has shown feral cats to be frequent predators of endangered Hawaiian birds (Banko 1992, Smith et al. 2002, Hess et al. 2004). Cats can adversely affect local wildlife populations, especially in habitat "*islands*", such as suburban and urban parks, wildlife refuges, and other areas surrounded by human development (Wilcove 1985). The loss of bird species from habitat islands is well documented and nest predation is an important cause of the decline of neotropical migrants (Wilcove 1985). A 2-year study was conducted in two parks with grassland habitat. One park had no cats but more than 25 cats were being fed daily in the other park. There were almost twice as many birds seen in the park with no cats as in the park with cats. California thrasher and California quail, both ground-nesting birds, were seen during surveys in the no-cat area; whereas, they were never seen in the cat area. In addition, more than 85% of the native seer mice and harvest mice trapped were in the no-cat area; whereas, 79% of the house mice, an exotic pest species, were trapped in the cat area. The researchers concluded, "*Cats at artificially high densities, sustained by supplemental feeding, reduce abundance of native rodent and bird populations, change the rodent species composition, and may facilitate the expansion of the house mouse into new areas*" (Hawkins et al. 1999).

1.3. RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

WS-Arizona PDM EAs. WS-Arizona previously completed two PDM EAs for Arizona (WS 1996, 1999a). In October, 2016, WS-Arizona published a draft statewide PDM EA and received public comments on that draft. In May 2017, WS-Arizona published a second statewide draft PDM EA and has received public comments on that draft. This new statewide PDM EA which will supersede the prior PDM EAs.

EA, FONSI, and Decision – Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Foxes, and Coyotes in the United States. USDA (2010) analyzed the environmental effects of APHIS-WS involvement in rabies management and the funding of and participation in oral rabies vaccination programs to eliminate or stop the spread of raccoon rabies in a number of eastern states (Alabama, Connecticut, Delaware, Florida, Georgia, Indiana, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, and West Virginia) and gray fox and coyote rabies in Arizona, New Mexico, and Texas. The analysis area included BLM and USFS lands, excluding Wilderness Areas. WS determined the action would not have any significant adverse impact on the quality of the human environment. Although USDA (2010) is separate from this statewide PDM EA, it is referenced in this document where information on rabies may be helpful in providing a more complete picture of WS activities.

National Level Memoranda of Understanding. MOUs have been signed between WS and BLM and between WS and USFS which recognize WS' authority and responsibility for WDM, and related compliance with NEPA, on BLM and USFS lands. WS is recognized through the MOUs with BLM and USFS as being the lead agency concerning most WDM on public lands; USFS and BLM are responsible for NEPA compliance when WDM is to protect federal resources such as gopher control to planted seedlings. In the current MOUs that WS has with USFS and BLM, it is recognized that the state of Arizona has management authority over resident wildlife. The AGFD and ADA are the entities that have been given the primary management authority for resident wildlife on federal lands and they establish the management objectives for these species and their damage. WS defers to applicable state laws in the management of predators on these federal lands.

USFS Land and Land and Resource Management Plans (LRMPs). The National Forest Management Act requires that each NF prepare an LRMP for guiding long-range management and direction. Arizona has 6 NFs that are managed under the direction of Forest Supervisors and are further subdivided into 26 Ranger Districts. WS provides USFS District Rangers, the Forest Supervisors, or both with WPs annually on those Ranger Districts where WS expects to conduct PDM. USFS discusses the compatibility of the proposed PDM activities with the LRMP. WS conducts PDM activities according to all applicable laws and regulations. WS could potentially conduct PDM on all NFs in the state where requested and appropriate (*i.e.*, to protect livestock on grazing allotments, wildlife, or HHS). If WS is requested to conduct PDM on USFS lands not covered by the scope of this statewide PDM EA, then a determination of the need for additional NEPA compliance would be made at that time.

BLM Resource Management Plans (RMPs). The Federal Land Policy and Management Act of 1976 as amended direct the BLM to develop and maintain land use plans which provide for the use of public lands. Arizona has four BLM districts and eight Field Offices, which includes five National Monuments, and three National Conservation Areas covering approximately 12.2 million surface acres, and 17.5 million subsurface acres. The BLM State Office is located in Phoenix. WS-Arizona provides the appropriate BLM offices with work plans annually where WS-Arizona expects to conduct PDM. The BLM discusses the compatibility of the proposed PDM with the RMP. WS-Arizona conducts PDM activities according to all applicable laws and regulations, and policies. If requested, WS-Arizona could conduct PDM through any BLM Field Office in Arizona where appropriate. If WS-Arizona is requested to conduct PDM on BLM lands not covered by the scope of this statewide PDM EA, then a determination on the need for additional National Environmental Policy Act compliance would be made at that time.

AGFD Management Plans. AGFD has various plans that outline short- and long-term goals and management objectives for species populations in Arizona and within smaller geographic areas called Game Management Units (GMUs). These include a strategic plan which provides a long-term, broad overview of the Department's varied responsibilities, operational plans which are more specific and focus on a shorter time-frame, and implementation plans which provide guidance to all work units on the activities to be implemented by that work unit. Operational and implementation plans may include management focus area plans, species management plans, area-specific predation management plans, and other statewide plans. WS-Arizona mostly responds to requests concerning agricultural related damage for these species and some HHS threats. WS-Arizona relies on AGFD to determine the species management objectives are in each GMU and ensure that management objectives are met.

1.4. WS-ARIZONA'S COMPLIANCE WITH NEPA

WS-Arizona PDM activities are subject to the National Environmental Policy Act (NEPA) (Public Law 9-190, 42 U.S.C. 4321 et seq.). The APHIS-WS program follows the Council on Environmental Quality (CEQ) regulations implementing the NEPA (40 CFR 1500 et seq.) along with USDA (7 CFR 1b) and APHIS Implementing Procedures (7 CFR 372) as part of the decision-making process. NEPA sets forth the requirement that all 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;
- Making informed decisions; and
- Including agencies and the public in their NEPA planning in support of informed decision-making.

Updates regarding WS-Arizona implementation of PDM in Arizona have prompted WS-Arizona to initiate this new analysis. The analyses contained in this environmental assessment (EA) are based on information and data derived from APHIS-WS' Management Information System (MIS) database; data from the ADA and AGFD regarding species under their jurisdiction; published and, when available, peer-reviewed scientific documents (Chapter 5); interagency consultations; public involvement; and other relevant sources.

This EA describes the needs for resolving predator damage problems for which WS-Arizona is typically requested to assist. The EA identifies the potential issues associated with reasonable alternative ways and levels of providing that assistance. It then evaluates the environmental consequences of the alternatives for WS-Arizona involvement in PDM.

To assist with understanding applicable issues and reasonable alternatives to managing predator damage in Arizona and to ensure that the analysis is complete for informed decision-making, WS-Arizona has made this EA available to the public, agencies, tribes and other interested or affected entities for review and comment prior to making and publishing the decision (either preparation of a Finding of No Significant Impact (FONSI) or a Notice of Intent to prepare an Environmental Impact Statement (EIS)). Public outreach notification methods for an EA include postings on the national APHIS-WS NEPA webpage and on www.regulations.gov, a direct mailing to known local stakeholders, electronic notification to registered stakeholders on www.GovDelivery.com, and notification in the legal section of the Statesman Journal newspaper. The public will be informed of the decision using the same venues, including direct mailed notices to all individuals who submit comments and provide physical addresses.

Wildlife damage management is a complex issue requiring coordination among state and federal agencies and the tribes. To facilitate planning, efficiently use agency expertise, and promote interagency coordination with meeting the needs for action (Section 1.2), WS-Arizona is coordinating the preparation of this EA with cooperating and consulting partner agencies, including ADA, AGFD, USFS, BLM, USFWS, and Arizona Department of Health Services (ADHS). WS-Arizona also recognizes the sovereign rights of Native American tribes to manage wildlife on tribal properties, and has invited all federally recognized tribes in Arizona to cooperate or participate in the development of this EA. The WS-Arizona program is committed to coordinating with all applicable land and resource management agencies including tribes when PDM activities are requested.

1.4.1. Use of This EA to Inform WS-Arizona's Decisions

Although WS-Arizona only conducts PDM when requested by a governmental, commercial, or private entity, as a federal agency, it is required to comply with NEPA for its activities. WS-Arizona is the lead for APHIS-WS' PDM program in Arizona. WS-Arizona has the technical expertise in management of damage caused by native predators and their activities. Consulting agencies in the development of this EA are BLM, USFS, ADA, AGFD, ADHS, and Native American tribes. Each of the consulting agencies are asked to review the draft document and provide input and direction to WS-Arizona to ensure that actions are in compliance with applicable federal and state regulations and policies, federal land management plans and joint MOUs, and cooperative agreements.

WS-Arizona will use the analyses in this EA to help inform WS-Arizona decision-making, including whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI); and whether or not to continue WS-Arizona PDM activities and, if so, to determine how and to what degree such activities would be implemented.

1.4.2. The Relationship of the EA to Site-Specific Analyses and Decisions, Using the APHIS-WS Decision Model

Many of the species addressed in this EA can be found statewide within suitable habitat, and damage or threats of damage can occur wherever those species occur and overlap with human presence, resources, or activities. Wildlife damage management falls within the category of actions in which the exact timing or location of individual requests for assistance can be difficult to predict with sufficient notice to accurately describe the locations or times in which WS-Arizona can reasonably expect to be acting. Although WS-Arizona could predict some of the possible locations or types of situations and sites where some kinds of predator-related damage could occur, the program cannot predict the specific locations or times at which affected resource owners would determine that a damage problem has become intolerable to the point that they request assistance from WS-Arizona. Therefore, WS-Arizona must be ready to provide assistance on short notice anywhere in Arizona to protect any resource or human/pet health or safety upon request.

The APHIS-WS Decision Model Directive 2.201 (Figure 2) is the site-specific procedure for individual actions conducted by WS-Arizona personnel in the field when they respond to requests for assistance. Site-specific decisions made using the model are in accordance with NEPA decisions and include applicable WS' directives (Section 1.6), relevant laws and regulations, interagency agreements and memoranda of understanding, and cooperating agency policy and procedures.

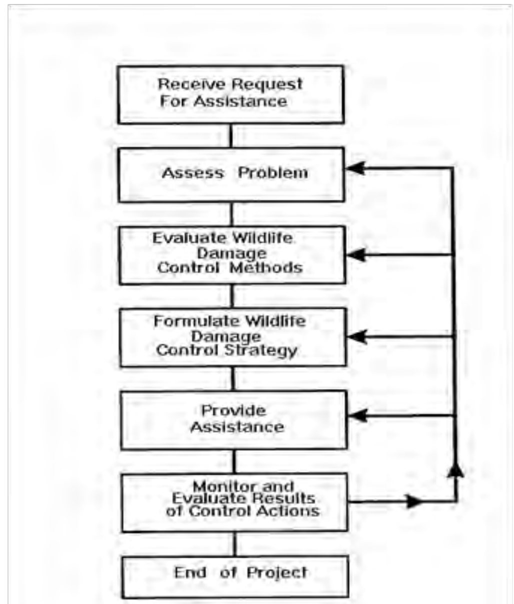

Figure 2. APHIS-WS Decision Model

1.5. SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS

1.5.1. Actions Analyzed

This EA documents the need for PDM, the issues associated with meeting that need, and five alternative approaches to address those issues and to meet the need for action. The EA also evaluates the issues and impacts of statewide PDM to protect livestock, agriculture, property, natural resources and HHS in Arizona.

Section 3.1.5.4 of this EA discusses the methods available for use or recommendation under each of the alternatives evaluated. The five alternatives discuss how WS-Arizona and other entities could recommend or use methods to reduce damage and threats associated with predators in the State. Therefore, the actions evaluated in this EA are the use or recommendation of methods available under the alternatives and WS-Arizona' use or recommendation of methods to reduce or prevent damage and threats associated with predators from occurring when requested by the appropriate resource owner or manager. Activities that could involve the lethal removal of target predators by WS-Arizona under the alternatives would only occur when agreed upon by the requester.

It is important to remember that APHIS-WS does not have any authority to manage wildlife other than the authority provided by Congress for assisting with wildlife-caused damage. APHIS-WS policy is to respond to requests for assistance with managing wildlife damage. Managing wildlife populations and even individual wild animals is under the legal jurisdiction of state wildlife agencies, the USFWS, National Oceanic and Atmospheric Administration/National Marine Fisheries Services (NOAA NMFS) for ESA-listed species, the USFWS for migratory birds and eagles, and tribal governments on tribal lands, and APHIS-WS defers to the applicable laws.

APHIS-WS has no authority to determine national policy regarding use and commitment of local, state, tribal or federal resources or lands for economic use by private entities, such as livestock grazing or timber growth and harvest, nor use of private land, such as for livestock feedlots, or government, commercial, or residential development.

APHIS-WS does not make public land use management decisions. Policies that determine the multiple uses of public lands are based on Congressional acts through laws such as the Taylor Grazing Act of 1934 and the Federal Land Policy and Management Act (FLPMA) for the BLM, and the Forest Service Organic Act of 1897 and the Multiple Use-Sustained Yield Act of 1960 for the Forest Service. Congressional appropriations support the implementation of these authorities. In contrast, WS-Arizona only addresses PDM upon request (Section 1.5 and WS Directive 2.201).

WS-Arizona cannot use pesticides unless they are approved by the U.S. Environmental Protection Agency (EPA) per FIFRA and are registered for use in Arizona. WS-Arizona must ensure that all storage, use, and disposal by WS-Arizona personnel is consistent with FIFRA label requirements and WS Directive 2.401.

In Arizona, most native wildlife species are managed by AGFD per ARS § 17.102. The U.S. Fish and Wildlife Service (USFWS, Department of Interior) and the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA NMFS, Department of Commerce) have authority regarding wildlife and plant species listed per the Endangered Species Act (Public Law 93-205, 15 USC 1531 as amended).

Migratory birds are managed by the USFWS per the Migratory Bird Treaty Act (MBTA). The USFWS also manages waterfowl hunting and take of migratory birds, whether intentional or incidental to other activities pursuant with this law. A permit from the USFWS is required for all activities that would involve take of native migratory birds, which includes pursuing, hunting, taking, capturing, or killing migratory birds, or destroying any active nest or live egg. The USFWS is also the authority for managing intentional and non-purposeful take of bald and golden eagles through the issuance of permits under the BGEPA.

WS-Arizona has no authority for determining the appropriate management of wildlife populations that are under the jurisdiction of AGFD and ADA per their statutes, regulations, and species management plans and strategies, or management of species regulated in accordance with the ESA, the MBTA, or the BGEPA. Rather, WS-Arizona responds to governmental and non-governmental requesters for assistance in managing wildlife damage and threats.

1.5.2. Native American Indian Lands and Tribes

WS-Arizona recognizes that wildlife is a key component of Native American culture and beliefs. The exact nature of this relationship and role varies among Tribes and individuals within Tribes. WS-Arizona would only conduct PDM on Native American lands when requested by a Native American Tribe and after WS-Arizona and the Tribe requesting assistance signed a MOU or Work Initiation Document and/or a Cooperative Service Agreement or Cooperative Service Field Agreement. Since Tribes are sovereign, the methods employed are the same as for any private land upon which WS-Arizona provides services, tribal officials determine if PDM is desired and the PDM methods allowed. Therefore, the Tribe would determine what activities would be allowed and when assistance was required. Because Tribal officials would be responsible for requesting assistance from WS-Arizona and determining what methods would be available to alleviate damage, no conflict with traditional or cultural properties or beliefs would likely occur. The methods available to alleviate damage from predators on federal, state, county, municipal, and private properties under the alternatives analyzed in this EA would be available for use to alleviate damage on Tribal properties when the Tribe requesting assistance approved the use of those methods. Therefore, the activities and methods addressed under the alternatives would include the activities that WS-Arizona could use on Native American lands, when requested and when agreed upon by the Tribe and WS-Arizona.

1.5.3. Federal Lands

Arizona has a fairly large proportion of lands owned by the federal government and WS-Arizona is often requested to conduct PDM on them. State laws can impact the types of PDM that can be conducted on these lands. With the passage of Proposition 201 in Arizona, the use of foothold traps, snares, and pesticides for WDM is limited only to private and tribal lands in the state, except for situations involving HHS, wildlife disease surveillance, scientific research, and wildlife relocation. Thus, the only methods available that WS-Arizona can use in PDM actions for livestock or wildlife protection on USFS and BLM lands in the state are nonlethal methods, aerial shooting, and ground-based shooting with the exception of foot-hold traps for Mexican wolves and tools for PDM for HHS, wildlife disease surveillance, scientific research, and wildlife relocation. Therefore, WS-Arizona will not use M-44 devices on public lands. This further reduces the risk to HHS because most WS-Arizona PDM methods are used in areas where public access is limited. Additionally, WS-Arizona prominently posts warning signs to alert the public when and where, in the general area, devices or traps are deployed. WS-Arizona coordinates with cooperators or landowners about where and when PDM methods are to be used, thereby decreasing the likelihood of conflicts with the public.

WS-Arizona does not anticipate conducting PDM in National Parks. The potential exists that a request could come from the National Park Service or AGFD for responding to a threat to HHS or for research purposes, and WS-Arizona would work with those entites to assist them within the laws and regualtions governing National Parks or other protected lands

PDM in Wilderness Areas would be conducted in accordance with each land management agency's Wilderness Policies, guidance documents, MOUs, and the provisions identified in work plans (e.g., BLM Manual 6340, and WS authorities). Should any of BLM's existing Wilderness Study Areas (WSA) be officially designated as Wilderness Area (WA) in the future, WDM would be performed in accordance with the enacting legislation and wilderness rules and regulations that pertain to WS-Arizona PDM. Should any of BLM's existing WSAs be officially dropped as a WSA, PDM would follow standard procedures for public lands and as specified in the WP. If WS-Arizona were requested to conduct PDM on federal lands for the protection of livestock, property, HHS, or natural resources such as T&E species, this EA would cover such actions implemented.

1.5.4. Geographic Scope of this EA

The geographic scope of the actions and analyses in this EA is statewide. WS-Arizona has decided that one EA analyzing potential operational impacts for the entire State of Arizona provides a more comprehensive and less redundant analysis than multiple site specific EAs covering smaller regions. This approach also provides a broader scope for the effective analysis of potential cumulative impacts and for using data and reports from state and federal wildlife management agencies, which are typically on a state-wide basis.

Areas in which WS-Arizona PDM activities occur encompass rural and urban areas, including residential and commercial development; rangelands, pastures, ranches and farms; agricultural croplands; timber and forested areas; recreation areas and trails; airports; wildernesses and wilderness study areas where authorized, and other places where predators may overlap with human occurrence, activities, and land uses and create conflicts.

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within Arizona for which WS-Arizona may be requested for assistance. Using the WS Decision Model for field operations, this EA meets the intent of NEPA with regard to site-specific analysis, informed decision-making, and providing the necessary timely assistance to agencies and cooperators per WS-Arizona objectives.

Operational areas may include:

A. Private Property

Private and commercial property owners and/or managers of private property request WS-Arizona for assistance to manage predator damage and threats. WS-Arizona reported that 29% of the responses to damage or damage threats by the species in this EA occurred on private lands. Private property includes areas in private ownership in urban, suburban, and rural areas, including agricultural lands, timberlands, pastures, residential complexes, subdivisions, and businesses.

B. Federal Property

Per the MOUs with the USFS and BLM, WS-Arizona responds to permittee and agency requests for PDM for protection of livestock on federal grazing allotments. WS-Arizona coordinates with the agencies prior to the grazing/recreation seasons to identify needs, types of operations, and restrictions (documented in an Annual Work Plan), and reports annually to the agencies on their activities (Section 1.6). WS-Arizona may also respond to requests for assistance with human health and safety and protection of ESA-listed species.

C. State and Municipal Property

Activities are conducted on properties owned and/or managed by the state or Arizona municipalities when requested. Such properties can include parks, forestland, historical sites, natural areas, scenic areas, conservations areas, and campgrounds. Sometimes private landowners that are being affected by predators that reside in habitat located on adjacent public lands may request assistance. The adjacent property owner/manager may agree to allow PDM activities to occur to assist the affected landowner. WS-Arizona can also conduct PDM activities directly on state and city properties as agents for AGFD when requested, or independently.

D. Tribal Property

Tribal governments and landowners can request assistance from WS-Arizona for PDM on lands under their authority and/or ownership. Predators have an important role in tribal culture and religious beliefs. WS-Arizona continues to work with tribes to address their needs through consultation for this EA, with policy, and in the field, as requested. The primary WS-Arizona work conducted for tribes involved the White Mountain Apache tribal government for wildlife damage management to protect agriculture, natural resources, property, and human health and safety. Work conducted at the request of tribal governments is consistent with tribal decisions, values, and traditions.

Native American tribes may choose to work with relevant cooperating agencies for meeting PDM needs, use WS-Arizona's services, hire commercial control companies, or conduct their own work. Any participating Tribes would need to make the decision regarding the management alternative they choose to implement. WS-Arizona respects the rights of sovereign tribal governments, provides early opportunities for all federally-recognized tribes in Arizona to participate in planning and developing IPDM strategies affecting tribal interests and requests for assistance through consultations, cooperating agency status, and effective means of engagement through the government-to-government relationship consistent with USDA APHIS Directive 1040.3 and federal policy.

E. Airports

Because habitat for small mammals, and small mammals that are prey for predators may be found within fenced active airfields, these predators can become hazards to aircraft during are takeoffs and landings. WS-Arizona receives requests for assistance and training from several airport authorities to address threats of aircraft strikes at some of the airports or airbases in Arizona and may be requested for assistance at other airports in the future. WS-Arizona currently provides services and/or training to several airports in Arizona, including Luke Air Force Base in Glendale, Davis Monthan Air Force Base in Tucson, Phoenix-Mesa Gateway Airport in Mesa, Show Low Regional Airport in Show Low, and Sierra Vista Municipal/Libby Army Airfield in Sierra Vista.

1.5.5. Period of Time That This EA Will Remain Valid

If WS-Arizona determines that the analyses in this EA indicate that an EIS is not warranted (impacts are not significant per 40 CFR §1508.27; Section 1.4), this EA remains valid until WS-Arizona determines that new or additional needs for action, changed conditions, new issues, and/or new alternatives having different environmental impacts need to be analyzed to keep the information and analyses current. At that time, this analysis and document would be reviewed and, if appropriate, supplemented if the changes would have "environmental relevance" (40 CFR 1502.9(c)), or a new EA would be prepared pursuant to the NEPA.

WS-Arizona monitors PDM activities conducted by its personnel and ensures that those activities and their impacts remain consistent with the activities and impacts analyzed in the EA and selected as part of the decision. Monitoring includes review of adopted mitigation measures and target and non-target take reported and associated impacts analyzed in the EA. Monitoring ensures that program effects are within the limits of evaluated/anticipated take in the selected alternative. Monitoring involves review of the EA for all of the issues evaluated in Chapter 3 to ensure that the activities and associated impacts have not changed substantially over time.

1.5.6. Interdisciplinary Development of the EA

WS-Arizona solicited comments from the BLM, USFS, ADA, AGFD, ASLD, WMAT, Tribes, and USFWS to facilitate an interdisciplinary approach to analysis. Comments are maintained in an administrative file located at the WS-Arizona State Office, 8836 North 23rd Avenue, Suite 2, Phoenix, AZ 85021.

1.5.7. Public Involvement

As part of this process and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document was made available to the public through multiple means. The public was informed of the availability of the EA for review and comment on October 26, 2016 through notices on the WS NEPA web site, Regulations.gov, and a legal notice in The Arizona Republic requesting public review and comments on the analysis. WS-Arizona also sent out notices through the WS National Stakeholder email registry. The comment period closed on December 9, 2016. During this comment period, WS-Arizona received 3 comment letters. The public was informed of the availability of the 2nd EA for review and comment on May 17, 2017 through notices on the WS NEPA web site, Regulations.gov, and a legal notice in The Arizona Republic requesting public review and comments on the analysis. WS-Arizona also sent out notices through the WS National Stakeholder email registry. The comment period closed on June 19, 2017. During this comment period, WS-Arizona received 3 comment letters. WS-Arizona has clarified and expanded the information in the EA to better inform the public of the proposed action and analysis, and is seeking additional public input on the document. A list of the literature submitted to WS-Arizona for review during the first public review period can be found in Appendix D. All of the literature submitted was reviewed and incorportated in the the discussion and analysis as appropriate. This pre-decisoinal EA will be recirculated for public comment for 30 days and the same notification process will be used to inform the public and stakeholders of the opportunity.

1.6. AUTHORITY AND COMPLIANCE OF THE USDA/APHIS/WILDLIFE SERVICES PROGRAM

Roles of USDA APHIS Wildlife Services in WDM

APHIS-WS provides federal professional leadership and expertise to resolve wildlife conflicts to help create a balance that allows people and wildlife to coexist. APHIS-WS applies and recommends a cohesive integrated approach, which incorporates biological, economic, environmental, legal and other information into a transparent wildlife damage management decision-making process, and includes many methods for managing wildlife damage, including nonlethal and lethal options.

The APHIS-WS mission is broad, and includes resolution of wildlife conflicts in rural and urban areas; conservation of natural resources (including threatened and endangered species, and managed wildlife populations), protection of public, private and commercial property and assets; and control of invasive species and wildlife disease vectors. Increasingly, APHIS-WS is responsible for minimizing wildlife threats to public health and safety, as well as to the Nation's vital agricultural base.

APHIS-WS' success is based in its paired programs of fieldwork (operations) and research. Its National Wildlife Research Center (NWRC), internationally recognized as a leader in wildlife damage management science, conducts research and develops tools to address dynamic wildlife damage management challenges. APHIS-WS operations personnel and NWRC researchers work closely together. This ensures that APHIS-WS will continue to resolve wildlife conflicts effectively and as humanely as possible, using advanced science and technology. The NWRC applies scientific expertise to the development of practical methods to resolve these problems and to maintain the quality of the environments shared with wildlife. NWRC designs studies to ensure that the methods developed to alleviate animal damage are biologically sound, effective, safe, economical, and acceptable to the public. NWRC scientists produce and test the appropriate methods, technology, and materials for reducing animal damage. Through the publication of results and the exchange of technical information, the NWRC provides valuable data and expertise to the public and the scientific community, as well as to APHIS-WS' operational program.

Federal Law Authorizing Wildlife Services' Actions

APHIS-WS is the federal agency authorized by Congress to protect American resources from damage associated with wildlife. The Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 8351) states:

> "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 Act was amended in 1987 (Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 8353) to further provide:

> On or after December 22, 1987, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with State, 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 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."

APHIS-WS' and WS-Arizona's Mission, Goals, and Objectives

APHIS-WS Mission, Goals, and Objectives

APHIS-WS' mission is to provide professional federal leadership in improving the coexistence of people and wildlife. The agency is funded by Congressional appropriations and by funds provided by governmental, commercial, private, and other entities that enter into an agreement with APHIS-WS for assistance. In Arizona, IWDM activities are funded by Congressional appropriations (about 54%), federal and state interagency agreements (about 21%), and private, commercial, or other cooperators (about 25%). Cooperators are always responsible for contributing a proportion of the costs, including WS-Arizona administrative overhead.

APHIS-WS' stated mission, developed through a strategic planning process, is:

- "To provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and
- To safeguard public health and safety" (APHIS-WS Directive 1.201).

To facilitate long-term strategic planning, APHIS-WS identified a list of core program functions in the APHIS-WS 2013-2017 Strategic Plan (APHIS-WS 2013), including these functions relevant to WS-Arizona:

- Predation management for the protection of wildlife
- Protection of natural resources (including threatened and endangered species) from other injurious wildlife
- Protection of agricultural resources and property from wildlife damage
- Airport wildlife hazard management
- Conducting wildlife damage research

APHIS-WS responds to requests for assistance from private and public entities, tribes and other federal, state, and local governmental agencies (APHIS-WS Directive 1.201 and 3.101).

Directive 1.301 states:

> "APHIS-WS is specifically authorized to enter into cooperative programs with Government agencies, public or private institutions, organizations associations or private citizens to manage conflicts with wild animals. By coordinating Federal Government involvement in managing wildlife conflicts and/or damage, WS officials help ensure that wildlife management activities are environmentally sound and conducted in compliance with applicable Federal, State, and local laws and regulations, including two significant environmental laws, the Endangered Species Act and the National Environmental Policy Act (NEPA).
>
> "Wildlife Services' successes in developing and providing its expertise in WDM methodologies, and strategies have increasingly created methodologies, strategies, and opportunities for private industry to provide similar WDM services. WS activities are differentiated from commercial WDM activities by among other things, adherences to the environmental protection requirements promulgated under NEPA….WS may implement methods approved exclusively for WS personnel who are the only individuals, public or private, that are trained and certified in their use. WS cooperates with private businesses by 1) providing technical training at State, regional, and national conferences; 2) developing certain WDM methods and registering certain chemical or pesticide WDM products for use by the industry and the public, and 3) assisting businesses by applying WS-specific management methods when requested."

The APHIS-WS program carries out its federal mission for helping to solve problems that occur when human activity and wildlife are in conflict with one another through:

- Providing training to governmental and commercial wildlife damage management professionals when requested;
- Developing and improving strategies to reduce economic losses and threats to humans from wildlife;
- Collecting, evaluating, and disseminating information on wildlife damage management techniques;
- Responding to requests for assistance with wildlife damage management situations, including providing technical advice and a source for loaned, limited-use management materials and equipment such as cage traps and pyrotechnics; informing and educating the public and cooperators on how to avoid or reduce wildlife damage; and/or addressing the problem through direct action.

The goal of WS-Arizona is to respond in a timely and appropriate way to all requests for assistance. Responses, whether over the phone, remotely, or in the field, follow a formal decision process (APHIS-WS Decision Model, APHIS-WS Directive 2.201, Section 3.1.5.3) to evaluate, formulate, and implement or recommend the most effective strategy. The recommended strategy is designed to reduce or eliminate damage and risks caused by the offending animal(s) to resolve conflicts with humans and their valued resources, health, and safety. These strategies may be both short term and long term, are often a combination of methodologies, and are based on APHIS-WS' mission of professionally supporting the coexistence of humans and wildlife.

The WS-Arizona objectives are to:

- Professionally and proficiently respond to all reported and verified losses or threats due to predators using the IPDM approach using the APHIS-WS decision model (APHIS-WS Directive 2.201; Section 3.1.5.3). IPDM must be consistent with all applicable federal, state, and local laws, APHIS-WS policies and directives, cooperative agreements, MOUs, and other requirements as provided in any decision resulting from this EA.
- Implement IPDM so that cumulative effects do not negatively affect the viability of any native predator populations.
- Ensure that actions conducting within the IPDM strategy fall within the management goals and objectives of applicable wildlife damage management plans or guidance as determined by the jurisdictional state, tribal, or federal wildlife management agency.
- Minimize non-target effects by using the APHIS-WS Decision Model (APHIS-WS Directive 2.201; Section 3.1.5.3) to select the most effective, target-specific, and humane remedies available, given legal, environmental, and other constraints.
- Incorporate the use of appropriate and effective new and existing lethal and non-lethal technologies, where appropriate, into technical and direct assistance strategies.

APHIS-WS' activities are conducted in accordance with applicable federal, state, and local laws, Work Initiation Documents (WIDs), cooperative agreements, agreements for control (Section 1.6.3), Memoranda of Understanding (MOU) (Section 1.6.4), and other applicable agreements and requirements, and the directives found in the WS Program Policy Manual, updated April 20, 2016 (https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_ws_program_directives). These documents establish the need for requested work, legal authorities allowing the requested work, and the respective responsibilities of APHIS-WS and its cooperators.

Ensuring the Implementation of Professional WDM Practices

Each APHIS-WS state office carries out the APHIS-WS mission in accordance with the differing management goals of its state. WDM activities can include providing assistance with WDM for the purposes of managing property and asset damage and losses, protecting special status wildlife, reducing or eliminating invasive species, protecting human health or safety, managing diseases that can be passed from wildlife to people or domestic animals (zoonosis), and conducting research.

Per APHIS-WS policy and practice, APHIS-WS State Directors and District Supervisors are professional wildlife biologists. Supervisors oversee teams of highly trained and specialized wildlife biologists and other field personnel.

APHIS-WS field personnel must be experienced in wildlife management and ecological principles and practices, and highly competent in identifying predator sign, field skills, and developing and implementing effective strategies within a wide diversity of challenging conditions and circumstances. They are highly trained in the use of firearms, capture techniques, pyrotechnics, field chemicals, and other methods described in detail in Appendix A per APHIS-WS Directives. They must also be experienced in working with people, and in using clear strategic skills in applying their experience, expertise, and training in applying the APHIS-WS Decision Model in effective and creative ways (Section 3.1.5.3).

Directive 1.301 states: "WS is the Federal leader in providing wildlife damage management solutions that are safe, effective, selective, economically feasible, and environmentally responsible…Our individual and collective adherence to this Code of Ethics will promote public service and will uphold the standards of the WS program."

Employee characteristics identified in the Code of Ethics (Directive 1.301) include commitment to compliance with legal requirements; honesty; integrity; accountability; continual learning and professional development; showing high levels of respect for people, property, wildlife, and varying viewpoints regarding wildlife and wildlife management; conservation of natural resources; using the most selective and humane methods available, with preference given to non-lethal methods when practical and effective; using the APHIS-WS Decision Model to resolve WDM problems; providing expertise on managing wildlife damage to the public upon request; and working in a safe and responsible manner.

All field personnel, as needed and appropriate, are trained, with periodic refreshers, in:

- The safe and proficient use of firearms (WS Directive 2.615);
- The safe involvement in aerial operations (WS Directives 2.620 and 2.305);
- The safe and proficient use of explosives and pyrotechnics (WS Directive 2.625);
- The safe use and management of hazardous materials (WS Directive 2.465);
- The safe and compliant use of pesticides (WS Directive 2.401);
- The safe and proficient use of M-44s (WS Directive 2.415); and
- The safe and humane use of immobilizing and euthanizing drugs (WS Direct 2.430).

<u>How APHIS-WS Operates</u>

APHIS-WS personnel respond to requests for assistance with particular problems, by reviewing the circumstances to determine whether wildlife caused the problem, and, if so, identifying which species of wildlife caused the problem, and then recommending to the requester one or more courses of actions they can take to minimize the risk of further damage (APHIS-WS Directive 2.201). This first type of action is called "technical assistance" wherein APHIS-WS personnel recommend actions that can be implemented by the resource owner or manager, such as better fencing, closer husbandry of livestock, or removing the offending animal themselves compliant with applicable laws.

APHIS-WS field personnel may also take action directly in response to a request for assistance, called "direct assistance" activities. These actions can include non-lethal techniques such as harassment and/or lethal measures that remove the offending animal(s), such as capturing them with specialized equipment and conducting euthanasia when needed. The actions can occur in urban or field settings, including secured and limited use areas such as military bases and airports. Before wildlife damage management of any type is conducted, a WID must be signed by a representative of WS-Arizona and the land owner or manager, or, for work on federal lands, an Annual Work Plan is discussed and agreed upon by the land management administrator or agency representative and WS-Arizona (per MOUs with the US Forest Service (USFS) and Bureau of Land Management (BLM), Section 1.6.4).

The APHIS-WS Directive 2.101 states:

> "When responding to requests for assistance, WS may provide technical assistance, direct control assistance, and/or research assistance. Technical and direct control assistance…may involve the use of either lethal or non-lethal methods, or a combination of the two. Preference is given to non-lethal methods when practical and effective."

Trained and experienced field personnel determine the appropriate PDM methodologies to recommend and/or implement using the APHIS-WS Decision Model (Slate et al. 1992, APHIS-WS Directive 2.201, Section 3.1.5.3, hereafter called the "Decision Model"). Using this Decision Model, after the field employee receives a request for assistance, s/he assesses the problem, evaluates the effectiveness of the various methods available using IPDM, recommends the strategy based on short-term and long-term effectiveness and possible restrictions, constraints, and environmental considerations and cost, discusses the options with the cooperator, and formulates the strategy, then provides the appropriate assistance, and the field and/or the cooperator monitors the effectiveness of the results. The use of the APHIS-WS Decision Model is discussed in more detail in Section 3.1.5.3.

The ultimate intent of APHIS-WS personnel responding to a request for assistance is to develop and, when appropriate, implement strategies to alleviate and/or avoid wildlife damage and threats to human/pet health or safety, using one or more of the following strategies:

- Manage the resource being damaged so it is more difficult for the wildlife to cause the damage.
- Manage the wild animals responsible for or associated with the damage in lethal and/or non-lethal ways so they cannot continue to cause damage and potentially train their young or conspecifics to cause such damage, and/or
- Create physical separation of the protected resource and the problem animals so that the damage is inherently minimized.

All APHIS-WS actions are consistent with applicable federal, state, and local laws and regulations (APHIS-WS Directive 2.210). All actions must be consistent with memoranda of understanding and agreements with federal and state agencies, such as the AGFD, USFWS, USFS, or BLM, if the actions involve those agencies. Most importantly, as a federal agency, all APHIS-WS actions must be in compliance with the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Migratory Bird Treaty Act (MBTA), and FIFRA, as well as the federal and state statutes discussed in this EA (Section 1.6.2).

When PDM assistance is requested, the APHIS-WS decision is whether or not to participate based on authority, jurisdiction, funding, and a professional determination of the scientific appropriateness and effectiveness of the strategy proposed by the requester, especially if the requester is the AGFD or USFWS. AGFD is authorized to control the threat of predator-related damage to wildlife populations under their authority using hunting seasons and administrative removals of predators. The USFWS is authorized to manage ESA-listed species, migratory birds, and eagles (Section 1.5.1 and Appendix A). Therefore, when requested by AGFD or the USFWS to conduct PDM for protection or management of species under their jurisdiction, especially if the requested action involves localized population reduction, WS-Arizona evaluates the potential effectiveness and appropriateness of their involvement before making a final decision to assist. WS-Arizona considers whether such actions would be strategically planned to occur at a specific time when the managed wildlife population is vulnerable to predation, such as on the winter range or during calving, lambing, or nesting, and when population reductions are determined to be necessary on a temporary and short-term basis.

WS-Arizona activities are described in detail in Section 3.1.5 (Alternative 5).

<u>WS-Arizona's Cooperation with other Agencies, Governments, and Municipalities</u>

When assistance is requested from AGFD, ADA or counties for a predator damage-related problem that involves a state agency, WS-Arizona cooperates with the state agency per applicable Arizona statute and regulations, and in accordance with guidelines, restrictions, and objectives set forth by these AGFD management plans and cooperative agreements. WS-Arizona can act as an agent to AGFD, ADA, or a landowner, depending on the entity requesting assistance.

The ADA, AGFD, counties, tribes, associations, and private entities form the basis of cooperative WS-Arizona IPDM work activities. The ADA, AGFD, and counties are authorized by ARS §§3-2401, 3-2405, and 17-302 to allocate funds to mutually cooperate with WS-Arizona for wildlife damage control of predatory animals wildlife damage and wildlife disease management.

WS-Arizona has Cooperative Service Agreements with ADA, AGFD, and counties. These documents establish a cooperative relationship between WS-Arizona and ADA, AGFD and counties, outline responsibilities and agreements for funding, and set forth objectives and goals for resolving wildlife damage conflicts in Arizona. Recognizing that the wording of these Cooperative Services Agreements may change upon renewal, it is not expected that future conditions included in the agreements would have environmental relevance not already evaluated in this EA.

At other times, when not working as an agent for ADA, AGFD, or counties WS-Arizona has authority under the Act of 1931 and subsequent amendments allowing for WS-Arizona to enter into agreements with public and private entities. Additionally, ARS §17-302, 3-1311, and §3-2405 allows property owners or their agents to address predators and/or damage caused by wildlife on their property. WS-Arizona therefore may either act as an agent for ADA, AGFD, and Counties or may directly act for requesting land/resource owners to address wildlife damage conflicts under legislative authority and state law. The Cooperative Service Agreement with ADA does not specify that WS-Arizona may operate as their agent when requested. However, state law provides for cooperation between ADA and WS-Arizona, and ADA provides funds to WS-Arizona for the control of predatory animals. Therefore, WS-Arizona can operate under federal authority as well as the authority of state law to work directly for cooperators.

WS-Arizona policy allows personnel to assist in feral and free-ranging dog control at the request of local authorities upon approval by the State Director. APHIS-WS Directive 2.340, regarding responding to damage caused by feral, free-ranging, and hybrid dogs, states that such actions will be coordinated either for each action or programmatically with state, local, and tribal authority before taking such action, and that each APHIS-WS state office will develop a state-wide policy. WS-Arizona's policy is under development.

The pertinent components of the current WS-Arizona Cooperative Service Agreements are:

A. ADA/WS-Arizona Cooperative Service Agreement for Wildlife Damage Management Actions

WS-Arizona has a Cooperative Service Agreement with ADA that provides for mutual consultations, development of annual work plans, compliance with NEPA and other laws, and payment of services for wildlife damage management actions taken at the request of ADA.

The resultant Work Plan typically includes the following goals and objectives:

- WS-Arizona will provide professional assistance upon request to resolve wildlife/human conflict related to wildlife damage to agriculture, property, natural resources, and human health and safety, as well as assisting ADA with wildlife diseases surveillance.
- Goals: 1) To provide a professionally conducted and ecologically sound predatory animal control program in Arizona using the most effective and safest control tools and techniques available; 2) To provide an agreement for ADA and WS-Arizona to share responsibilities for funding, planning, and evaluation for WDM actions; 3) To establish and maintain cooperative relationships between WS-Arizona, ADA, AGFD, county governments, the agricultural community, environmental groups, and the general public.
- Objectives: WS-Arizona will provide technical assistance and/or direct control where it is determined there is a need to resolve problems caused by wildlife. Lethal control efforts will be directed towards specific offending individuals or local populations. Method selection will be based on an evaluation of selectivity, humaneness, human safety, effectiveness, legality, and practicality. Technical assistance involves providing verbal or written advice, recommendations, information, demonstrations or training to use in managing wildlife damage problems, with implementation generally the responsibility of the resources/property owner. Direct control is usually provided when the resource/property owner's efforts have proven ineffective and/or technical assistance alone is inadequate. Direct control methods may include trapping equipment, shooting, and other methods as mutually agreed upon.

B. AGFD/ WS-Arizona Cooperative Service Agreement for Wildlife Damage Management activities

- WS-Arizona will provide professional assistance upon request to resolve wildlife/human conflict related to wildlife damage to human health and safety and wildlife, and other natural resources, as well as assisting AGFD with surveillance of wildlife diseases. WS-Arizona is designated by AGFD to act as AGFD's agent when appropriate to control predatory animals, recognizing that WS-Arizona also advises AGFD that other private sector providers may be available to provide wildlife damage management services. WS-Arizona field personnel can also act directly as the agent of the person owning, leasing, occupying, possessing, or having charge or dominion over any land on which predatory animals are or may be destructive to human health and safety and wildlife.
- Again, as a federal agency, WS-Arizona must determine that compliance with NEPA, ESA, and other applicable federal environmental statutes are completed before undertaking any wildlife damage management actions.
- Goals: 1) To provide a professionally conducted and ecologically sound predatory animal control program in Arizona using the most effective and safest control tools and techniques available; 2) To provide a mechanism for cooperating entities to participate in a WS-Arizona program with shared responsibilities for funding, planning, and evaluation; 3) To establish and maintain cooperative relationships between WS-Arizona, AGFD, ADA, county governments, the agricultural community, environmental groups, and the general public.

- WS-Arizona will use field personnel to respond to requests for assistance in controlling and destroying predatory animals, including coyotes, rabbits, rodents and birds that are or may be destructive to agricultural crops, products and activities, but excluding game birds and other birds determined by the AGFD to be in need of protection.
- Methods used by WS-Arizona may include lethal and non-lethal methods with trap check times recommended by AGFD and ARS regulations for predatory animals. ARS §17-302 states that when taking of bear or mountain lion for protection of property; that all traps shall be inspected within seventy-two hours and nontarget animals released without further injury. The Arizona Administrative Code, Title 12. Natural Resources, Chapter 4. Game and Fish Commission, R12-4-307 states in relation to trapping regulations states that a trapper shall inspect traps daily. WS-Arizona personnel comply with the daily trap check law.

C. Counties/WS-Arizona Cooperative Service Agreement for Wildlife Damage Management

- WS-Arizona will provide professional assistance upon request to resolve wildlife/human conflict related to wildlife damage to agriculture, property, natural resources, and human health and safety, as well as assisting Counties with wildlife disease surveillance.
- Goals: 1) To provide a professionally conducted and ecologically sound predatory animal control program in Arizona using the most effective and safest control tools and techniques available; 2) To provide an agreement for Counties and WS-Arizona to share responsibilities for funding, planning, and evaluation for WDM actions; 3) To establish and maintain cooperative relationships between WS-Arizona, ADA, AGFD, county governments, the agricultural community, environmental groups, and the general public.
- Objectives: WS-Arizona will provide technical assistance and/or direct control where it is determined there is a need to resolve problems caused by wildlife. Lethal control efforts will be directed towards specific offending individuals or local populations. Method selection will be based on an evaluation of selectivity, humaneness, human safety, effectiveness, legality, and practicality. Technical assistance involves providing verbal or written advice, recommendations, information, demonstrations or training to use in managing wildlife damage problems, with implementation generally the responsibility of the resources/property owner. Direct control is usually provided when the resource/property owner's efforts have proven ineffective and/or technical assistance alone is inadequate. Direct control methods may include trapping equipment, shooting, and other methods as mutually agreed upon.

Any state agencies not currently under a cooperative service agreement or intergovernmental agreement with WS-Arizona may enter into one consistent with the analyses and impacts in this EA and APHIS-WS policies and directives, thereby the activities would be covered by this EA.

WS-Arizona Cooperation with other Federal Agencies

WS-Arizona Cooperation with the US Forest Service and the BLM

The USFS and the BLM manage federal lands under their jurisdiction for multiple uses, including wildlife habitat, livestock grazing, timber, wilderness, cultural resources, and recreation.

APHIS-WS coordinates with these land management agencies before performing PDM activities on lands under their jurisdiction. The federal land management agencies USFS and BLM prepare land management plans per the National Forest Management Act and FLPMA (BLM) that guide long-range management direction and include action constraints for protecting sensitive resources. At some time either during or prior to the last five years, WS-Arizona has been requested to operate on most National Forests and BLM Districts. Current work plans involve six national forests in Arizona and four BLM districts for protection of agriculture, natural resources, and human health and safety. All national forests and BLM Districts may request WS-Arizona assistance with emergency work at any time.

For this EA, the USFS and BLM are cooperating agencies and have been involved with this EA to ensure consistency with their land management plans (WS-Arizona does not currently have cooperative agreements with forests and districts in italics):

- *Apache-Sitgreaves NF*
- *Coconino NF*
- *Coronado NF*
- *Kaibab NF*
- *Prescott NF*
- *Tonto NF*

BLM has four districts, each with a Resource Management Plan (RMP):

- *Arizona Strip District*
- *Colorado River District*
- *Gila District*
- *Phoenix District*

For WS-Arizona, over the last five years, less than 8% of take of target predators and 13% of responses to conflicts with predator species occur on Federal land (MIS 2017).

MOUs between APHIS-WS and US Forest Service and BLM

APHIS-WS has memoranda of understanding (MOUs) with the USFS and the BLM for PDM work on federal lands and resources under their jurisdiction.

A. MOU with the Forest Service:

- Documents the cooperation between the USFS and APHIS-WS for managing indigenous and feral vertebrates causing resource damage on National Forest System (NFS) lands, minimizing livestock losses due to predation by coyotes, mountain lions, and other predators, managing wildlife diseases, managing invasive species, and protecting other wildlife, plants, and habitat from damage as requested by the Forest Service and/or state or Federal wildlife management agencies.
- APHIS-WS evaluates needs for IPDM in cooperation with the USFS, develops and annually updates Annual Work Plans (AWPs) in cooperation with the USFS and appropriate state and federal agencies, tribes, and others. USFS cooperates with APHIS-WS to ensure that planned PDM activities do not conflict with other land uses, including human safety zones, and to ensure

that work plans are consistent with forest plans. APHIS-WS notifies the USFS before conducting activities on NFS lands and provides reporting on PDM results.

- APHIS-WS is responsible for NEPA compliance for wildlife damage, invasive, and wildlife disease management activities when requested by entities other than the USFS, and coordinates with the USFS, relevant state and federal agencies and tribes in completing NEPA compliance; the USFS complies with NEPA for all actions initiated by the USFS.
- APHIS-WS provides technical assistance and training to the USFS on WDM methodologies when requested.

B. MOU with the BLM:

- Documents cooperation with BLM, APHIS-WS, and state governments, provides guidelines for field operations, and identifies responsibility for NEPA compliance for PDM activities regarding predation by native and feral animals on livestock and wildlife, including federally-listed threatened and endangered species, and to other resources and human health and safety, consistent with multiple-use values.
- APHIS-WS and BLM cooperate to identify areas on BLM lands where mitigation or restrictions may apply, including human health and safety zones; the development and annual review of IPDM plans on BLM resources, consistent with the Federal Land Policy and Management Act (FLPMA), land and resource management plans, and federal laws; and evaluate needs for PDM in cooperation with state agencies, grazing permittees, adjacent landowners, and any other resource owner or manager, as appropriate.
- APHIS-WS is responsible for NEPA compliance for predator and invasive species damage and wildlife disease management activities conducted in response to requests on BLM lands, and will coordinate with and report to the BLM and state and local agencies and tribes during compliance.
- APHIS-WS will notify the BLM about the results of actions taken on BLM lands in an annual report.

WS-Arizona Cooperation with the US Fish and Wildlife Service

When WDM activities may affect federally listed threatened or endangered species, WS-Arizona consults with the US Fish and Wildlife Service (USFWS) to ensure its program will not jeopardize the continued existence of the listed species. Under Section 7 of the ESA, Federal agencies must consult with the USFWS when any action the agency carries out, funds, or authorizes may affect a listed endangered or threatened species. Effects of WS-Arizona activities on federally listed species in Arizona were evaluated by the USFWS in a Biological Opinions for impacts on listed Ocelot (June 27, 2017) and Jaguar (June 22, 1999) in formal consultations and Biological Assessment for all other species **(**dated March 13, 2018). WS-Arizona closely follows operational measures outlined in its ESA consultation documents to minimize the risk of take of listed species (Section 2.6).
WS-Arizona may also assist the USFWS in protecting ESA-listed species, when requested. Protective measures, reasonable and prudent measures, and terms and conditions included in the consultation documents are identified in Section 3.3 and analyses of the potential impacts of the WS-Arizona program on threatened and endangered species is located in Section 4.2.2.

APHIS-WS has a national Memorandum of Understanding with the US Fish and Wildlife Service, including the following pertinent sections:

- APHIS-WS and the USFWS recognize that non-target migratory birds might incidentally be killed despite the implementation of all reasonable measures to minimize the likelihood of take during actions covered under depredation permits, depredation and control orders, and agricultural control and eradication actions.
- During NEPA compliance, APHIS-WS will evaluate the reasonable range of alternatives, assess and estimate impacts on migratory birds, monitor migratory birds with other collaborators (as funds allow), and consider impacts on target and non-target species and ways to minimize impacts.
- USFWS will provide APHIS-WS available migratory bird population data, reported take by non-APHIS-WS entities, and biological information as requested within a reasonable time frame.

WS-Arizona Cooperation with the Federal Aviation Administration and National Association of State Aviation Officials

WS-Arizona works with the Federal Aviation Administration (FAA) and National Association of State Aviation Officials (NASAO), when requested, for necessary resolution of wildlife damage manage at airports to support aviation safety.

APHIS-WS MOU with the FAA and the NASAO:

- This partnership supports the organizations' common mission to collaboratively advance and encourage aviation safety within their respective areas of responsibility and to reduce wildlife hazard risks through education, research, and outreach, including promoting effective communication for ensuring critical safety, security, efficiency and natural resources/environmental compatibility.
- The end goal is to increase wildlife strike reporting and technical and operational assistance and necessary training to the aviation community to ultimately reduce the risk of wildlife hazards and ensure safer operations at airports.

1.6.1. Authority of Federal and State Agencies for PDM in Arizona

WS-Arizona conducts PDM in cooperation with and under the authorities of ADA and AGFD. PDM is also conducted in cooperation with Arizona Departments of State Land and Health, USFWS, BLM, and USFS. WS-Arizona provides PDM assistance statewide for its constituents, working cooperatively with several entities such as local livestock associations and county governments. PDM activities occur on private, tribal, and public lands. PDM methods that can be used in Arizona are discussed in Section 3.1.5.4. Each predator damage situation may require the use of one or more of these methods.

Arizona Department of Agriculture. A primary cooperator of the WS-Arizona Program, by legislation, is the Arizona Department of Agriculture (ADA) (Arizona Revised Statutes [ARS] 3-2401). ADA's mission and support of WS-Arizona is primarily focused on the development and protection of agriculture. The relationship and responsibilities between WS-Arizona and ADA are defined in a Memorandum of Understanding (MOU). Under the MOU and under the authority of ARS 3-2401, WS-Arizona has the authority to respond to damage requests for agriculture-related resources from predator, furbearer, and nongame species.

The MOU establishes a cooperative relationship between WS-Arizona and ADA, outlines responsibilities, and sets forth objectives and goals of each agency for resolving WDM conflicts in Arizona. ADA has regulations allowing the take of feral dogs harassing, injuring, or killing livestock (ARS 3-1311). Additionally, ADA regulates pesticide use in Arizona under Title 3 Articles 5 and 6.

Arizona Game and Fish Department. The Arizona Game and Fish Department (AGFD) is another primary cooperator with WS-Arizona for wildlife damage management because they have management authority over native and introduced wildlife in the state (ARS 17-102). AGFD's authority includes all of the species discussed in the introduction except feral domestic pets (dogs, cats, and ferrets) and feral livestock. The species managed by AGFD that may be involved in WS-Arizona wildlife damage management are classified as big game (mountain lions and black bears only), furbearers (badgers, otters, raccoons, ringtails, and weasels), predators (coyotes, bobcats, foxes, and skunks) and nongame (opossum) under Arizona statutes. WS-Arizona and AGFD have an MOU which lists responsibilities and authorities as they relate to PDM. Under the MOU, WS-Arizona has the authority to respond to damage requests resulting from mountain lions, black bears, predators, furbearers, and nongame, and provide information on take of these species annually to AGFD.

Arizona Revised Statutes Title 17 directs the responsibility for maintaining and managing the state's wildlife resources to the AGFD. ARS 17-102 designates wildlife in Arizona as property of the state, except federally listed T&E species. WS-Arizona has an MOU with AGFD that details the responsibilities of each agency and the cooperative relationship. WS-Arizona conducts activities in accordance with ARS 17-239, Wildlife Depredations, and 17-302, Taking of Bear or Mountain Lion. Coyotes and skunks are classified as a predatory animal under ARS Title 17-101.B.6 and regulated under Arizona Game and Fish Commission Order No. 13. AGFD issues aerial shooting permits according to ARS 28-8281 and Arizona Game and Fish Commission Policy A2.31, but AGFD can only issue permits to federal agencies or conduct aerial shooting themselves. Landowners, lessees or any other person can resolve wildlife depredations nonlethally or may obtain a permit to take any wildlife species causing damage to property in Arizona (ARS 17-239, ARS 17-302, R12-4-113). WS-Arizona is considered an agent of the landowner for the purpose of this section, but does not need a Wildlife Services permit required for private animal control operators (ARS 17-201: R12-4-421).

Arizona State Land Department. The Arizona State Land Board is responsible for maximizing economic returns from State Trust Lands in Arizona for the benefit of Trust beneficiaries. Livestock grazing and other agricultural leases are one source of economic return realized from State Trust Lands. As such, the Board has a vested interest in maintaining the economic viability of ranching and other agricultural operations that pay leases on State Trust Lands.

Arizona Department of Health Services. The Arizona Department of Health Services (AZDHS) is responsible for the protection of HHS in Arizona and would be involved in public health crises involving the outbreak of a wildlife disease such as rabies that impacts humans in coordination with ADA and County Health Departments.

U.S. Fish and Wildlife Service. USFWS has statutory authority to manage federally listed T&E species through the ESA of 1973 (16 USC 1531-1543, 87 Stat. 884) and migratory birds under the Migratory Bird Treaty Act of 1918 (16 USC 703-711; 40 Stat. 755), as amended. USFWS are also responsible for managing refuges and conflicts with predators if they conflict with the refuge management goals. Refuges can request WS-Arizona to conduct PDM, but would be responsible for the NEPA compliance for that work.

U.S. Forest Service and Bureau of Land Management. USFS and BLM are responsible for managing the resources on federal and public lands for multiple uses. These uses include livestock grazing, timber production, recreation and wildlife habitat. USFS and BLM recognize the state's authority to manage wildlife populations, and these uses are outlined in LRMPs and RMPs. USFS and BLM recognize the importance of reducing wildlife damage on lands and resources under their jurisdictions, as integrated with their multiple use responsibilities. For these reasons, both agencies have entered into MOUs with WS to facilitate a cooperative relationship. National level MOUs were signed between WS and Bureau of Land Management (BLM) in 2012 and between WS and U.S. Forest Service (USFS) in 2017. These MOUs transferred the responsibilities for wildlife damage management and related NEPA compliance from BLM and USFS to WS. WS conducts PDM activities on USFS and BLM lands in accordance with all applicable laws and regulations. These agencies recognize WS's expertise in PDM and rely on WS to determine the appropriate methodologies for conducting PDM to reduce losses of livestock and other resources, sometimes on adjacent properties. USFS and BLM can conduct some WDM activities themselves to protect resources on their lands, but would be responsible for the NEPA associated with it.

White Mountain Apache Tribe. The WMAT through its White Mountain Apache Outdoor and Recreation Program has managed its own wildlife on 1.6 million acres following the Supreme Court decision in 1982, wherein a case of the Mescalero Apache Tribe v. State of New Mexico, the Court recognized tribes' sovereign authority over the management of tribal fish and wildlife resources. This decision paved the way for the WMAT to institute its own management practices and to develop innovative, culturally appropriate recreation-based businesses. Building on its success in fisheries management – a program contracted from the Bureau of Indian Affairs (BIA) some years earlier – the Tribe established its wildlife management program through a 638 contract with the BIA and focused on the development of various big and small-game hunting programs. In addition through recognition by the USFWS, the two entities signed a path-breaking "Statement of Relationship," which recognizes the Tribe's sound institutional capacity and recognizes the Tribe's sovereignty to carry out its own management and protections for the threatened and endangered species on the reservation. WS-Arizona carries out PDM activities on WMAT at the request of tribal authorities.

1.6.2. Compliance with Federal Laws and Executive Orders (EO)

Several laws or statutes authorize, regulate, or otherwise affect the activities of WS under the alternatives. WS would comply with applicable federal, tribal, state, and local laws and regulations in accordance with WS Directive 2.210. Below are brief discussions of those laws and regulations that would relate to PDM that WS-Arizona could conduct.

National Environmental Policy Act

All federal actions are subject to NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS follows CEQ regulations implementing NEPA (40 CFR 1500 et seq.) along with USDA (7 CFR 1b) and APHIS Implementing Guidelines (7 CFR 372) as part of the decision-making process. Those laws, regulations, and guidelines generally outline five broad types of activities that federal agencies must accomplish 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. In part, the CEQ, through regulations in 40 CFR, Parts 1500-1508, regulate federal activities that could affect the physical and biological environment. In accordance with regulations of the CEQ and the USDA, the APHIS has published guidelines concerning the implementation of NEPA (see 44 CFR 50381-50384).

Pursuant to NEPA and CEQ regulations, this EA documents the analyses resulting from proposed 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 WS infuses the policies and goals of NEPA into agency actions. WS-Arizona prepared this EA by integrating as many of the natural and social sciences as warranted, based on the potential effects of the alternatives, including the potential direct, indirect, and cumulative effects of the alternatives.

Animal Damage Control Act:
The Animal Damage Control Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 8351-352) states: "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 Act was amended in 1987 (Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 8353) to further provide:
On or after December 22, 1987, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with state, 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 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." The agency is funded by Congressional appropriations and by funds provided by governmental, commercial, private, and other entities that enter into an agreement with APHIS-WS for assistance.

Migratory Bird Treaty Act of 1918 (16 USC 703-711; 40 Stat. 755), as amended

The Migratory Bird Treaty Act provides the USFWS regulatory authority to protect native species of birds that migrate outside the United States. The law prohibits any take of these species, except as permitted by USFWS. The WS-Arizona program receives authorization from USFWS through depredation and salvage permits to take migratory birds that are causing damage problems.

Endangered Species Act

The ESA states that all federal agencies shall seek to conserve T&E species and shall utilize their authorities in furtherance of the purposes of the Act (Sec. 2(c)). WS-Arizona conducts consultations with the USFWS, as required by Section 7 of the ESA, to use 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 species or threatened species. . .*" (Sec. 7(a)(2)).

Fish and Wildlife Act of 1956 Section 742j-1 – Airborne Hunting

The USFWS has delegated authority to approve permits for commercial and private aerial shooting of coyotes, and for administering the program to reduce damage caused by predatory animals (ARS§28-8281). AGFD has determined that WS-Arizona, must seek approval from the AGFD Director, or the Director's designee for the aerial take of coyotes to benefit wildlife or livestock before an agency may use aircraft for taking coyotes. Other federal agencies, commercial and private entities must request permission and obtain a permit from AGFD for use of aerial operations for predator removals (Section 1.6.1 and 3.3.4).

EO 13186: Responsibility of Agencies to Protecet Migratory Birds

Migratory bird conventions impose substantive obligations on the United States for the conservation of migratory birds and their habitats, and through the Migratory Bird Treaty Act (Act), the United States has implemented these migratory bird conventions with respect to the United States. This Executive Order directs executive departments and agencies to take certain actions to further implement the Act.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)

All pesticides used or recommended for cooperator use are registered with and regulated by the US Environmental Protection Agency (USEPA) and the ADA. WS-Arizona uses or recommends for use all chemicals according to label requirements as regulated by USEPA and DOA.

Federal Food, Drug, and Cosmetic Act, as Amended

This law places administration of pharmaceutical drugs, including some chemical methods used for wildlife capture and handling, under the Food and Drug Administration (FDA). Ketamine/xylazine, Beuthanasia-D®, and other immobilization/euthanasia drugs used by WS-Arizona are regulated under this Act by FDA.

National Historic Preservation Act

WS-Arizona has reviewed its program per this EA and continues to conclude that the program is not an "undertaking" as defined by NHPA and that consultation with the SHPO is not necessary. WS-Arizona works closely with the USFS and BLM on public lands to ensure there are no conflicts with cultural resources. WS-Arizona has also reached out to tribes as discussed under "Consultation and Coordination with Indian Tribal Governments" in this section, and the tribes have not identified cultural issues of concern to the tribes. Each of the methods described in the EA that may be used operationally and locally by WS-Arizona does not cause major ground disturbance, does not cause any physical destruction or damage to property, does not cause any alterations of property, wildlife habitat, or landscapes, and does not involve 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-Arizona 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 based on the analysis in this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

Consultation and Coordination with Indian Tribal Governments (EO 13175)

WS-Arizona recognizes the rights of sovereign tribal nations, the unique legal relationship between each Tribe and the federal government, and the importance of strong partnerships with Native American communities. WS-Arizona is committed to respecting tribal heritage and cultural values when planning and initiating wildlife damage management programs. Consultation and coordination with tribal governments is conducted consistent with EO 13175 and APHIS-WS' plan implementing the executive order. WS-Arizona has offered early opportunities for formal government-to-government consultation on its proposed program to all Tribes in Arizona, and has requested their involvement for this EA through direct invitations (October 2016) and agency draft EA review opportunities.

Executive Order 13045 "Protection of Children"

Children may suffer disproportionately from environmental health and safety risks, including their developmental physical and mental status, for many reasons. APHIS-WS policy is to identify and assess environmental health and safety risks and avoid or minimize them, and WS-Arizona has considered the impacts that alternatives analyzed in this EA might have on children. All WS-Arizona PDM is conducted using only legally available and approved damage management methods where it is highly unlikely that children would be adversely affected. See Section 3.1.5.4 for a detailed description and analysis of all damage management methodologies included in the WS-Arizona program.

Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (Public Law 101-106, 25 USC 3001) 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. Work on federal projects is stopped until a reasonable effort has been made to protect the items and the proper authority has been notified.

The Wilderness Act

The Wilderness Act preserved management authority for fish and wildlife with the state for those species under state jurisdiction. Some portions of wilderness areas (WAs) and wilderness study areas (WSAs) in Arizona have historic grazing allotments and WS-Arizona may conduct limited damage management in those as identified in compliance with federal and Arizona laws, the Interim Management Policy (IMP) for WSAs, MOUs, and after a Minimum Requirements Analysis is completed (for WAs). WS-Arizona only provides assistance to requesting entities in designated wilderness areas when allowed under the provisions of the specific wilderness legislation and as specified in MOUs between APHIS-WS and the land management agencies, BLM or USFS.

The Wilderness Act does not prohibit PDM within designated wilderness. With certain exceptions, the Act prohibits using motorized equipment and motorized vehicles such as ATVs and landing of aircraft. The Forest Service and BLM may approve wildlife damage management in wilderness study areas and wilderness (FSM 2323 and BLM Manuals 6330 and 6340 respectively). WS-Arizona works closely with the BLM and Forest Service in cooperatively implementing their respective interagency MOU for operations in wilderness and wilderness study areas (Section 1.6). WS-Arizona will not conduct any PDM on wilderness areas until a Minimum Requriements Analysis has been completed by the land management agency.

Controlled Substances Act of 1970 (21 USC 821 et seq.)

This law requires an individual or agency to have a special registration number from the United States Drug Enforcement Agency (DEA) to possess controlled substances, including some chemical methods used for wildlife capture and handling.

Animal Medicinal Drug Use Clarification Act of 1994

The Animal Medicinal Drug Use Clarification Act (AMDUCA) and its implementing regulations (21 CFR 530) establish several requirements for the use of animal drugs, including those animal drugs used to capture and handle wildlife in damage management programs. Those requirements are: (1) a valid "veterinarian-client-patient" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under any alternative where WS could use those immobilizing and euthanasia drugs.

Veterinary authorities in each state have the discretion under this law to establish withdrawal times (*i.e.*, a period after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that people might consume within the withdrawal period must be identifiable (e.g., use of ear tags) and labeled with appropriate warnings.

Occupational Safety and Health Act of 1970

The Occupational Safety and Health Act of 1970 and its implementing regulations (29 CFR 1910) on sanitation standards states that, "*Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected*." This standard includes wildlife that may cause safety and health concerns at workplaces.

Environmental Justice in Minority and Low Income Populations - Executive Order (EO) 12898

EO 12898 promotes the fair treatment of people of all races, income levels, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. EO 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse HHS and environmental effects of federal programs, policies, and activities on minority and low-income persons or populations. This EA will evaluate activities addressed in the alternatives for their potential impacts on the human environment and compliance with EO 12898.

WS-Arizona would use only legal, effective, and environmentally safe damage management methods, tools, and approaches. The EPA through FIFRA, the ADA, the DEA, MOUs with land managing agencies, and WS' Directives would regulate chemical methods that could be available for use by WS-Arizona pursuant to the alternatives. WS-Arizona would properly dispose of any excess solid or hazardous waste. WS-Arizona does not anticipate the alternatives would result in any adverse or disproportionate environmental impacts to minority and low- income persons or populations. In contrast, the alternatives may benefit minority or low-income populations by reducing threats to HHS and property damage.

Invasive Species - EO 13112

EO 13112 establishes guidance for federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm or harm to human health. The EO 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 of invasive species.

Executive Order 13175 – Consultation and Coordination with Indian Tribal Governments

This EO was issued to ensure that there would be "*meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications*…" The goal of the EO is to provide for engagement with Tribal entities concerning activities that may impact them. WS-Arizona only conducts PDM on Tribal lands at a Tribe's request, which provides the opportunity to discuss potential impacts from PDM activities on Tribal lands.

1.6.3. Compliance with State Laws

Several State laws authorize, regulate, or otherwise affect WS-Arizona PDM activities. WS-Arizona complies with these laws as applicable, and consults and cooperates with state agencies as necessary. State laws with which WS-Arizona complies include the following:

Wildlife Damage Management Laws. Arizona Revised Statutes (ARS) 3-1207. The Director of Agriculture may cooperate with USDA APHIS, or other agency of the United States vested with similar powers and duties, in: the control of contagious or infectious diseases of animals, and contagious or infectious diseases of poultry. ARS 3-2401 The Director of Agriculture shall cooperate with USDA APHIS in the control and destruction or relocation of predatory wildlife, reintroduced predatory wildlife, noxious rodents and related animals that are injurious to livestock, poultry, game, agriculture, other industries and the public health in accordance with organized and systematic plans of the animal and plant health inspection service. The authority to destroy predatory wildlife, noxious rodents and related animals does not include big game animals as defined in section 17-101, except: 1. Bear and mountain lion taken pursuant to section 17-302. 2. To protect public health and safety. ARS 3-2405 Allows the County Boards of Supervisors may within their respective counties: Control and destroy predatory wildlife, noxious rodents and related animals as defined by section 3-2401 and Enter into cooperative agreements with USDA APHIS to complete the aforementioned tasks. ARS 17-101 defines the different classifications for predators in Arizona such as predatory animals, big game, furbearers, and nongame wildlife. ARS 17-239 and ARS 17-302 allows for the take of wildlife to alleviate depredations. ARS 17-301 defines the methods to take wildlife and restrictions on the PDM methods that can be used on public lands. ARS 17-301, prohibits the use of foothold traps, snares, and poisons to take wildlife on federal, state, county, or city land in Arizona, with exceptions for the protection of HHS, wildlife disease surveillance, scientific research, wildlife relocation, aquatic wildlife management, and non-furbearing rodent control.

Feral/Free-roaming Dog Control Laws. ARS 3-1311. If any person discovers a dog killing, wounding or chasing livestock, or discovers a dog under circumstances which show conclusively that it has recently killed or chased livestock, he may pursue and kill the dog. Additional feral dog control laws are delegated to the County Board of Supervisors through ARS 11-1005. ARS 11-1012 states that neither a female dog during her breeding or mating season nor a vicious dog shall be permitted at large. WS Directive 2.340 provides for WS to assist County Boards of Supervisors, Arizona Department Health Services, Tribes, or ADA with feral/free ranging dog problems, upon request with approval by the WS-Arizona State Director.

1.6.4. Appropriateness of preparing an EA for such a large area, rather than preparing multiple EAs covering individual counties in a state

The determination of the relevant geographical region to be covered by an EA falls within the informed discretion and expertise of the agency responsible for conducting the Preferred Alternative. We have considered both the Preferred Alternative and the geographic area involved and have determined that the preparation of this EA to address WS-Arizona' PDM activities on a statewide basis for Arizona is the appropriate approach to take. Moreover, if in fact a further determination is made through this EA that the Preferred Alternative would have a significant environmental impact, then an EIS would be prepared. We believe we have appropriately, effectively and adequately covered all the direct and indirect impacts as well as the site-specific and cumulative effects issues related to WS-Arizona' PDM actions in Arizona within this statewide document. Accordingly, there is no need to prepare multiple EAs covering individual counties in this state.

Purpose of the Environmental Assessment

The primary purpose of an EA is to determine if impacts of the proposed action or alternatives might be significant, to determine if an EIS is appropriate (40 CFR 1508.9(a)(3) and 40 CFR 1501.4). This EA is prepared so that WS-Arizona can make an informed decision on whether or not an EIS is required for the WS-Arizona PDM activities included in this EA.

WS-Arizona prepared this statewide EA for its PDM activities to clearly communicate the analysis of individual and cumulative impacts of its actions to the public using guidance at 40 CFR §1506.6, and to evaluate and determine if there are any potentially significant impacts that may occur from the proposed action and alternatives. This EA also facilitates planning and interagency coordination, streamlines informed decision-making, and provides for timely and effective responses to requests for PDM assistance.

In order to make this decision, this EA conducts a thorough analysis of direct, indirect, and cumulative impacts associated with WS-Arizona assistance to requesting entities in managing predator damage and threats to resources and assets, and threats to human safety and health. WS-Arizona addresses all anticipated issues and reasonable alternatives in this EA.

This EA includes thorough and comprehensive analyses of the impacts and effectiveness of five alternative PDM programs in Arizona, including no WS-Arizona activities at all (Section 3.1.1), in compliance with NEPA Section 102(2)(E). It also documents compliance with other environmental laws, such as the Endangered Species Act, describes the current WS-Arizona activities and alternatives in detail, and provides rationale for not considering other alternatives and issues in detail.

WS-Arizona involves the public in its EA processes by providing for public comment on pre-decisional EAs, and agency involvement on an internal interagency draft prior to public release. WS-Arizona has provided two 30-day review and comment periods on the pre-decisional draft of the EA for the public to provide comments regarding new issues, concerns, and/or alternatives. Using the guidance provided in 40 CFR §1506.6 for public involvement, WS-Arizona has clearly communicated to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. Public notification processes regarding the availability of the final NEPA document and decision was identical to that used for the pre-decisional EA, with the addition of direct contact with commenters.

If WS-Arizona makes a determination based on this EA that the selected alternative would have a significant impact on the quality of the human environment, then WS-Arizona would publish a Notice of Intent to prepare an EIS, and this EA would be the foundation for developing the EIS, per the CEQ implementing regulations (40 CFR §1508.9(a)(3)).

WS-Arizona Evaluation of Significant Impacts

The process for determining if a project or program may have significant impacts is based on the CEQ regulations at 40 CFR §1508.27. WS-Arizona will review the impacts evaluated in Chapter 3 of this EA in two ways: the severity or magnitude of the impact on a resource and the context of the impact. For example, context may be considered when the resource is rare, vulnerable, not resilient, or readily changed long-term with even a short-term stressor.

Most of the factors included in 40 CFR §1508.27(b) include the phrase “the degree to which” a particular type of resource might be adversely impacted, not a determination of no adverse impact at all. Therefore, WS-Arizona evaluates the impacts to resources and documents the predicted effects in the EA. These effect analyses are used to determine if the levels of impact are indeed “significant” impacts for which a FONSI would not be appropriate. If WS-Arizona determines that the levels of impacts are not significant, then, per the CEQ regulations, the agency will document the rationale for not preparing an EIS in a publicly available FONSI.

The factors identified in 40 CFR §1508.27 are not checklists, nor do they identify thresholds of impacts; they are factors for consideration by the agency while making the decision regarding whether to prepare a FONSI based on the impact analyses in an EA or an EIS. The agency will determine how to consider those factors in its decision on whether to prepare a FONSI or an EIS. WS-Arizona will determine the *degree* to which a factor applies or does not apply to the impacts documented in the EA.

The following discussion outlines how WS-Arizona will use this EA and the criteria at 40 CFR §1508.27 to make the decision regarding whether an EA or an EIS is appropriate for the WS-Arizona PDM program.

Controversy Regarding Effects

The factor at 40 CFR §1508.27(b)(4) is described as "the degree to which the effects on the quality of the human environment are likely to be highly controversial." The failure of any particular organization or person to agree with every act of a Federal agency does not create controversy regarding effects. Dissenting or oppositional public opinion, rather than concerns expressed by agencies with jurisdiction by law or expertise and/or substantial doubts raised about an agency's methodology and data, is not enough to make an action "controversial." This EA evaluates peer-reviewed and other appropriate published literature, reports, and data from agencies with jurisdiction by law to conduct the impact analyses and evaluate the potential for significant impacts. This EA also includes and evaluates differing professional opinions and recommendations expressed in publications where they exist and that are applicable to APHIS-WS informed decision-making.

A relatively recent comment raised in response to APHIS-WS PDM EAs in the Western United States suggests that scientific controversy exists regarding APSHI-WS removal of predators considered to be at the top of the ecological food chain ("apex predators") that can cause "trophic cascades" resulting in reductions in biodiversity. This comment argues that changes at the top of the food chain (such as wolves) may result in ecological changes, including releases of populations of smaller predators (such as coyotes or foxes), in which other, often smaller predator populations may be released from suppression caused by larger predators. This ecological issue and its cumulative impact analysis are evaluated in detail in Section 4.2.2.

Commenters also often express concern about the perception of the humaneness of lethal and non-lethal operational methods used by WS-Arizona personnel. This issue is considered in detail using the best scientific and professional wildlife management and biology and veterinarian information available (Section 4.2.4). APHIS-WS recognizes that people may readily disagree on the subjective analysis of the degree to which animals may feel pain and react to short-term and long-term stress associated with capture, immobilization, and euthanasia. This EA includes APHIS-WS Directives and other measures (Section 3.3.1) that are used routinely by WS-Arizona personnel for minimizing the potential for pain and stress on animals in the field.

Unique or Unknown Risks

Another concern commonly expressed in comments involves the potential for unknown or unavailable information (40 CFR §1502.22) to potentially result in uncertain or unique or unknown risks (40 CFR §1508.17(b)(5)), especially related to population numbers and trends and the extent and causes of mortality of target and non-target species. Throughout the analyses in Chapter 4 of this EA, WS-Arizona uses the best available data and information from wildlife agencies having jurisdiction by law

(AGFD, ADA, and USFWS; 40 CFR §1508.15), as well as the scientific literature, especially peer-reviewed scientific literature, to inform its decision-making. Data provided by livestock producers, especially regarding the economic value of livestock lost to predation as reported for inclusion in the APHIS-WS MIS database, is inherently subjective to some degree, and is therefore used only as an indicator for the costs associated with livestock depredation in Section 1.2.1.1.

Population and mortality data for many native species, such as raccoons, badgers, fox, coyotes, opossums, skunks, and weasels, are typically non-existent from any credible source, in or outside of Arizona. WS-Arizona recognizes that estimating wildlife populations over large areas can be extremely difficult, labor intensive, and expensive. AGFD, or, for that matter, any state wildlife management agency, has limited resources for estimating population levels and trends for predator species that are not managed as game or furbearers. Therefore these state agencies do not directly set population management objectives for these species. States may choose to monitor population health using factors such as sex ratios, age distribution of the population, indices of abundance, and/or trend data to evaluate the status of populations that do not have direct population data. This EA uses the best available information from wildlife management agencies, including AGFD when available, and peer-reviewed literature to assess potential impacts to predator and non-target wildlife species.

If population estimates are available, then the analyses in Chapter 3 use the lowest density or number estimates for wildlife species populations (where high and low population estimates are provided in the text) to arrive at the most conservative impact analysis. Coordination with AGFD and the USFWS and providing the opportunity for agency review of and involvement in this EA ensure that analyses are as robust as is possible. The analyses in Section 4.2.1.5 provides information for WS-Arizona to determine if WS-Arizona contribution to cumulative mortality from all sources would adversely affect population levels for each predator species considered.

Threatened or Endangered Species, Unique Geographic Areas, Cultural Resources, and Compliance with Environmental Laws

This EA also provides analyses and documentation related to threatened and endangered species, areas with special designations such as wilderness areas, cultural and historic resources, and compliance with other environmental laws, including state laws. This will be used to address the significance criteria at 40 CFR §1508.27(b)(3, 8, 9, and 10).

These issues are evaluated in the following sections:

- Impacts to threatened and endangered species: Section 2.2.2.2.
- Impacts to unique geographic areas: Section 4.2.4
- Impacts to cultural and historic resources: Section 4.2.4
- Compliance with other environmental laws: Section 1.6.2

Cumulatively Significant Impacts

Another common comment involves the criterion for the analysis of “cumulatively significant impacts” (40 CFR §1508.27(b)(7)), which is considered in this EA in various ways.
Many of the issues evaluated in detail are inherently cumulative impact analyses including, for example (Section 2.2):

- Impacts to target species' populations, as each population has many sources of mortality, only one of which is take by WS-Arizona;
- Impacts to non-target species' populations, as each population has many sources of mortality, loss of habitat, climate change, and/or other stressors, and only one source of mortality is take by WS-Arizona;
- Impacts to populations of ESA-listed species, as these species' populations are already cumulatively impacted by many sources of mortality, loss of habitat, climate change, and other stressors, causing them to be listed;
- Potential ecological impacts caused by removal of apex predators, as many ecological factors contribute to any resulting impacts; and
- Potential for lead from ammunition to impact environmental and human factors, as there are many sources of lead in the environment, including lead from hunting activities and ingesting game meat shot with lead ammunition, and lead may chronically enter the environment and people over time.

Public and Employee Health and Safety

The concern regarding public health and safety (significance criterion at 40 CFR §1508.27(b)(2)) is evaluated in several analyses in this EA in Chapter 3:

- The potential for humans to ingest lead sourced from ammunition through water and game meat (Section 3.2.11);
- The potential for hazardous chemicals being spilled or leached into surface and groundwater, and being ingested by humans (Section 4.2.3.5]);
- The risk of injury to WS-Arizona employees during aerial shooting operations (Section 4.2.3.5); and
- The risk of injury to WS-Arizona employees while handling hazardous chemicals, being exposed to diseased animals, and the risk of attack by captured animals Section 3.3).

Impacts Can Be Both Beneficial and Adverse

Some commenters may believe that, because the protection of human and pet health and safety, livestock and other property, and wildlife is extremely beneficial, an EIS must be prepared, based on 40 CFR §1508.27(b)(1). It is important that beneficial outcomes and effects be identified as well as adverse effects as contributions to informed decision-making. This EA describes the various needs to which WS-Arizona responds when requested (Sections 1.2.1 through 1.2.4), and evaluates the impacts associated with PDM actions in Chapter 4.

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

Chapter 2 contains a discussion of the issues and affected environment, including issues that will receive detailed environmental impacts analysis in Chapter 4: Environmental Consequences, issues that were used to develop SOPs, and issues that will not be considered in detail, with brief discussion. Also included is a list of issues identified and addressed in previous WS-Arizona PDM EAs and Decisions (WS 1996, 1999a), but for which explanations are not repeated in detail in this document because the analysis and discussion of those issues in prior EAs remains virtually the same. Pertinent portions of the affected environment are described in this chapter in the discussion of the issues. Descriptions of additional portions of the affected environment will be incorporated into the discussion of the environmental impacts in Chapter 4 and the description of the current program (the "*No Action*" Alternative) in Chapter 3.

2.1. THE AFFECTED HUMAN ENVIRONMENT

NEPA requires federal agencies to determine if federal actions affect the quality of the *human environment*. As defined by NEPA implementing regulations, the *"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, when a federal action agency analyzes its potential impacts on the *human environment,* it is reasonable for that agency to compare the effects of the federal action against the human-caused effects that would occur or can be expected to occur in the absence of the federal action. This concept is applicable to situations involving federal assistance in reducing damage associated with state-resident wildlife or unprotected wildlife species. This section discusses the human environment that could or could not potentially be affected by WS-Arizona PDM.

2.1.1. Aspects of the Human Environment Relevant to WS-Arizona PDM Actions

In Arizona, WS-Arizona PDM activities are conducted on a variety of land classes, primarily private, tribal, BLM, and USFS (Section 1.1.3). WS-Arizona PDM is carried out in several kinds of habitats throughout the state including forests, rangeland, riparian areas, as well as suburban and urban areas. All of these habitats and lands have been impacted, and continue to be impacted, by humans in a variety of ways independent of actions or involvement by WS-Arizona.

The natural and physical environment includes a multitude of native, as well as certain introduced and invasive, animal and plant species and the air, water, soils, terrain and human developments that make up their habitats. WS-Arizona PDM targets several of the animal species (Section 2.2.1) and can take others incidentally (Section 2.2.2). Impacts on these species are analyzed in the EA under the alternatives (Sections 4.2.1.5 and 4.2.2.5). Additionally, WS-Arizona PDM can be conducted to protect natural resources, primarily other wildlife species, where predation has been identified as a limiting factor and when requested by other agencies or entities with management authority over the species involved (Section 1.2.4). The PDM methods (Section 3.1.5.5) used that have the potential to affect the natural and physical environments include removing wildlife, physical exclusionary methods, and habitat alterations. The PDM methods that WS-Arizona uses are legal and allowed under applicable laws and regulations. The primary methods used by WS-Arizona include wildlife removal techniques. WS-Arizona could operationally use physical exclusion methods (*e.g.*, predator-proof fencing) and habitat alterations (*e.g.*, brush removal near runways on an airport). Arizona laws allow property owners to conduct these activities in the absence of federal assistance. Thus, these activities could be done by private individuals and other non-federal entities with or without assistance from WS-Arizona.

Human relationships with the natural and physical environment have resulted in the establishment and management of the many resources protected by WS-Arizona PDM such as agricultural resources and property. For example, livestock raised or maintained on private and public lands in the state have been placed there, and are managed by humans. Thus, the livestock and their human owners or managers are a long established part of the human environment. They are also a primary group requesting WS-Arizona PDM assistance in counties or localities where WS-Arizona has programs. Urban and suburban residential and commercial developments established and maintained by humans are also established components of the human environment. People living, working, and recreating in urban and suburban areas as well as in rural areas where wildlife and their habitats exist are also established components of the human environment. Threats to the HHS as a result of interactions with predators can and do result in PDM actions by WS-Arizona. These actions could also be conducted by private or government entities to reduce such threats, and those types of actions by such non-federal entities are also established components of the human environment.

It is common knowledge that humans have altered and continue to alter the natural and physical environment. WS-Arizona PDM activities do not affect habitat to any substantial degree. On occasion, program personnel might perform minor habitat alterations in specific isolated situations to reduce the attractiveness of a site to problem-causing wildlife (*e.g.* removal of brush that serves as hiding cover for coyotes near an airport runway or assistance with the installation of a barrier fence to exclude predators from lambing grounds). However, most such alterations are not done by WS-Arizona, but by the resource owner or manager, which means they are included among the human relationships that exist with the natural and physical environment. Larger actions that alter one habitat into another, such as housing developments, generally result in major shifts in wildlife species composition, diversity, and population levels. Several of the species that cause needs for PDM in Arizona, for example raccoons and coyotes, often thrive in these heavily human-altered environments. For example, raccoon densities can increase substantially in urban settings as a result of increased availability of food, water, and cover. As a result, an increase in PDM may be needed in such areas to prevent damage to houses, landscaping, pets, or to reduce threats to HHS. All of these human-caused changes to the natural and physical environment are established components of the human environment.

The human environment also includes less concrete relationships between people and the environment, including the animals found there. On the one hand, many people experience aesthetic appreciation or enjoyment of the outdoors (Section 2.4.9). On the other hand, some people can be fearful of or attacked by large predators and may deem their experience with such wildlife as negative. Livestock and other resource owners may not have a favorable opinion of some predators because of the damage such predators have caused or may cause. The relationship also includes the use of PDM methods and their potential risks to the public (Section 2.2.3). Most PDM methods used by WS-Arizona can also be used by the public as allowed under state and local laws. Inherent dangers of use may increase for the public depending on who is conducting PDM and which methods are being used (Section 3.1.5.5). All of these types of human relationships are established components of the human environment.

2.2. ISSUES

The following issues or concerns about PDM have been identified through interagency planning and coordination, and from the EAs which preceded this document as areas of concern that will be addressed in this EA.

2.2.1. Effects on Target Predator Species

Maintaining viable populations of all native species is a concern of the public and of biologists within state, tribal, and federal wildlife and land management agencies, including WS-Arizona. However, a concern of some is that WS-Arizona PDM will adversely affect target wildlife populations, which, for purposes of this EA are primarily coyotes, striped skunks, mountain lions, black bears, and raccoons. The effects of PDM on feral dogs and feral cats is also a concern, but not from the standpoint of their population in a native environment because they are not native. The USDA Office of Inspector General (2015) audited WS and did not reveal any problems with wildlife damage management activities, or with WS' system for tracking controlled materials. WS' actions in these areas complied with all applicable Federal and State laws and regulations. As public attitudes changed, the WS focus changed as well, and it now emphasizes killing only problem animals when necessary (GAO 2001).

However, many different views on PDM exist. Some persons believe PDM interrupts the *balance of nature* and this should be avoided. Others believe that the *balance* has shifted to unfairly favor generalist species, including predators. Several species' populations have steadily increased over the past several years due to the adaptability of these wildlife to human-made environments, and damage from these species has increased accordingly (International Association of Fish and Wildlife Agencies 2004).

To address these concerns, the effects of the alternatives on populations for each target species are examined. To fully understand the need for PDM, it is important to have knowledge about the species that cause damage and the likelihood of damage. Full accounts of life histories for these species can be found in mammal reference books and from AGFD (2017) but some background information is given for the predators in Arizona covered by this EA, especially information pertaining to their range in Arizona. The species are discussed in descending order based on WS-Arizona PDM efforts directed toward them, their subsequent take, and the occurrence and value of damage that the species cause in Arizona. Some of the lesser damaging species are combined with other similar species such as skunks and foxes because life history or damage are usually similar. Jurisdiction and management of these species primarily lies with AGFD or Tribes as discussed in Chapter 1 of this EA, with WS-Arizona assisting as requested. Additionally, most of the predators addressed in this EA are also harvested in Arizona by hunters and trappers afield. Historic harvest records provide valuable insight into these species abundance in Arizona and potential take levels (Table 7). These data are most useful in determining long-term trends rather than year-to-year comparisons. It should also be noted that a ban on the use of foothold traps on public lands was enacted in 1994 which, combined with low fur prices reduced trapping effort in Arizona considerably. Harvest on tribal lands in Arizona is not included in AGFD harvest statistics and that population estimates provided by AGFD do not include tribal lands or National Parks; for the purposes of this EA, populations of predators are estimated for the entire State.

2.2.1.1. Coyotes

Coyotes are managed as a predator by AGFD and can be taken year-round. Coyotes are one of the primary predators in Arizona, along with mountain lions and feral dogs, which kill the majority of livestock reported to or verified by WS and NASS (2012, 2010). Because of the extent of damage, they are a major focus of WS-Arizona PDM efforts. Coyotes were responsible for an average of about $24,102 in damage to agriculture, property, pets, and crops reported to or verified by WS-Arizona for an average of 235 complaints received annually from FY11 to FY15 (Table 1). Coyotes averaged 26% of all mammalian predator complaints in Arizona from FY11 to FY15. The resources protected, in order of reported economic losses included agriculture, livestock, primarily lambs, calves, ewes, exotic game and poultry, property (*e.g.*, aircraft, drip irrigation lines, pets), crops, and HHS (*i.e.*, injuries to people, concern for children). Coyotes killed an average of 69 livestock annually from FY11 to FY15 (Table 3) (MIS 2016). In addition, coyote predation on other wildlife species in Arizona such as black-footed ferrets and antelope fawns has created concern in some areas, but no value is presented here for such losses. Hunters harvested an average of 43,889 coyotes annually from FY12 to FY15 in Arizona, but harvested an average of 31,838 from FY87 to FY91 (Table 7).

Table 7. Historic take of furbearers, black bears, and mountain lions in Arizona (trapping and hunting harvest) (AGFD 2016). Furbearers taken by trappers and hunters in Arizona by season[1].

Species	Five Year Averages					Season Total				FY12-FY15 Ave.
	FY87-FY91	FY92-FY96	FY97-FY01	FY02-FY06	FY07-FY11	FY12	FY13	FY14	FY15	
Trapper Harvest										
# Trappers	680	136	50	52	106	149	267	343	279	260
Badger	386	59	17	27	31	38	57	75	52	56
Bobcat	3,556	640	220	317	919	1,366	2,045	2,250	1,438	1,420
Coyote	7,641	1,620	1,047	549	624	667	905	1,278	1,083	780
Fox[2]	1,291	2,682	568	285	836	875	1,932	2,151	1,497	1,613
Raccoon	442	46	58	17	57	60	120	118	127	106
Ringtail	2,312	240	20	14	34	31	51	52	21	39
Skunk[3]	1,387	225	98	71	182	357	310	390	378	359
Predator Hunter Harvest										
# Hunters	10,449	12,029	13,381	12,427	18,969	23,331	50,662	26,155	23,479	30,907
Bobcat	737	877	1,681	2,382	2,332	4,520	3,132	1,074	781	2,377
Coyote	24,197	27,882	34,919	34,301	54,701	51,647	52,888	24,792	24,595	38,481
Foxes[4]	1,387	2,440	5,598	3,606	2,962	8,973	7,377	4,173	1,562	5,521
Raccoon	377	1,413	1,162	190	3,781	2,991	209	909	112	1,055
Big Game Hunter Harvest										
# BB Tags Issued	4,131	3,994	4,285	4,654	5,570	5,347	5,463	5,371	N/A[5]	5,394
Black Bear	193	185	209	192	232	344	246	247	255	273
# ML Tags Issued	5,308	4,230	6,944	9,275	10,565	10,942	10,951	11,128	N/A[5]	11,007
Mountain	216	252	335	280	299	276	344	268	360	312

[1] Trapping/Hunting Season correspond to next federal FY (i.e., the 2010-11 hunting season = FY11)
[2] Assumes all fox harvested by hunters were gray fox to be conservative.
[3] Includes primarily striped skunks, and also hog-nosed, hooded, and western spotted skunks.
[4] Assumes all fox harvested by hunters were gray fox to be conservative
[5] For 2014-2015 AGFD (2016) report only includes trapper harvest data. FY 12-FY15 is only averaged using FY12-FY14 data as hunter harvest data is unpublished AGFD data.

Coyotes were once found only in western states, but have expanded their range in recent history to much of North America as a result of changes in habitat, loss of wolves throughout much of their historic range, and possible introductions into other parts of the country where they were previously not found (Bekoff and Wells 1982, Voigt and Berg 1999). They are very common throughout Arizona (AGFD 2016) and were present at high density levels in 1978 (USFWS 1978) with lowest densities in dense coniferous forests and highest in broken (i.e. forest with open spaces) and disturbed habitat types. They have consistently been the top predator species harvested by hunters in Arizona with estimated harvest levels between 21,481 and 56,136 from the 2010-11 to 2011-12 seasons (Table 7) (AGFD 2016). To discuss the impacts of various environmental constraints and external factors on coyote populations and density, it is essential to understand the basic mechanisms that play a role in the coyote's response to constraints and actions. This species is often characterized by wildlife biologists as having a unique resilience to change because they have a strong ability to adapt to adverse conditions. Habitat changes that have occurred over the last 200 years have often favored this species.

Coyotes are highly mobile animals with home ranges (territories) that vary seasonally and with the sex, age, and breeding status of the animal (Todd and Keith 1976, Althoff 1978, Pyrah 1984). The literature on coyote spatial organization is unclear (Messier and Barrette 1982, Windberg and Knowlton 1988). Coyote home ranges may vary from 2.0 mi^2 to 21.3 mi^2 (Andelt and Gipson 1979, Gese et al.1988[4]). Ozoga and Harger (1966), Edwards (1975), and Danner (1976), though, observed a wide overlap between coyote home range and did not consider coyotes territorial. Each occupied coyote territory may have several nonbreeding helpers at the den during whelping (Allen et al. 1987, Bekoff and Wells 1982). Therefore, each defended coyote territory may have more than just a pair of coyotes. Messier and Barrette (1982) reported that from November through April, 35% of the coyotes were in groups of three to five animals and Gese et al. (1988) reported that coyote groups of 2, 3, 4, and 5 comprised 40%, 37%, 10% and 6% of the resident population, respectively. The presence of unusual food concentrations and nonbreeding helpers at the den can influence coyote densities, and complicate any effort to estimate abundance (Danner and Smith 1980). A positive relationship was established between coyote densities in mid-late winter and the availability of dead livestock (Roy and Dorrance 1985).

To understand impacts of hunter harvest and depredation take on the coyote population, it is useful to have a relative idea of the population size. However, AGFD does not have estimates of the coyote population for the state of Arizona. A population estimate is difficult to determine given the wide distribution range of this species in Arizona. AGFD reported take of coyotes by hunters has been relatively stable during the past 10 years, with approximately 13,000 hunters taking an average of between 30,000 and 40,000 coyotes a year (AGFD 2017). They inhabit every habitat type including urban areas and are opportunists and generalists when it comes to food allowing them to eat just about

[4] All literature citations reported in km^2 have been converted to mi^2 for reader convenience and to maintain consistency.

anything and thrive just about anywhere. Achieving a population estimate for coyotes would require an enormous undertaking in terms of time, funding, and manpower that is nearly impossible.

Many authors have estimated coyote populations throughout the West and elsewhere (Andelt 1985, Pyrah 1984, Camenzind 1978, Knowlton 1972, Clark 1972, USFWS 1979). Coyote population densities will vary depending on the time of year, food abundance, and habitat. Coyote densities in some studies have ranged from a low of 0.4/mi^2 prior to whelping when populations are low (just prior to the annual period of pup birth) and a high of 3.6 to 5.0 coyotes/mi^2 when populations are high (just after the period of pup birth) (Pyrah 1984, Knowlton 1972). Scent-post survey densities for Arizona from 1972 to 1977 averaged 168 coyote visits/1,000 scent posts in one of the most widespread studies undertaken on predator densities (USFWS 1979). Arizona had relatively high densities of coyotes; in general coyote populations decrease as you travel north in the 13 western states averaging 149 visits/1,000 scent posts in the southern tier of western states, 114/1,000 in central tier of western states, and 83/1,000 in the northwestern tier of states (Knowlton and Stoddart 1983). Coyote densities as high as 5/mi^2 have been reported in the Southwest (Voigt and Berg 1999). Knowlton (1972) estimated coyote densities West-wide to be an average of 0.5 to 1.0 per square mile over a large portion of the coyote's range. However, Knowlton and Stoddart (1983) placed Arizona in a band of high abundance based on the predator surveys. Arizona is 114,006 mi^2 in size and the coyote is found throughout. Using the estimate provided by Knowlton (1972) at 1.0 coyotes/mi^2 would put the estimated coyote population at 114,006 in Arizona. However, the estimated coyote numbers in Arizona are at a relatively high density, especially compared to other western states. A comparison of scent-post survey data (USFWS 1979) at 168 visits/1,000 scent posts in Arizona, would suggest a pre-whelping population density of 1.7 coyotes/mi^2. Thus, this could be used as a conservative population estimate for the Arizona coyote population. Thus, the pre-whelping coyote population would be estimated at 193,810. Under reasonable assumptions used by Pitt et al. (2003) that the sex ratio is 50:50, 43% of the females breed, and the average litter size is 4.6 pups, the post-whelping population would be about 385,488.

For the sake of the analysis, a pre-whelping coyote population of a conservative 125,000 will be used to determine WS-Arizona PDM and cumulative impacts. Based on this information and analysis presented in Chapter 4 of the EA, it is reasonable to assume that if harvest exceeds 70% of the pre-whelping population on a sustained basis for 2 or more consecutive years, then the population could be reduced based on the model by Pitt et al. (2001)[5].

2.2.1.2. Feral Dog

Feral and free ranging dogs are fairly common in Arizona and problems from them can be extensive. Feral/free ranging dogs kill livestock and poultry, and present a problem for HHS (attacks and disease threats). WS-Arizona responded to an average of 53 requests for assistance annually from FY11 to FY15. Most of the damage, averaging $10,534 annually (13.5% of the total value of all predator damage), was to agriculture and HHS (Table 1). The greatest number of requests were for agriculture, followed by HHS complaints. Primary responsibility for dog control rests with county and municipal authorities, or the Departmetn of Defense (on lands owned by DOD). WS Directive 2.340 provides

[5] This does not mean that localized complete removal of a coyote population would necessarily result in a significant effect on the human environment because immigration from surrounding areas can be expected to replenish the population (Knowlton 1972). Localized removal of coyotes would generally only be short-term.

for WS-Arizona to assist County Boards of Supervisors, Arizona Department Health Services, tribes, or ADA with feral/free ranging dog problems, upon request with approval by the WS-Arizona State Director. WS-Arizona's Feral, Free-ranging and Hybrid Dogs Damage Management Policy establishes further guidance for WS-Arizona program personnel when responding to requests for assistance in addressing damage problems or HHS threats due to feral, free-ranging and hybrid dogs. Feral dogs are not part of the native environment, and left abandoned in the wild are considered ecological pests.

2.2.1.3. Mountain Lion

The majority of mountain lion complaints involve predation of livestock and pets. Mountain lions have the potential to attack humans, but this is a rare occurrence. Mountain lions were responsible for an average of $37,488 damage (48% of all predator damage), most all of the damage was to livestock, an average of 213 requests were received annually from FY11 to FY15 (Table 1). Two of the requests were for assistance involving HHS concerns. Lions killed an average of 53 cattle/calves, 8 sheep/lambs, and 1 other hoofed stock (i.e. goats, swine, horses, llamas, exotics) annually from FY11 to FY15 (Table 4). Hunters harvested an average of 315 mountain lions annually from FY11 to FY15 in Arizona (Table 8). The AGFD management goal is to manage the mountain lion population, its numbers and distribution, as an important part of Arizona's fauna and to provide mountain lion hunting opportunity while maintaining existing occupied habitat and the present range of mountain lions in Arizona. The harvest of females with spotted kittens or spotted kittens is prohibited, and the legal hunting season is open year round. Each mountain lion harvested must be physically checked by the AGFD where harvest and hunter information is collected, a tooth is pulled for aging, and a tissue sample is collected for DNA analysis. These data suggest that the mountain lion population in Arizona is healthy and stable (A. Howard, AGFD, Pers. comm. 11/27/2017).

Table 8. Actual or estimated predators, furbearers and big game taken during 2010 through 2014 (AGFD 2016).

Species	Hunting/Trapping Season					Average Harvest**
	2010-11	2011-12	2012-13	2013-14	2014-15	
Badger	39	38	57	75	52	52
Black Bear*	322	344	246	247	255	283
Bobcat	2,282	3,851	6,565	5,382	2,512	4,118
Coyote	21,481	56,136	52,552	54,166	25,875**	42,042
Foxes	4,061	10,460	10,905	9,528	5,670**	8,910
Mountain Lion*	329	276	344	268	360	315
Raccoon	595	1,391	3,111	327	1,036**	1,292
Skunks	187	357	310	390	378	324
Ringtail	22	31	51	52	21	35

* Actual harvest, including mortality from private and WS-Arizona depredation take, highway mortality, and poaching for the established hunting seasons in Arizona.
**Average Harvest data through the 2010-15 season.

Mountain lions have an extensive distribution across western North America, and most of Arizona; they are absent only from those areas heavily impacted by human development. Mountain lions live in many habitat types in Arizona from desert to montane environments, indicating a wide range of adaptability. They are closely associated with deer, elk, javelina a, and other large hoofed mammal herds because they rely on these species for food. Analysis of 159 mountain lion scats collected in southwestern Arizona from 1987 to 1990 resulted in observation of mule deer remains in 39% of the samples, collared peccaries in 25%, cattle in 13%, mountain sheep in 7%, small rodents in 8%, lagomorphs in 8%, badgers in 5%, skunks in 4%, raccoons in 2%, porcupines (*Erethizon dorsatum*) in 2%, beetles in 2%, mountain lion in 1%, bobcat in 1%, canidae in 1%, Gila monster (*Heloderma suspectum*) in 1%, and a trace amount of chuckwalla (*Sauromalus obesus*) in samples (Cashman, et al., 1992). The mountain lion is a big game animal in Arizona and managed by AGFD. Permits are not required prior to take of mountain lions attacking or killing livestock but livestock operators are required to notify AGFD within 5 days of initiating pursuit and file a report within 10 days of taking a mountain lion. If requested by AGFD, a livestock operator shall provide reasonable evidence of having livestock recently attacked or killed by mountain lion. WS-Arizona has agreements with AGFD and WMAT to assess damage and provide PDM for them as needed.

Female mountain lions typically breed for the first time between 22 and 29 months of age (Ashman et al. 1983) but initial breeding may be delayed until a territory has been established (Hornocker 1970). Mountain lions breed and give birth year round but most births occur during late spring and summer following about a 90 day gestation period (Ashman et al. 1983, Seidensticker et al. 1973, Robinette et al. 1961). One to six offspring per litter is possible, with an average of two to three young per litter. Mountain lion density is primarily dependent on prey availability and intraspecific (between or among members of the same species) competition with other mountain lions. Prey availability is directly related to the habitat quality of the prey species and this directly influences a mountain lion's nutritional health, and reproductive and mortality rates. Studies indicate that as available prey increases, so do lion populations, but because mountain lions are territorial animals, the rate of population increase tends to decrease as lion density increases, even though the prey availability continues to increase. As the mountain lion population density increases, the mortality rate from intraspecific strife, cannibalism, and dispersal into marginal quality, unoccupied habitats also increases. Shaw (1981) presented evidence that livestock such as sheep and calves provide a supplemental prey base that supports mountain lions through seasonal declines in their primary prey which is normally deer. This allows an artificially high population level to be reached, especially during times of low wild prey availability. Although the relationship of the mountain lion to its prey can help mountain lion populations to increase, their behavioral relationships to other lions (e.g., intolerance) is a greater factor in determining peak density for a particular site. They typically do not reach density levels observed in a number of other wildlife species (Oregon Department of Fish and Wildlife 1993).

Mountain lion densities, based on a variety of population estimating techniques, range from a low of about 1/100 mi^2 (McBride 1976, Hemker et al. 1984) to a high of 2.5/100 km^2 (Johnson and Strickland 1992). The average density estimate for western states was estimated at 7.5/100 mi^2 (Johnson and Strickland 1992). Cunningham et al. (1995) determined that mountain lion densities were about 75% higher in the portion of their study area which was subject to greater depredation control and regulated hunting. Their estimates of density ranged from 4-7/100 mi^2. However, studies that followed mountain lions for at least 12 months found that densities ranged from 0.13-0.013/mi^2 (Lindzey 1999). In Arizona, mountain lions occupy about 80% of the lands. Resident adults comprise 47%-82% of unhunted populations and 32%-50% of moderately hunted populations (Cougar Management Guidelines Working Group 2005). Since Arizona is moderately hunted, it is likely that subadults comprise about 50% of the population. However, to be conservative for the purpose of analysis in this EA, it will be assumed that the adult population makes up 67% of the population, about halfway between the ranges for non-hunted and moderately hunted populations. For this analysis, it will be assumed that the density of mountain lions in Arizona is 4 adults/100 mi^2, which is the low end of the mean range of density estimates (Cunningham et al. 1995), below the mean for mountain lions followed for 12 months in studies (Lindzey 1999), and below the western state average (Johnson and Strickland 1992). Using the density of 4 adults/100 mi^2, Arizona's mountain lion population, including tribal lands and National Park lands, would be about 5,300. This estimate should be suitable for the purpose of analysis and considered conservative. For the entire State, including tribal lands and National Parks, it could be estimated that Arizona has about 3,500 adult or a population of 5,300 (assuming subadults make up 33% of the population).

2.2.1.4. Skunks

Four species of skunks inhabit Arizona, the striped, hooded, American hog-nosed, and western spotted skunks. The most notable characteristic of skunks is the ability to discharge nauseating musk from their paired anal glands. Skunks primarily cause odor problems around homes, which comprise the majority of damage complaints. They also potentially transmit diseases such as rabies to humans and domestic animals, sometimes prey on poultry and their eggs, or dig and cause damage. WS-Arizona has conducted some PDM for rabies in skunks in Arizona, but in the past 5 FY skunks have not been taken while assisting with skunk-rabies research activities.

Most of the damage complaints are for striped skunks which are commonly found in urban settings, but the other skunk species can also be a problem. Though skunks generally usually do not cause considerable monetary damage, the striped skunk is consistently responsible for a high number of complaints in Arizona averaging 229 from FY11 to FY15 (Table 1). An average of 171, 45, 11, complaints were received annually from FY10 to FY14 for stripped, hooded, and American hog-nosed skunks, respectively. Even though a large number of requests were received for skunks, they were responsible for less than 1% of the value of damage reported to or verified by WS-Arizona annually.

Skunks eat a variety of food including small rodents, insects, fruits, and eggs, and sometimes kill poultry. Skunks nest in underground dens, hollow logs, under buildings, and in rock crevices. During the winter they will go through periods of inactivity, especially while it is bitter cold. They typically are solitary, except they may communally roost in the winter, especially the females, for warmth.

<u>Striped Skunks</u>
Striped skunks are found throughout the United States, including Arizona and have expanded their range with the encroachment of people. The striped skunk is by far the most common in Arizona. It is a large skunk, up to 10 pounds, with two white stripes down its back. The striped skunk is mostly associated with farmland and urban areas whereas the others are mostly associated with rocky areas such as in canyons and outcrops, or grasslands (Rosatte 1999).

The home range of striped skunks is not sharply defined over space and time, but is altered to accommodate life history requirements such as raising young, winter denning, feeding activities, and dispersal (Rosatte 1999). Home ranges reported in the literature averaged between 0.85 to 1.9/mi^2 for striped skunks in rural areas (Houseknecht 1971, Storm 1972, Bjorge et al. 1981, Rosatte and Gunson 1984). The range of skunk densities reported in the literature was from 0.85 to 67/mi^2 (Jones 1939, Ferris and Andrews 1967, Verts 1967, Lynch 1972, Bjorge et al. 1981). Many factors may contribute to the widely differing population densities. Habitat type, food availability, disease, season of the year, and geographic area are only but a few of the reasons (Storm and Tzilkowski 1982). Overall, the striped skunk has the densest population of the four species of skunks in Arizona. Using the lowest reported density of 0.85 striped skunks/mi^2 would result in a conservative population estimate of about 97,000.

Hooded Skunks

The hooded skunk looks similar to a striped skunk but is sleeker, has a longer tail, and generally weighs less. Its pelage also has white stripes, but these can vary from large white stripes to almost none. The hooded skunk gets its name from a ruff of long hair on its upper neck, which distinguishes it from the other skunks. Hooded skunks are common in Mexico with their range extending into southeast Arizona, encompassing approximately 20% of the state.

The hooded skunk is chiefly a low desert animal, but can be found in ponderosa habitat at higher elevations where it seems to prefer rocky slopes, bases of cliffs, or rocky sides of arroyos, and are often found along watercourses. Not much is known about hooded skunks because few studies have been conducted on them (Rosatte 1999). In a baiting study conducted by WS-Arizona, a study area of about 54 mi^2 was censused with 90 cage traps for 10 consecutive days (minimal coverage), captured 16 hooded skunks or about 0.3/mi^2, 9 striped skunks (0.17/mi^2), and 2 western spotted skunks (0.04/mi^2) suggesting that populations of hooded skunks have higher densities than striped skunks in some areas (it is likely many skunks' home ranges were in the study area, but not covering an area with a trap in it (B. Schmidt, APHIS National Wildlife Research Center, 2016, unpublished data). Because densities of hooded skunks are likely to be similar to striped skunks in appropriate habitat in Arizona, at 0.85 hooded skunks/mi^2, would have a population of about 19,000 hooded skunks.

American Hog-nosed Skunks

The hog-nosed skunk is similar in size to the striped skunk. It is distinguished by its elongated naked snout and spends most of its time rooting for food. Hog-nosed skunks typically have one large white stripe down their back. They will sometimes climb to elude danger and search for food. Hog-nosed skunks are found in the southeast quarter and a corridor to the northwest part of Arizona, covering over 30% of the state.

Hog-nosed skunks occur in creosote desert to at least the pine-oak forest, and are most common in warm woodlands, grasslands, and deserts in their preferred habitat of rocky areas for denning (Rosatte 1999). Residential areas and farmlands are classified as secondary habitat (Thompson et al. 1992). Not much is known about hog-nosed skunks because few studies have been conducted on them (Rosatte 1999). The low density of hog-nosed skunks, being somewhat similar in size to striped skunks, would likely provide a conservative estimate of the hog-nosed skunk population for Arizona at 29,000.

Western Spotted Skunks

The Western spotted skunk is the smallest of the types found in Arizona, typically not weighing much more than a pound. They have a number of white spots covering their backs, sides, and head. Like hog-nose skunks, spotted skunks will climb to elude danger and search for food. Western spotted skunk distribution is spotty throughout the state in appropriate habitat.

Western spotted skunks are found in diverse habitats preferring rocky canyons and outcrops in woodlands and prairies, especially shrub habitats in broken mountainous country, and often along or near wetlands and riparian areas. They can also be found in agricultural areas, and often take advantage of the food and cover. Spotted skunks make their dens in cracks and crevices among rocks, woodrat nests, hollow logs, burrows under large rocks, and sometimes under buildings. Unlike striped skunks, western spotted skunks are adept climbers. They are almost entirely nocturnal and seldom are seen in the daytime. They breed in the fall, but exhibit delayed implantation of the eggs until the following spring when they give birth after a 50-65 day gestation period. Little is known about densities of spotted skunks. Densities of eastern spotted skunks (*Spilogale putorius*) averaged about 5.7/ mi^2 of habitat in Iowa. One study found that western spotted skunks had home ranges (overlapping) from 75 to 150 acres, varying seasonally, on Santa Cruz Island, California (Crooks and VanVuren 1995). This would suggest that the population at a minimum would be about 5/mi^2 in occupied habitat. Over larger areas, though, the population would be less because ideal habitat conditions are scattered. If good habitat were found in 10% of Arizona, then the density would be 0.5/mi^2 over the state. With that density, the population in Arizona would be estimated to be 57,000.

2.2.1.5. Black Bear

Black bears are protected as big game in Arizona and, as such, AGFD and Tribes manage their population. WS-Arizona gives AGFD information on the take of all depredating black bears to help them determine population impacts from PDM activities. AGFD sometimes requests WS-Arizona to take a bear when the need arises from a damage situation. WS-Arizona also receives calls from individuals to remove bears that have caused damage. WS-Arizona Specialists responded to an average of 40 damage complaints annually from FY11 to FY15 involving mostly livestock, HHS, and property concerns (Table 1). Black bears accounted for an annual average of 7% of the value of damage that WS-Arizona recorded in Arizona. An average of 255 black bears were harvested annually from FY11 to FY15 in Arizona, while an average of 193 black bears were harvested from FY87 to FY91, suggesting that black bear populations are stable or increasing throughout the state of Arizona (Table 7).

Black bears can be found throughout much of North America, including the forested areas in mountainous habitat in Arizona south of the Colorado River. Black bears are found in scattered areas, but primarily in east central Arizona. Highest population densities are found in the montane forests and cottonwood canyons. Black bears can live up to 25 years (Rogers 1976). Bears will eat a variety of foods including grass, fruits, nuts, carrion, livestock, mammals, insects, bees (especially the larva) and garbage; they may overturn rocks and logs looking for grubs and insects or small rodents. Research indicated they may also be a more efficient predator of large game than was previously believed (Pederson 1988), along with livestock. Female black bears reach reproductive maturity at approximately 3.5 years (Kohn 1982, Graber 1981). Following a 7-8 month gestation period, they may have one to five cubs (Rogers 1976, Alt 1981, Kolenosky and Strathearn 1987). Juvenile black bear annual mortality ranges between 20 and 70%, with orphaned cubs having the highest mortality (Kolenosky and Strathearn 1999). Natural mortality in adult black bears is approximately 10-20% per year (Fraser et al. 1982).

In the southwestern U.S., black bear population densities have been documented at 1/mi^2 (LeCount 1982). However, their density is variable between 0.3-3.4/mi^2, depending on habitat conditions (Kolenosky and Strathearn 1999). The age ratio and harvest appears to be skewed towards subadults (<4 years of age), about 50% or more (Higgins 1997, California Department of Fish and Game 1998). Black bears occupy over 15% of Arizona and a population estimate using 0.3 bears/mi^2, the lowest density estimate, would be 5,100. However, assuming that 50% of the population is subadults and the density of 0.3 bears/mi2 was applied to only 70% of their range, the population estimate would be 7,100. Though no true population estimate exists, for the purposes of the analysis in this EA, a conservative estimate of 5,100 black bears in Arizona will be used.

2.2.1.6. Feral Cat

WS-Arizona targets feral cats in damage management activities for relatively few annual requests for assistance, but can take a number of them in these projects. Feral cats are common in many parts of Arizona, especially close to human habitation. WS-Arizona responded to an average of 44 damage occurrences annually from FY11 to FY15 for feral cats and most all were related to HHS concerns for people or pets, and property damage near residences. Primary responsibility for feral cat control rests with state, county and municipal authorities. It is WS-Arizona policy to respond only to requests for controlling feral cats that come from these local authorities including County Boards of Supervisors, Arizona Department Health Services, Tribes, or ADA. Since WS-Arizona only responds at the request of local agencies, and many have animal control officers, WS-Arizona receives relatively few calls concerning free-roaming/feral cats. WS-Arizona records therefore only reflect minor damage for them. Feral cats are not part of the native environment, and left abandoned in the wild are considered an ecological pest and are very efficient predators killing millions of native wildlife annually (American Bird Conservancy 1997, 2006) and competing with native predators.

Feral and free-ranging cats can be present in very high densities, which can potentially lead to devastating effects on native animals. Scientists estimate that nationwide cats kill 1.3–4.0 billion birds and 6.3–22.3 billion mammals, 228 to 871 million reptiles and between 86 and 320 million amphibians annually (Loss et al. 2013). Cats have been listed among the 100 worst non-native invasive species in the world (Lowe et al. 2000). Researchers at the University of Wisconsin coupled their four-year cat predation study with the data from other studies, and estimated that rural feral and free-ranging cats kill at least 7.8 million and perhaps as many as 217 million birds a year in Wisconsin (Coleman et al. 1997). In some parts of Wisconsin, feral and free ranging cat densities reached 114 cats per square mile, outnumbering all similar-sized native predators (Coleman et al. 1997). Churcher and Lawton (1989) observed 77 well fed free-ranging cats in a British village for one year. Churcher and Lawton (1989) estimated that 30% to 50% of a cat’s catch were birds and that the cats had adversely affected house sparrow populations within the village. Based on information acquired in the study, Churcher and Lawton (1989) estimated that more than 20 million birds are killed by cats in Britain each year with more than 70 million animals overall being taken by cats annually. Pearson (1964) found rodents composed a large portion of a cat’s diet. Some people view the predation of rodents by cats as beneficial, but native small mammals are important to maintaining biologically diverse ecosystems. Field mice and shrews are also important prey for birds such as great horned owls and red-tailed hawks.

2.2.1.7. Raccoon

Raccoons are a furbearer in Arizona and AGFD is responsible for oversight of their management. They are abundant throughout North America, except much of Canada, the Rocky Mountains, and Great Basin regions. They are typically associated with waterways and forested habitats, but are especially common in urban areas. In Arizona, they are found mostly in urban areas, along waterways, and in forests of the less arid portions, but sometimes they can be found a long way from water in a variety of habitats including desert scrub. Raccoons are omnivorous, feeding on carrion, garbage, birds, mammals, insects, crayfish, mussels, other invertebrates, a wide variety of grains, various fruits, other plant materials, and most or all foods prepared for human or animal consumption (Sanderson 1999). Raccoon damage problems including, agriculture, property, and HHS concerns, were reported an average of 50 times annually from FY11 to FY15 causing less than 1% of the value of all predator damage recorded by WS-Arizona annually in Arizona (Table 1).

Densities of raccoons can be very high where they are common, especially along watercourses and suburban areas. Twichell and Dill (1949) reported one of the highest densities where 100 raccoons were removed from a winter tree den area on 101 acres of a waterfowl refuge in Missouri. Other studies have found raccoon densities that ranged from 9.3/mi^2 to 80/mi^2 (Yeager and Rennels 1943, Urban 1970, Sonenshine and Winslow 1972, Hoffman and Gottschang 1977, and Rivest and Bergerson 1981). Densities in Arizona likely average towards the lower end of the range over large tracts of land similar to that found in Colorado, 1.3-8.3/mi^2 (Fitzgerald et al. 1994) because perennial water is limited in Arizona. Considering this information, and using 1.3/mi^2 for the state, a reasonable estimate of the number of raccoons in Arizona would be 148,000. Raccoon densities in Arizona are likely highest in riparian woodlands and urban areas.

2.2.1.8. Foxes

AGFD is the agency responsible to oversee the management of foxes which are classified as predators in Arizona. Three species inhabit Arizona, the gray fox, kit fox, and red fox. Hunters harvested an average of 1,615 foxes annually from FY12 to FY15 in Arizona, but took an average of 1, 387 from FY87 to FY91, suggesting that fox populations are remaining stable (Table 7).

<u>Gray Fox</u>

Gray fox are found throughout Arizona, but tend to prefer coniferous forests, chaparral and rimrock country with scattered pinyon-juniper and agricultural habitats. They primarily feed on small mammals, birds including poultry, mast, and insects. They have 3-7 pups and den in hollow logs, under rocks, and sometimes in underground dens.

Published estimates of gray fox densities range form 3.1-5.4/mi^2 with densities probably lower over broader areas (Fritzell 1999). Since gray fox densities tend to be lower over large areas (Fritzell 1999) and occur only in appropriate habitat, a density of 1.0/mi^2 over its range (a third of the lowest density estimate), would provide a conservative estimate of about 114,000 gray fox in Arizona. Gray fox in Arizona cause little damage but have been responsible for 19 requests for assistance from WS-Arizona annually. The requests involved HHS, property, and agriculture from FY11 to FY15 (Table 1). Hunters harvested an average of 1,615 foxes annually from FY12 to FY15 in Arizona, but took an average of 1, 387, from FY87 to FY91, when many more trappers were afield (Table 7).

Kit Fox

Kit foxes occupy desert habitats, and occasionally the fringe of agricultural lands. This species prefers areas where the soils are loose-textured to easily dig underground dens which are used throughout the year (O'Farrell 1999, Scott-Brown et al. 1999, BISON-M 2012). These fox are most common in areas that support large populations of prey such as rodents, especially kangaroo rats (*Dipodomys* spp.) and deer mice (*Peromyscus* spp.), birds, and insects. They reach reproductive maturity between 10 and 22 months of age and litters average 3-5 pups.

Kit fox are found in much of southern and western Arizona, and some areas in northeastern Arizona, occupying roughly 60% of the state. Population density information is poorly understood for this species. Studies in California and Utah, found kit fox densities anywhere from 0.25-6.0/mi^2 (O'Farrell 1999); a density of 0.25/ mi^2 for Arizona would result in a population of 28,501 statewide. Kit fox in Arizona cause little damage and few requests for assistance. From to FY11- FY15, less than one request for assistance was received for kit fox (Table 1).

Red Fox

WS-Arizona received less than 1 damage complaint for red fox from FY11 to FY15 (Table 1). Red fox have good adaptations for cold climates which probably reduces their distribution in Arizona. Red fox are found throughout much of North America, but are only found in extreme northwestern Arizona. Much debate has occurred about the distribution of native versus nonnative red fox in the United States (Voigt 1999, Kamler and Ballard 2002). Through the 20th century, it is believed that the European red fox expanded their range in the United States because of their adaptability to living in close association with man; these fox were brought from Europe for *fox hunting* because the native gray fox were not as sporting (they often *tree* as they can readily climb) and for the fur market. However, the population that inhabits Arizona is within the native range (Kamler and Ballard 2002). In addition, the red fox in Arizona has not expanded its range which is more characteristic of native red fox not being able to adapt as well to newly developed or disturbed habitats. States surrounding Arizona have seen red fox expand their range and it is very conceivable that these could invade Arizona in the future, particularly in northern Arizona from Utah. The native red fox are mostly limited to mountainous areas with coniferous forests and alpine tundra whereas the introduced red fox can be found in many habitat types, including those in close association with human activities such as agricultural lands and suburban developments. They are limited in range to about 2% of the State and currently found only on tribal lands.

Red fox eat mostly small mammals, birds, insects and mast, and will take small livestock and poultry. Of the foxes and where abundant red fox typically create the most complaints, typically with livestock. Red fox have a home range of 1-2 mi^2, but often travel outside. Red fox usually den on slopes in porous soils and have 1 litter per year of 4-9 pups. Densities range from 0.3 (tundra)-80 (urban with abundant food)/mi^2 in studies (Voigt 1999). An average density for Arizona, where tundra is limited may be conservatively estimated at 0.5/ mi^2. Thus in Arizona, a conservative estimate would be 1,100 red fox.

2.2.1.9. Bobcat

The bobcat is managed as a predator by AGFD in Arizona. They prey mostly on small mammals as lagomorphs (rabbits) and rodents, but will also take lizards, birds, carrion, and potentially larger mammals. Bobcats were responsible for an average of 14 requests for assistance and $83 in damage, mainly to agriculture, annually from FY11 to FY15. Bobcats are found in much of North America, excluding most of Canada and the East, and are most abundant in western states. They are found statewide in Arizona.

They are typically associated with rimrock and chaparral habitat, but can be found in other habitats such as forests. Bobcats reach reproductive maturity at approximately 9 to 12 months of age and may have one to six kittens following a two-month gestation period (Crowe 1975, Koehler 1987). They may live up to 14 years, but annual mortality is as high as 47% (Rolley 1985). Hunters harvested an annual average of over 2,377 bobcats in Arizona from FY11 to FY15, suggesting a fairly abundant population (Table 7). Bobcat population densities range between 0.1/mi^2 and 7/mi^2 according to published estimates (Rolley 1999) and in Arizona at 0.24 -0.28/mi^2 (Jones and Smith 1979, Lariviere and Walton 1997). Using the low density estimate for Arizona, 0.24/mi^2 (Lariviere and Walton 1997), at the low end of the published density estimates (Rolley 1999), the bobcat population in Arizona would be estimated to be about 27,000.

2.2.1.10. Badger

Badgers are classified as a furbearer in Arizona and managed by AGFD. WS-Arizona occasionally takes badgers as target species, most often for the protection of rangeland, pasture, and cropland damage. WS-Arizona responded to an average of 4 damage occurrences annually from FY11 to FY15. During this time there was no monetary value attributed to badgers (Table 1). The damage involved from badgers can be to agriculture, HHS, natural resources, and property. Badgers are found throughout most of the western states and are found in Arizona at moderate densities. Badgers occur in practically all habitat types in Arizona. They prefer open habitats and avoid densely wooded areas, although they will enter forest margins. Badgers occur in grasslands, meadows in subalpine and montane forests, alpine tundra, and semi-desert shrublands (Fitzgerald et al. 1994). Their distribution is typically associated with *fossorial* (below ground) prey such as prairie dogs (*Cynomys spp*.) and ground squirrels, and where the ground is conducive for digging. The smallest and largest estimated sustainable yield rates mentioned in the literature are 18% and 33%, respectively (Cook 1986). Hunters harvested an average of 56 badgers annually from FY12 to FY15 in Arizona, but took an average of 386, from FY87 to FY91, when many more trappers were afield (Table 7). Density estimates range from 1/mi^2 to 13/mi^2 (Messick 1999). Using the low estimate of 1/mi^2, Arizona would have 114,000 badgers.

2.2.1.11. River Otter

River otters are water dwelling members of the weasel family (Mustelidae) and native to North America, including Arizona, though they likely have always been rare. They are managed by AGFD as a furbearer, but are completely protected. WS-Arizona had no complaints for river otters from FY11 to FY15 in Arizona. Being semi-aquatic and carnivorous, otters feed mainly on fish and aquatic crustaceans (primarily crayfish). They also feed on insects, small mammals, reptiles, and birds (Melquist and Dronkert 1999). They were believed extirpated in Arizona, but have been reintroduced into central Arizona along the Verde River. Melquist and Dronkert (1999) compiled a comprehensive review of river otter natural history and population dynamics.

While river otter damage is not a major problem in Arizona, they can cause serious losses to individuals locally by preying on fish, crayfish, and other types of commercially produced aquaculture products (Hill 1994). In addition, they occasionally can cause property damage or be a general nuisance. Considering that there is little information on the species in Arizona, we do not have a reasonable estimate of the number of river otters in Arizona. The number of nuisance river otter issues at AGFD owned fish hatcheries has also increased over the past 5 years and is likely to continue to increase indicating that the population of river otters is healthy and stable.

2.2.1.12. Ringtail

Ringtails are a furbearer managed by AGFD found throughout Arizona. The ringtail is most common in southern and western Arizona where it is found in rimrock, desert, and rocky ridge habitats near water. Ringtails feed on small mammals, birds, lizards, insects, and mast. The ringtail is managed as a furbearer, but its pelt has never been particularly valuable. Trappers and hunters in Arizona took most ringtails with 35 being harvested annually from 2010-11 to 2014-2015 (Table 8). Densities of ringtails in the literature vary greatly from 0.2/mi^2 to 51.8/mi^2, but many of these were determined prior to 1950. Estimates from a Utah study in the late 1970s, with habitat similar to areas in Arizona where they occur, were reported as 3.9-7.5/mi^2 (Kaufmann 1999). However, using the lowest density estimate of 0.2/ mi^2, Arizona would have an estimated 23,000 ringtails which is likely conservative. Because of their habitat choice and secretive nature, ringtails seldom become a problem, but have been known to become a nuisance in and around human habitations. WS-Arizona had an average of 2 complaints annually for ringtails from FY11 to FY15. Hunters harvested an average of 39 ringtails annually from FY12 to FY15 in Arizona, but took an average of 2,312, from FY87 to FY91, when many more trappers were afield (Table 7). There was no damage value attributed to these complaints (Table 1).

2.2.1.13. Opossum

AGFD manages the opossum as a non-game mammal which can be taken year round. WS-Arizona received only one request for assistance with opossum from FY11 to FY15 (Table 1). Opossum often will cause damage to residential property and create HHS concerns living in attics or under houses. They cause some damage to agricultural resources. The opossum was likely introduced into several areas of Arizona from intentional or unintentional releases from those kept mostly as pets (BISON-M 2012). The opossum in extreme southwestern Arizona is likely the Mexican subspecies (*D. v. californica*) at the north end of its range. They typically are associated with riparian areas and inhabit deciduous woodlands, cottonwood forests, pinyon-juniper woodlands, farmlands, old fields, grasslands, marshlands, agricultural and forested edges, and desert plains; they have also been reported in mountainous areas. Opossums are omnivorous and have a wide-ranging diet. Females breed the first season following their birth and produce potentially two litters per year in Arizona. They may have as many as 25 young, but average between 6 and 9. Most opossums die in their first year and turn-over is expected by their third year. Opossum populations can fluctuate dramatically. Opossums may occupy about 2% of the state and their density ranges from 1.3/mi^2 to 20.2/mi^2 with an average of 10.1/mi^2 (Seidensticker et al. 1999). Using the low density estimate of 1.3/ mi^2, about 3,000 would inhabit Arizona.

2.2.1.14. Long-tailed Weasels

AGFD has management authority over weasels as they are classified as furbearers. WS-Arizona occasionally receives damage complaints for weasels and most always for poultry predation. WS-

Arizona received an average of less than 1 complaint from FY11 to FY15 involving the long-tailed weasel. The long-tailed weasel inhabits about 10% of Arizona at higher elevations. They are found in a wide variety of habitats, usually brushy and rocky, and typically in close association with water. They feed primarily on small mammals (rodents and rabbits) and some birds and lizards. Long-tailed weasels are found at densities of 1/mi^2 in large areas including non-preferred habitats to as many as 98/mi^2 in appropriate habitat (Fagerstone 1999). Using the most conservative estimate, Arizona would have a minimum of 11,000 long-tailed weasels.

2.2.1.15. Feral Domestic Ferrets

Domestic or European ferrets are frequently sold as pets and may be released into the wild or escape captivity. WS nationally gets only a few requests for assistance with feral ferrets annually, and WS in Arizona received an average of less than 1 request for assistance from FY11 to FY15 for feral ferrets. Once feral, ferrets feed on small rodents, rabbits, and potentially poultry to survive. Feral ferrets are not part of the native environment, and left abandoned in the wild are considered an ecological pest. They are very uncommon in the wild, but they are sometimes encountered.

2.1.1.16. White-nosed Coati

In Arizona, the coati inhabits canyons characterized by riparian vegetation such as Arizona sycamore (*Platanus wrightii*) and oaks (*Quercus spp*.). They climb trees easily and rapidly and often take to trees as a means of escape from predators. They are usually found near streams, creeks, or some source of water and typically live in natural retreats such as rock crevices, cavities among tree roots, and caves or mines. Coatis often travel together in bands, and these bands move at a slow pace rooting in litter, crevices, and other places for food, both on the ground and, to a lesser extent, in trees. They are primarily diurnal and quite omnivorous, eating fruits and nuts of native trees, prickly pear, and yucca, roots, eggs, soil-inhabiting invertebrates, lizards, snakes, carrion, rodents. They can cause damage to poultry and orchards, but damage is mostly localized where it occurs. Coatis are susceptible to predation from mountain lions, jaguars, and other large predators. Coatis are found throughout southeastern Arizona covering about 10% of the state (Cochise, Santa Cruz, and eastern Pima Counties) with periodic stragglers found in a greater area covering about 30% of the state. Little is known about coati densities, but have been found at densities of 0.6/ mi^2 in Central America (Kaufmann 1999) which would provide an estimate of 7,000. Since the population is relatively low and coatis inhabit less densely populated areas of the state, it is likely that this species will not invoke many complaints. WS-Arizona received 2 complaints involving this species from FY11 to FY15 (Table 1).

2.2.2. Effects on Non-target Species Populations, Including T&E Species

This section discusses historical data on T&E species taken from previous PDM activities, providing this information to better inform the discussion on environmental consequences in Chapter 4 of this EA. A common concern among members of the public and wildlife professionals, including WS personnel, is the possible impact of PDM methods and activities on non-target species, particularly T&E species. Another concern regarding impacts to wildlife that has arisen from EAs in other state WS programs is the effect of aerial shooting overflights on wildlife. SOPs of WS include measures intended to reduce the effects of PDM on non-target species populations, especially T&E species, and are detailed in Chapter 4.

When PDM activities may affect federally listed threatened or endangered species, WS-Arizona consults with the US Fish and Wildlife Service (USFWS) to ensure its program will not jeopardize the continued existence of the listed species. Under Section 7 of the ESA, Federal agencies must consult with the USFWS when any action the agency carries out, funds, or authorizes may affect a listed endangered or threatened species. Effects of WS-Arizona activities on federally listed species in Arizona were evaluated by the USFWS in a Biological Opinions for impacts on listed Ocelot (July 7, 2010) and Jaguar (June 22, 1999) in formal consultations. On June 27, 2017, the USFWS issued a new Biological Opinion and completed the formal consultation on the Wildlife Service's WDM program with regard to its effects on ocelots in Arizona. On March 13, 2018, the USFWS issued a new Biological Opinion and completed the section 7 formal consultation on the Wildlife Service's WDM program for actions occurring in Arizona. WS-Arizona closely follows operational measures outlined in its ESA consultation documents to minimize the risk of take of listed species.

The effectiveness of PDM methods to capture target species, yet reduce capture of non-target species, may vary widely depending on local circumstances at the time of application (*e.g.*, target and non-target species are similar in weight and in the same area). Some PDM methods may be more or less effective or applicable depending on experience of the user, weather conditions, time of year, biological considerations, economic considerations, legal and administrative restrictions, or other factors.

2.2.2.1. Non-target Species Taken by WS-Arizona in PDM and Potential Non-targets

WS-Arizona implements many measures to minimize the possibility of affecting non-targets (as outlined in Section 3.3 and analyzed in Section 4.2.2). From FY11 to FY15, WS-Arizona took 18 different non-target species (Table 9). Nine of 18 species taken from FY11 to FY15 during PDM are predator species that were not targeted during a specific operation or were not the specific individual targeted. Information on target predator species was discussed in Chapter 2 and take will be included in the analysis in Chapter 4.

Non-target species, other than predators, included rock squirrel (*Spermophilus variegatus*), Abert's squirrel (*Sciurus aberti*), Arizona gray squirrel (*Sciurus arizonensis*), collared peccary (*Peccari tajacu*), and 3 domestic animals. Only one of these non-target species, a collared peccary, was killed during PDM between FY11 and FY15. All other non-predator non-target species were released on-site.

WS-Arizona has the potential to capture other non-target species, species that are not listed in Table 9. Species that are of similar or more weight and size than the species targeted can be taken with several of the PDM methods used, though it is expected to be infrequent. Species such as jackrabbits (*Lepus spp*.) have infrequently been taken by WS in Arizona or surrounding states. Despite the potential for take, no jackrabbits were taken by WS-Arizona from FY11 to FY15. This is primarily a result of the high selectivity of PDM methods used by WS-Arizona (i.e. pan-tension devices on leg-hold traps, strategic trap placement, and appropriate lure type). Species with the highest potential to be taken as a non-target species, with the exception of the T&E, candidate, and sensitive species presented in Tables A-1 and A-2, are relatively common in Arizona, either locally or statewide. The potential to take T&E and sensitive species is discussed in Section 4.2.2.

Table 9. Non-target species killed or freed by WS-Arizona during PDM from FY11 to FY15 on all land classes in Arizona.

YEAR	FY11		FY12		FY13		FY14		FY15		Average	
Species	**Killed**	**Freed**	**Killed**	**Freed**	**Killed**	**Freed**	**Killed**	**Freed**	**Killed**	**Freed**	**Killed**	**Freed**
Non-targets Taken with All Foothold Traps and Snares												
Gray Fox	0	4	0	0	0	1	2	0	0	0	0.4	1
Javelina	1	2	0	3	0	2	0	1	0	0	0.2	1.6
Badger	0	0	0	1	0	0	1	1	0	0	0.2	0.4
Raccoon	0	0	0	0	0	1	0	0	0	0	0	0.2
Bobcat	0	4	0	6	0	7	0	10	0	0	0	5.4
Domestic Animal	0	0	0	5	0	7	0	0	0	0	0	2.4
Feral Cat	0	2	0	0	0	0	0	1	0	0	0	0.6
Feral Dog	0	0	0	1	0	0	0	0	0	0	0	0.2
Trap/Snare Subtotal	**1**	**12**	**0**	**16**	**0**	**18**	**3**	**13**	**0**	**0**	**0.8**	**11.8**
Non-targets Taken in Cage Traps												
Rock Squirrel	0	22	0	0	0	0	0	3	0	2	0	5.4
Abert's Squirrel	0	6	0	0	0	0	0	0	0	0	0	1.2
Ringtail	0	0	0	0	0	0	0	1	0	0	0	0.2
Hooded Skunk	0	0	0	0	0	0	0	0	0	1	0	0.2
Striped Skunk	0	0	0	2	0	0	0	1	0	0	0	0.6
Feral Cat	0	0	0	1	0	0	0	0	0	0	0	0.2
Mountain Lion	0	1	0	0	0	0	0	0	0	0	0	0.2
Domestic Animal	0	0	0	1	0	0	0	0	0	0	0	0.2
Gray Fox	0	0	0	0	0	0	0	1	0	0	0	0.2
Raccoon	0	0	0	0	0	0	0	1	0	0	0	0.2
Subtotal Cage Trap	**0**	**29**	**0**	**4**	**0**	**0**	**0**	**7**	**0**	**3**	**0**	**8.6**
Non-target Total	**1**	**41**	**0**	**20**	**0**	**18**	**3**	**20**	**0**	**3**	**0.8**	**20.4**

2.2.2.2. Potential T&E and Sensitive Species Impacts

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects of WS-Arizona PDM activities and the establishment of special restrictions or measures to reduce the potential for take. WS-Arizona PDM has the potential to impact terrestrial vertebrates and will have no effect on fish, invertebrates, and plants.

Federally Listed T&E and Candidate Species. Table 10 shows that Arizona has 9 mammals, 8 birds, 4 reptiles, and 2 amphibians federally listed by USFWS as T&E species and 2 reptiles and 2 amphibian that are candidates for the federal list. Of these six T&E species, 3 mammals and 2 birds have been reintroduced as experimental/nonessential populations.

General information regarding species that WS-Arizona PDM could potentially affect is provided in Chapter 4. However, it should be noted that, even though Table 10 includes all mammals, birds, reptiles, and amphibians federally listed in Arizona and the potential for negative impacts from PDM, WS-Arizona may not conduct PDM activities in some of these species' occupied habitat. If no PDM program is selected and conducted, WS-Arizona would not impact these species. For example, WS-Arizona does not currently conduct PDM activities in the range of the Mt. Graham red squirrel or Sonoran pronghorn and, therefore, has no potential to impact these species. However, based on the alternative selected, WS-Arizona could be requested to conduct PDM in their habitat so PDM methods will be discussed that may have the potential to impact these species.

Other Agency Listed T&E and Sensitive Species. Several other agencies, including AGFD, USFS, BLM, and tribal nations monitor T&E species, species of concern, and other indicator species which are species not necessarily rare, but species that are monitored to determine the effects of landscape changes (collectively sensitive species) in Arizona (Table A-2). Additionally, the USFWS monitors birds of management concern (USFWS 2008). These lists include 144 mammals, 202 birds, 85 reptiles, 32 amphibians, 130 fish, 150 invertebrates, and 538 plants; USFWS T&E and candidate species given in Table 10 are included in Table A-2. Table A-1 contains a total of 1,237 sensitive species that are monitored by the agencies discussed here. When PDM activities may affect federally listed threatened or endangered species, WS-Arizona consults with the US Fish and Wildlife Service to ensure its program will not jeopardize the continued existence of the listed species. Wildlife Services is currently in consultation with the USFWS and will complete consultation prior to Wildlife Services issuance of a decision on this EA.

The implementation of PDM by WS-Arizona has the potential to negatively affect several species, primarily from the inadvertent take of these species as non-targets. On the other hand, PDM could also positively impact species that are being limited by predators. Current WS-Arizona PDM has less of an actual effect compared to potential effects because WS-Arizona does not currently conduct work in habitats occupied by many of these species or use the methods that have the potential to affect them. It should be noted that WS-Arizona did not take any sensitive species in Arizona during PDM from FY10 to FY15.

Sonoran Pronghorn. Pronghorn populations, including all subspecies, declined similar to the bison (*Bison bison*) during the 1800s with the settlement of the West. Pronghorns are unique ungulates found only in North America. They generally inhabit grasslands and deserts with few visual obstacles such as trees. They primarily browse on forbs. One of several remnant populations, the Sonoran pronghorn, remained into the 1900's in southwestern Arizona and adjacent Mexico and still occurs in the Sonoran Desert with over 400 animals in Arizona (A. Munig, AGFD, Pers. comm. 2017). This federally endangered species is found mostly on the Cabeza Prieta National Wildlife Refuge. Threats to this species have included habitat degradation and potentially predation from species such as the coyote and bobcat (AGFD 2012). If predation is identified as a limiting factor in their recovery and PDM could be implemented to reduce predation, PDM could be beneficial. PDM methods that have the potential to negatively impact this species include foothold traps and snares, and predator-proof fencing (pronghorn often get entangled because do not jump well). WS-Arizona currently does not conduct PDM in their range and, therefore, has no effect on their population. WS-Arizona had no take of Sonoran pronghorns from FY92 to FY16.

Table 10. Arizona Federally listed T&E mammals, birds, reptiles and amphibians.

SPECIES	Scientific Name	Status	Habitat	Locale	Diet	PDM
	MAMMALS					
Sonoran Pronghorn	*Antilocapra americana sonoriensis*	E X	GR	SW	G	-, 0,
Mexican Gray Wolf	*Canis lupus baileyi*	E*, X	FR	SE	L	-, 0
Ocelot	*Leopadus pardalis*	E	DF	SE	S	-, 0,
Lesser Long-nosed Bat	*Leptonycteris curasoae*	E, P	D	East	FN	0
Black-footed Ferret	*Mustela nigripes*	E*, X	GR	NE, NW	S	-, 0,
Jaguar	*Panthera onca*	E	DF	SE	L	-, 0
Mount Graham Red Squirrel	*Tamiasciurus hudsonicus*	E	F	SE	M	-, 0
New Mexico Meadow Jumping Mouse	*Zapus hudsonius luteus*	E	W	East	G	-,0,+
	BIRDS					
Yellow-billed Cuckoo	*Coccyzus americanus*	T	F	NW	IMS	0
Masked Bobwhite	*Colinus virginianus ridgewayi*	E	DG	S	GM	0, +
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E	F	State	I	0
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	E*, X	DG	SE	S	0
California Condor	*Gymnogyps californianus*	E*, X	FR	NW	C	- ,0, +
Yuma Clapper Rail	*Rallus longirostris yumanensis*	E	W	West	A	0
California Least Tern	*Sternula antillarum browni*	E	W	State	A	0,+
Mexican Spotted Owl	*Strix occidentalis lucida*	T	F	State	S	0
	REPTILES					
New Mex. Ridge-nosed rattlesnake	*Crotalus willardi obscurus*	T	F	SE	SI	-, 0,
Mojave Desert Tortoise	*Gopherus agassizii*	T	DG	NW	GM	-, 0, +
Sonoyta Mud Turtle	*Kinosternon sonoriense*	E	R	SW	GM	- ,0,+
Northern Mexican Gartersnake	*Thamnophis eques megalops*	T	FW	State	A	0
Narrow-headed Gartersnake	*Thamnophis rufipunctatus*	T	LSG	SE	A	- ,0,+
	AMPHIBIANS					
Sonora Tiger Salamander	*Ambystoma tigrinum stebbinsi*	E	GRW	SE	AI	-, 0
Chiricahua Leopard Frog	*Rana chiricahuensis*	T	LW	SE	AI	0

** Extirpated or not known to be present in State* ***Diet - Capitals = large proportion of diet - Lower case = small proportion of diet.*

STATUS
F - Federal
S - State
E - Endangered
T - Threatened
P - Proposed
C - Candidate
X - Exp. nonessential pop.
( ) - Not listed in AZ

HABITAT
D - Desert/desert scrub
F - Forests/riparian borders
G - Grassland/meadow
R - Rangeland/sage/high desert
W - Wetlands/marshes
L - Lakes, Rivers
S - Small rivers/creeks/springs
G - Gravel/flowing water
M - mud bottoms/pools

DIET
A - Aquatic-sm fish/invertebrates/plants
G - Grains/grass/seeds
I - Invertebrates/insects
M - Mast/fruit & nuts
N - Nectar/sap
S - Small vertebrates (i.e. rodents, birds)
L - Large Vertebrates
F- Fish
C- Carrion

WDM - Impacts
(-) - Negative
0 - none
(+) - Positive

USFWS. 2016. ECOS Environmental Conservation Online System. Conserving the Nature of America. Website @ http://ecos.fws.gov/ecp/. *Last visited 5/11/1*

Mexican Gray Wolf. The gray wolf was extirpated from much of the lower 48 continental United States by the 1930's. Gray wolves were once found in Arizona, but disappeared as a result of a campaign to rid the United States of *"Livestock Destroyers"* that was started in the late 1800s. Two subspecies occupied Arizona with both being extirpated, the Intermountain gray wolf (*C. l. youngi*) and Mexican gray wolf. The last Mexican wolves taken in the United States were in the 1970s and in Mexico in 1980s (AGFD 2012, BISON-M 2012). Although, reports are received periodically of sighted wolves, most are likely wolf-dog hybrids intentionally or unintentionally released by owners. A captive Mexican wolf breeding program began in 1977 from wolves captured in Mexico. By the 1990s, USFWS believed that wolves were extirpated from the United States. The Mexican wolf is still listed as endangered in Arizona and possibly wild wolves still exist in Mexico which could wander into the United States. However, no wild wolves were found in surveys conducted in Mexico where they historically had occurred and it is believed they may have been altogether extirpated from the wild.

The Mexican wolf was reintroduced as a NEP into Arizona and New Mexico from captive-bred stocks as outlined in the USFWS Wolf Recovery Plan (USFWS 1996a). Wolves outside the designated NEP area, including those believed to have originated from the NEP, but have wandered from the designated area, obtain endangered species status. Many tools used in WDM for large predators such as foothold traps, snares, M-44s, and aerial shooting have the potential of taking a wolf. WS-Arizona follows the conservation measures established in the 1998 Mexican Wolf BO and Conference Opinion issued by USFWS (1998a) and in the 10j Revision to the Regulations for the Nonessential Experimental Population of the Mexican Wolf (January 2015, https://www.fws.gov/southwest/es/mexicanwolf/pdf/Mx_wolf_10j_final_rule_to_OFR.pdf). The Arizona Program is part of the Interagency Field Team that manages Mexican wolves on a daily basis. The conservation measures consisted of two opinions - a BO for naturally occurring Mexican wolves and a Conference Opinion for the reintroduced NEP Mexican wolves. WS-Arizona has not taken an incidental wolf in at least the last 35 years, but have the potential with the reintroduced population, though this is minimized following the USFWS (1998a) and January 2015 10j conservation measures.

Ocelot. Ocelots possibly occupied or traveled through dense shrublands in southeastern Arizona. The species has been documented in southeastern Arizona a few times. In November 2009, an ocelot (*L. p. sonoriensis*) was documented in Arizona (in the Whetstone Mountains, Cochise County) with the use of camera traps. In April 2010, a young male ocelot was found dead on the road near Globe, Arizona. Genetic analysis determined that the specimen was not of captive origin. A recent study by the University of Arizona identified 3 ocelots through camera traps for the time period July 31, 2012, through February 2015 (Culver et al 2016). During the study two male ocelots were identified in the Huachuca Mountains (over 1,880 m in elevation) and another male was identified in the Santa Rita Mountains (> 1,553 m in elevation). One of the Huachuca males did range to the Patagonia Mountains for a brief time period. The study found the minimum home range size for ocelots in Arizona to be 11.83 km^2. The study was unable to determine residency of ocelots in the state. The last known ocelot in Arizona, prior to these findings, was lawfully shot on Pat Scott Peak in the Huachuca Mountains in 1964 (AGFD 2012). A new BO was issued in 2010 (USFWS 2010) and stated that *"WDM Program activities, as proposed, are not likely to jeopardize the continued existence of the ocelot"* with RPA and RPM to avoid take and WS-Arizona abides by these. WS has not taken an ocelot incidentally to PDM in the last 80 years. The USFWS Ocelot Recovery Team reanalyzed all the available information on ocelots through June 2016 including sightings, potential impacts, and habitat. In the Recovery Plan for Ocelot (USFWS 2016) the determination was made that "While Wildlife Services' WDM Program could result in the "take" of one ocelot in the U.S., it is not considered a significant threat to the species." WS-Arizona had undergone reinitiation of Section 7 Consultation with USFWS on the WDM Program and its effects on the ocelot and received an updated Biological Opinion on June 27, 2017.

Black-footed Ferret. Black-footed ferrets were once found amidst prairie dog colonies in northeast Arizona though they were thought to be fairly rare (AGFD 2012, BISON-M 2012). Their entire population in North America was thought to be extinct with the last known captive ferret dying in captivity in 1979. In 1981, a new population was found in a remote area of northwestern Wyoming. These ferrets were taken into captivity when many began dying of the canine distemper virus. The captive breeding program that was established with the last 18 ferrets that survived to produce more than 3,000 ferrets and some have been reintroduced into six states. Ferrets were reintroduced into northwestern Arizona in 1996 (AGFD 2012). These ferrets appear to be surviving. It is doubtful, though remotely plausible, that an actual wild population still exists in Arizona today. Black-footed ferrets could be negatively and positively affected by primarily two PDM methods, foothold and cage traps without pan-tension devices. On the other hand, predation and disease have been identified as key concerns for the reintroduced ferrets and WS-Arizona conducts PDM for their protection. The Arizona Program is active in dusting of prairie dog holes to prevent plague in fleas for the protection of black-footed ferrets on an annual basis. . In addition, WA-Arizona provide support for black-footed ferret spotlighting efforts, taking predators to use as surrogates for disease monitoring and participating in sylvatic plague vaccine applications. WS took no non-target ferrets from FY92 to FY16.

Jaguar. The jaguar is the largest species of cat now native to the Western Hemisphere. Jaguars are large muscular cats with relatively short massive limbs, a deep-chested body, and a cinnamon-buff color with many black spots. The jaguar prefers a warm tropical climate, is usually associated with water, and is only rarely found in extensive arid areas. Its range in North America includes Mexico and portions of the southwestern United States. A number of records of jaguars are known for Arizona, primarily in the very southeastern part of the state. Records of the jaguar have been attributed to the subspecies *P. o. arizonensis* (AGFD 2012, BISON-M 2012). The historical range of the jaguar included portions of Arizona, New Mexico, and Texas. The current range is from central Mexico through Central America and into South America as far as northern Argentina. It was felt that in the United States an established breeding population probably disappeared in the 1960s. However, Brown (1983) presented an analysis suggesting that at least into the 20th century a resident breeding population of jaguars was present in the southwestern United States. In March 1996, the presence of a jaguar was confirmed through photographs made in the Peloncillo Mountains of Arizona and New Mexico (Glenn 1996). USFWS (1999b) recognized that the jaguar continues to occur in the American Southwest as an occasional wanderer from Mexico. The jaguar was listed as endangered in 1997. WS initiated consultation and USFWS issued a BO and amendment in 1999 (USFWS 1999 a and b) and reconsulted in 2005. USFWS issued a *"may effect, but not likely to jeopardize"* opinion with reasonable and prudent alternatives and measures to avoid take. WS has not taken a jaguar incidentally from FY92 to FY16.

Mount Graham Red Squirrel. This subspecies of the red squirrel lives in high-elevation, montane conifer forests of the Pinaleno Mountains in Graham County. WS-Arizona has never worked in that area with PDM methods that would have the potential to take it. The only PDM method used by WS-

Arizona that has any potential to impact this species would be the use of small cage and foothold traps without pan tension devices used for capturing small predators. Prior to use of cage traps or small foothold traps (used potentially in a rabies outbreak) in the range of this species, WS-Arizona would consult with USFWS. This species will not be considered further in this EA because WS-Arizona will have no effect on it.

Grizzly Bear. The grizzly (*Ursus arctos horribilis*) is listed in Arizona under ESA, but has been considered extirpated for decades (1930's) and USFWS does not currently list them in Arizona. Prior to colonization by Europeans, grizzly bears roamed parts of Arizona (BISON-M 2012). The last documented grizzly in Arizona was during 1939 and it is not likely that the grizzly will be reintroduced into Arizona. Thus, WS-Arizona PDM will have no effect on them and this species will not be considered further in this EA.

Masked Bobwhite. This subspecies of the bobwhite is found in desert grasslands with a diversity of native grasses, forbs, and shrubs, particularly fern acacia (*Acacia angustissima*). It currently is known only from a reintroduced population on Buenos Aires National Wildlife Refuge. The masked bobwhites and their nests are predated by many species of carnivores (AGFD 2012). If predation on the refuge were found to be a limiting factor, PDM could be beneficial. However, there are currently no free-roaming bobwhite quail on the landscape. WS-Arizona is not currently conducting projects for the bobwhite and does not anticipate such, and therefore, will have no effect on them.

California Condor. The California condor was extirpated over most of its range by the late 1970s and all wild condors were taken into captivity in 1980s for a propagation program. The propagation program was a success and they were reintroduced back into the wild in California. The listed wild population in Arizona is believed to have been extirpated. A NEP under ESA Section 10(j) was established at Vermillion Cliffs in northern Arizona; the experimental range included areas in Arizona, Utah, and Nevada. Once outside of the NEP area, California condors are considered an endangered species under ESA. The California condor is strictly a scavenger, eating carrion such as cattle, sheep, deer, and ground squirrel carcasses. The condor finds carrion by sight and not smell, unlike a turkey vulture (*Cathartes aura*) which relies as much, or more, on odor to locate dead animals as it does sight. They have been known to be killed by coyotes (AGFD 2012). PDM, therefore, could have both negative and positive impacts on their population. WS-Arizona in Arizona restricts its PDM methods in the range of the condor and none have been taken from FY92 to FY16.

Desert Tortoise. The distribution of the desert tortoise covers the broadest range of latitude, climate, habitats, and biotic regions of any North American tortoise (Germano et al. 1994). The tortoise ranges from northern Sinaloa north to southern Nevada and southwestern Utah, and from south central California east to southeastern Arizona. The desert tortoise is divided into two populations for purposes of the Endangered Species Act; the Mojave desert tortoise inhabits the area north and west of the Colorado River and is listed as threatened under the Endangered Species Act. The Sonoran desert tortoise is found south and east of the Colorado River, in the central and western parts of Arizona and into northwestern Mexico (AGFD 2017a), and is not listed. The Sonoran population occurs at elevations ranging from about 155 m (510 ft.) in Mojave Desert scrub to semidesert grassland and interior chaparral at about 1615 m (5300 ft.; AGFD 2012). On the Arizona Strip the tortoise occurs at elevations between 300-1200 m (1000-4000 ft.; AGFD 2012). Primary threats to survival of the desert tortoise are related to loss and degradation of the species' habitat, through drought, wildfire, habitat destruction and fragmentation, and invasion of exotic plant and wildlife species. Predation, specifically by ravens is another limiting factor for populations. Other impacts to the species include removal of individuals from the wild, vandalism, mortality from vehicles, irresponsible off-highway vehicle (OHV) use, release of captive tortoises into the wild, and disease (AGFD 2017a). WS-Arizona conducts little PDM in the range of the tortoise. The biggest threats to this species from PDM are accidentally running them over with a vehicle or fumigation of burrows. WS had no known take of Mojave or Sonoran desert tortoises from FY11 to FY16 in Arizona.

Sonora Tiger Salamander. This subspecies of tiger salamander inhabits several ponds in San Rafael Valley in Santa Cruz and Cochise Counties, Arizona between the Huachuca and Patagonia Mountains. The juveniles are found in scattered livestock ponds in this area. As adults, most salamanders spend much of their time under things or in underground burrows they dig or those of rodents where they feed on worms, mollusks, and other small animals. Some adults remain branchiate (gilled) and live in aquatic environments their entire lives. The only PDM method that has the potential to affect this species is burrow fumigation. It is very unlikely that active coyote or other predator dens would be inhabited by a salamander as they would likely be killed. When dens are not being used, PDM does have the potential to impact them but active predator dens are easily distinguished from inactive dens. Despite the potential for impacts, because WS-Arizona does not conduct burrow fumigation in the range of the tiger salamander, PDM will have no effect on them. WS-Arizona did not take a salamander from FY11to FY15.

Rodents. Six species of rodents (antelope squirrel, ground squirrel, fox squirrel, and three kangaroo rats) are listed by the agencies in Arizona as sensitive. These rodents could be negatively or positively affected by PDM. The primary PDM method that has the potential for taking any of the listed sensitive rodents is the use of traps set for small predators. WS-Arizona uses cage traps for small predators. The majority of non-target rodents taken by WS-Arizona in cage traps are released (shown in Table 9) and historically have been taken in WS-Arizona skunk rabies projects. WS-Arizona has not conducted projects in habitats of any sensitive rodent species listed in Table A-2 with PDM methods that have the potential to impact them and, thus, will have no effect on them. Even if WS-Arizona were to work in these species' ranges in the future with the PDM methods likely to have an impact (small predator foothold traps and cage traps), it is unlikely that WS-Arizona would kill enough (no more than a few of any of these species as illustrated in Table 9) to impact their populations. The take of a few in any given year would not impact any of these species as all have high fecundity. Populations of these sensitive rodents are limited primarily by habitat loss and possibly high mortality from predators, so PDM could potentially have a positive impact on some sensitive species. For example, feral cats have been implicated in the decline of populations of the White Mountains ground squirrel (AGFD 2012). Although WS-Arizona is currently not conducting such a project, a concerted effort to take feral cats in that area could potentially be beneficial for the ground squirrel. WS-Arizona has conducted PDM for coyotes and feral dogs in the range of the ground squirrel and New Mexican banner-tailed kangaroo rat and this had the potential of being beneficial for these species. In all likelihood, however, WS-Arizona will have no, or negligible, effect on these species.

Kit Fox. The kit fox was discussed in Chapter 2 of this EA. The kit fox is listed by the Navajo Nation as sensitive because not enough information is available to assess the status of the kit fox on their lands. The kit fox historically has been absent from many tribal lands in Arizona. Limited distribution on tribal lands, habitat loss, and predation likely contribute to their rarity. Kit fox can be negatively and positively affected by PDM. Most PDM methods have the potential to take kit fox, but measures can be implemented such as pan-tension devices on foothold traps to reduce that potential because they weigh much less than the typical target species such as the coyote. On the other hand, PDM can be beneficial for kit fox. In studies in Kansas and Colorado, coyotes were found to be the major mortality factor for swift fox (*Vulpes velox*) (USFWS 1995, Sovada et al. 1998, Andersen et al. 2006), the Great Plains equivalent of the kit fox. The take of coyotes in their range would likely reduce predation of the fox and could be beneficial. However, in general, the kit fox population in Arizona is stable and not likely to be impacted by PDM. Kit fox take in Arizona is analyzed in Chapter 4 as a predator that could potentially be targeted in PDM. From FY11 to FY15, WS-Arizona killed 1 kit fox and freed 2 during PDM (Table 11). No non-target kit fox were taken or released from FY11-FY15 (Table 9).

Table 11. All target predators taken by WS-Arizona during PDM for FY11 to FY15 on all land classes.

Target Predator Species Taken in Arizona by WS-Arizona in FY11-FY15												
YEAR	**FY11**		**FY12**		**FY13**		**FY14**		**FY15**		**Average**	
Species	**Killed**	**Freed[1]**	**Killed**	**Freed[1]**	**Killed**	**Freed[1]**	**Killed**	**Freed[1]**	**Killed**	**Freed[1]**	**Killed**	**Freed[1]**
Coyote	993	5	1,325	6	823	16	628	6	623	10	878	9
Feral Dog	89	57	127	98	46	98	23	131	28	102	63	97
Striped Skunk	52	106	61	13	20	0	26	1	31	6	38	25
Mountain Lion	42	0	47	0	34	0	28	2	29	1	36	0.6
Raccoon	38	6	27	3	16	0	6	0	9	7	19	3
Feral Cat	27	6	32	25	12	13	9	23	5	9	17	15
Black Bear	14	11	12	10	3	10	4	11	1	6	7	10
Badger	6	1	13	0	10	0	1	0	0	0	6	0.2
Hooded Skunk	3	0	8	0	11	0	14	0	9	0	9	0
Gray Fox	13	8	7	2	1	0	3	0	1	1	5	2
Bobcat	6	0	9	1	4	3	0	0	4	1	5	1
W. Spotted Skunk	1	0	2	0	0	0	1	2	1	1	1	0.6
Hog-nosed Skunk	0	0	1	0	2	0	0	0	1	0	0.8	0
Kit Fox	0	2	0	0	0	0	1	0	0	0	0.2	0.4
Ringtail	0	0	0	1	0	2	0	1	0	0	0	0.8
European Ferret	0	0	0	3	0	0	0	0	0	0	0	0.6
White-nosed Coati	0	0	0	1	0	1	0	0	1	1	0.2	0.6
Total	**1,284**	**202**	**1,671**	**163**	**982**	**143**	**744**	**177**	**743**	**145**	**1,085**	**166**

[1] Total Freed includes transfer custody, relocated, freed/released, dispersed, immobilized, and collared.

Southwestern River Otter. The southwestern river otter inhabited the southwestern United States. It may have been a subspecies, but few were ever taken. In Arizona, otters were once distributed along the Colorado and Verde Rivers, but were believed to be extirpated by the 1960s (BISON-M 2012). Otters prey on a variety of animals but prefer fish and crayfish. Southwestern river otters are a state species of concern. As a result of their apparent extirpation, the Southeastern river otter (*L. c. lataxina*), not listed as a sensitive species, was successfully reintroduced into Arizona. The reintroduction site was the Verde River in central Arizona. None have been taken as a non-target species in PDM by WS-Arizona from FY11 to FY15. Southwestern river otters, could be negatively affected by PDM, particularly foothold traps and snares set near rivers in their occupied habitat. WS-Arizona uses trapping techniques that minimize the risk of accidently taking river otters. Furthermore, It is not believed that southwestern river otters are currently present in Arizona and, thus, WS-Arizona will have no effect on them and they will not be discussed further in this EA.

Ungulates. Four subspecies of ungulates, 2 pronghorn and 2 bighorn sheep, of which one species of antelope the Sonoran pronghorn occurs in Mexico and southwestern Arizona is listed by the USFWS as endangered. PDM methods that have the potential to negatively impact these subspecies include foothold traps and snares, and predator-proof fencing as discussed for the Sonoran pronghorn. Threats to these species have included habitat degradation and predation from species such as the coyote and mountain lion. If predation becomes an identified limiting factor to different populations and PDM could be implemented to reduce predation, PDM could be beneficial. Some biologists believe that mountain lions may need to be controlled to protect bighorn sheep because mountain lions limit the population numbers of bighorn (Kamler et al. 2002). WS-Arizona has conducted PDM for the benefit of bighorn sheep and pronghorns in Arizona at the request of AGFD and could do so in the future. Currently, WS-Arizona will not have an adverse impact on the bighorn sheep because PDM is not conducted in their range with the methods identified as having a negative effect. WS-Arizona has not taken a non-target bighorn sheep or antelope from FY11 to FY15.

Golden Eagle and Crested Caracara. Two species of raptors listed as sensitive could be impacted by PDM. Golden eagles are common throughout Arizona and are generalized predators feeding on rodents, rabbits, and other medium-sized mammals, snakes, birds, and carrion. They are typically found in hilly or mountainous areas nesting in cliffs and hunt open grasslands and other similar habitat. The much smaller caracara is found in extreme south-central Arizona where it prefers open brushland. It feeds primarily on carrion, often seen on the ground in the company of vultures. Caracaras will also hunt insects and small mammals. Exposed carcasses or other trap lures with traps set at them can negatively affect both raptor species, especially the golden eagle because of its weight (about 10 pounds). WS-Arizona has SOPs that minimize the potential for take. The caracara weighs much less and has such a limited distribution in Arizona that it is not likely to be impacted by WS-Arizona PDM at all. Statewide surveys for breeding golden eagles have been conducted throughout non-tribal lands in AZ annually since 2011. To date, there are 274 known golden eagle breeding areas across non-tribal lands in the state with low densities in the southwest corner of AZ (McCarty et al, 2011-2016; 2017 in prep.). According to Partners in Flight, the population estimates from the survey-wide Breeding Bird Survey data from 1998-2007 estimates the population of Golden Eagles in Arizona at 1,300 (http://pif.birdconservancy.org/PopEstimates/Database.aspx#continental). WS-Arizona did not take any golden eagles from FY11 to FY15 and does not anticipate taking any in the next ten years. WS-Arizona recognizes that there is potential for secondary risk associated with lead poisioning resulting from eagles feeding on carcasses of animals shot with lead ammunition. Predators taken by WS-Arizona with lead ammunition are disposed of in accordance with Directive 2.515 to minimize potential for secondary lead exposure to nontarget wildlife. Non-lead ammunition is used in all aerial gunning activities where carcasses are left in the field. Therefore, WS-Arizona PDM actions are not expeted to have an impact on Golden Eagles.

Upland Gamebirds and Shorebirds. Seven species of birds, the turkey, blue grouse, bobwhite, rails, and plovers inhabit Arizona that are considered sensitive by. For the most part, these species could be beneficially impacted by WS-Arizona PDM where predators have been identified as a limiting factor as discussed in Chapter 1 of this EA. PDM focused in areas of high predation could reduce the rate of predation and potentially restore numbers, as long as habitat was available. PDM could negatively affect the turkey where foothold traps are used in their range in extreme southeast Arizona because of their weight. However, no turkeys have been taken incidental to PDM from FY11 to FY15. Measures such as making cubby sets or the use of lures to attract predators away from trails can be implemented to reduce the likelihood of turkeys being taken in trap sets. WS-Arizona PDM is expected to have no impact on the turkey because of their limited distribution and SOPs to reduce take. WS-Arizona does not anticipate any impact on the other bird species from PDM activities.

Burrowing Owl. The burrowing owl lives in abandoned rodent burrows, primarily those of prairie dogs and rabbits, in sparsely vegetated areas of Arizona. Some also live in abandoned predator dens. Of the PDM methods in use, fumigant (large gas cartridges) used for coyote, fox, and skunk dens could potentially take an owl. When WS-Arizona personnel use gas cartridges, the dens are inspected for active predator sign (*i.e*., fresh tracks) and potential burrowing owl use. If burrowing owl use is detected, treatment is not conducted. Thus, the potential for take is negated. PDM in areas inhabited by burrowing owls could potentially be a benefit to them, but no studies have confirmed this. WS-Arizona did not take a non-target burrowing owl from FY92 to FY16.

Black-billed Magpie. A state species of concern, the magpie inhabits far northern Arizona with most being found in the state predominantly during winter. It has never been distributed broadly in Arizona. This species is abundant and mostly stable throughout its range outside of Arizona, increasing rapidly in the northeastern part of its range (Sauer et al. 2014). The primary PDM methods of concern for the magpie are the use of M-44s and cage traps set for small predators, however WS-Arizona did not take any non-target magpies from FY11 to FY15. Because of its limited distribution in Arizona, abundance within its range, range expansion, and minimal possible exposure to WS-Arizona PDM, it will not be adversely impacted by WS-Arizona PDM.

Burrowing Lizards, Snakes, and Amphibians. Three additional reptiles (i.e. 2 rattlesnakes and a lizard) and one amphibian that are state species of concern could be affected by PDM. Most have limited distributions in Arizona and have been impacted by habitat loss. The primary PDM method that could impact these species would be the use of a burrow fumigant, the large gas cartridge. Since most active predator dens do not have these inhabitants, it is unlikely that WS-Arizona would have more than a minor impact on these species. From FY11 to FY15, WS-Arizona used 15 large gas cartridges, but no or negligible impacts to these species populations were observed.

2.2.3. Impacts on Public Safety, Pets, and the Environment

Information on the potential impacts to pet and HHS and the environment are also necessary to present a full picture of the affected environment that could be impacted by PDM activities. Issues relating to these aspects are discussed in more detail below.

Although PDM methods may pose a slight public safety risk, they are often used to effectively eliminate some other recognized public safety risk. Additionally, although risks associated with PDM methods to humans may be low, HHS may be jeopardized by not having a full array of PDM methods for responding to complaints involving threats to HHS such as direct physical attacks on humans from predators, disease transmission, and airstrike hazards. WS-Arizona has responded to complaints involving coyotes, feral dogs, and bears for HHS concerns in the past five FYs. Although predator attacks do occur, they are rarely fatal. However, a fatality occurred on January 8, 2004 in Whiting Ranch Wilderness Park, Orange County, California when a mountain lion killed and partially ate a mountain biker. The same lion attacked another mountain biker in the park the following day, but was fought off by other bikers. A young male mountain lion was shot later in the day. Large predators such as coyotes represent a significant strike risk to aircraft at airports and have been struck by aircraft. This can result in damage and injuries to people. Disease, especially rabies, can also be a significant threat to HHS. Diseased wildlife can be very difficult to treat. WS-Arizona often uses several PDM methods (firearms, traps, snares, or chemical immobilization or pesticides) to capture offending animals, depending on the specifics of the situation, and vaccinate some animals.

Lack of assistance with PDM from experts such as WS-Arizona can also cause additional risks to HHS. It has been found that without the use of WS-Arizona assistance, people will often resort to the unwise or illegal use of methods to resolve predator problems.

Under some of the alternatives proposed in this EA, WS-Arizona could use immobilizing and euthanasia drugs, sodium cyanide in the M-44 device, and carbon monoxide (CO) produced from the gas cartridge used for fumigating coyote, skunk, and fox dens (see Chapter 3 for detailed descriptions of these methods).

As previously discussed, rabies work is discussed in more detail in a separate EA (FONSI and Deciison for Supplemental EA of Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Greay Foxes, and Coyotes in the US 1/6/09), but some data are provided here in order to present a complete picture of rabies activities as they related to PDM. WS-Arizona used 81cc, 18cc, 0cc, 4cc, 0cc of Imrab3® from FY11 to FY15, and 134,350 coated sachets containing Raboral V-RG® in FY11 to vaccinate small predators for rabies (i.e. striped skunk, raccoons, feral cats, and gray fox).

2.2.4. Effects of PDM on Sociocultural Resources

Effects of PDM on public lands used for recreation can be viewed as either negative or positive. Recreational activities include hunting, fishing, wildlife viewing, sightseeing, horseback riding, camping, hiking, fuelwood gathering, skiing, snowmobiling, and boating among others. Some members of the public believe that WS-Arizona PDM activities conflict with recreation on public lands. In addition, some individuals believe their recreational experiences on public lands are impaired by knowing that any lethal PDM actions are occurring on these lands. Others feel that they are being deprived of the aesthetic experience of viewing or hearing coyotes or other predators because of WS-Arizona PDM actions. On the other hand, some believe that PDM is wholly acceptable. PDM can help bolster populations of T&E species and big game, and remove individual predators that are a threat to HHS.

Aesthetics is a philosophy dealing with the nature of beauty or the appreciation of beauty. Therefore, aesthetics is subjective in nature and is dependent on what an observer regards as beautiful. Wildlife generally is regarded as providing economic, recreational and aesthetic benefits (Decker and Goff 1987) and the mere knowledge that wildlife exists is a positive benefit to many people. There may be some concern that the proposed action or alternatives would result in the loss of aesthetic benefits to the public, resource owners or neighboring residents. An example of concerns pertaining to aesthetic impacts are concerns that the noise (e.g., from aircraft) or viewing evidence of PDM activities would adversely impact aesthetic enjoyment of activities such as hiking on public lands.

Native American cultural practices: Native American tribes such as the Southern Utes tribe use natural resources for food, income and cultural practices. This Section also addresses potential for each of the alternatives to impact tribal uses of and relationships with wildlife resources and natural ecosystems.

2.2.4.1. Humaneness of Methods Used by WS-Arizona

The issue of humaneness and animal welfare as it relates to killing or capturing 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 . . ."* (American Veterinary Medical Association 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 . . ."* (California Department of Fish and Game 1991), such as shooting. Defining pain as a component of humaneness and animal welfare in PDM methods used by WS-Arizona appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would *". . . probably be causes for pain in other animals . . ."* (American Veterinary Medical Association 1987). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (California Department of Fish and Game 1991). Pain and suffering, as it relates to damage management methods, has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering since *". . . neither medical nor veterinary curricula explicitly address suffering or its relief"* (California Department of Fish and Game 1991).

The American Veterinary Medical Association states *". . . euthanasia is the act of inducing humane death in an animal . . ."* and *". . . the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness"* (Beaver et al. 2001). Some people would prefer accepted methods of euthanasia to be used when killing all animals, including wild and feral animals. The American Veterinary Medical Association states that *"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 use terms such as killing, collecting or harvesting, recognizing that a distress-free death may not be possible"* (Beaver et al. 2001).

Some individuals and groups are opposed to some management actions of WS. WS-Arizona personnel are experienced and professional in their use of management methods. This experience and professionalism allows WS-Arizona personnel to use equipment and techniques that are as humane as possible within the constraints of current technology. Professional PDM activities are often more humane than nature itself (*i.e.*, death from starvation) because these activities can produce quicker deaths that cause less suffering. Research suggests that with some methods, such as restraint in foothold traps, changes in the blood chemistry of trapped animals indicate *stress.* However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness. People concerned with animal welfare often express that they would like to see animal suffering minimized as much as possible and that unnecessary suffering be eliminated. The interpretation of what is unnecessary suffering is the point to debate (Schmidt 1989).

Humaneness, as perceived by the livestock industry and pet owners, requires that domestic animals be protected from predators because humans have bred many of the natural defense capabilities out of domestic animals. It has been argued that man has a moral obligation to protect these animals from predators. Predators frequently do not kill larger prey animals quickly, and will often begin feeding on them while they are still alive and conscious (Wade and Bowns 1982). The suffering apparently endured by livestock damaged in this manner is unacceptable to many people.

Thus, the decision-making process involves tradeoffs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

WS has improved the selectivity of management devices through research and development of pan-tension devices, break-away snares, and chemical immobilization/euthanasia procedures that minimize pain. Research continues to improve selectivity, practicality, and humaneness of management devices. Until such time as new findings and products are found to be practical, a certain amount of animal suffering will occur if PDM objectives are to be met in those situations where nonlethal PDM methods are ineffective or impractical. Furthermore, if it were possible to quantify suffering, it is possible that the actual net amount of animal suffering would be less under the Preferred Alternative (or any other alternative involving the use of lethal methods) than under the No Federal PDM Alternative since suffering experienced by livestock preyed upon by predators is reduced if PDM is successful in abating predation. Measures to reduce pain and stress in animals and SOPs used to maximize humaneness are listed in Chapter 3.

2.2.4.2. American Indian and Cultural Resource Concerns

The National Historic Preservation Act of 1966, as amended, requires federal agencies to evaluate the effects of any federal undertaking on cultural resources and determine whether they have concerns for cultural properties in areas of these federal undertakings. In most cases as discussed in Section 1.7.2, WDM activities have little potential to cause adverse effects to sensitive historical and cultural resources. If an individual PDM 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.

The Native American Graves and Repatriation Act of 1990 provides protection of American Indian burials and establishes procedures for notifying Tribes of any new discoveries. Senate Bill 61, signed in 1992, sets similar requirements for burial protection and tribal notification with respect to American Indian burials discovered on state and private lands. If a burial site is located by a WS-Arizona employee, the appropriate Tribe or official would be notified. PDM activities will only be conducted at the request of a Tribe or their lessee and, therefore, the Tribe should have ample opportunity to discuss cultural and archeological concerns with WS-Arizona. However, in consideration of Arizona’s Native Americans, WS-Arizona has included all of the recognized Tribes in Arizona on the mailing list for this EA to solicit their comments on each draft that was posted for the 30 day public comment period.

2.3. ISSUES NOT CONSIDERED FOR COMPARATIVE ANALYSIS

The following issues are not considered in detail because they are outside the scope of this EA:

- ***APHIS-WS activities could conflict with ongoing wildlife field research**:* Commenters have raised concerns that APHIS-WS PDM activities could interfere with ongoing wildlife research being conducted by state or educational entities. WS-Arizona coordination with AGFD, a tribe, or a federal or state land management agency would typically identify such ongoing research so that the two agencies would communicate about potential conflicts. Such research occurring on USFS or BLM lands would also be identified during development of the Annual Work Plan.

- ***Accuracy of reporting take of target and non-target animals:*** Commenters have questioned the accuracy of APHIS-WS recording of the number of target and non-target animals taken during field operations. All APHIS-WS personnel are required to accurately report their field activities and technical assistance work they conduct while on official duty in the MIS, including take of target and non-target animals (WS Directive 4.205). APHIS-WS supervisors are required to review recorded work tasks for accuracy and to monitor: 1) compliance with rules and regulations for the use of pesticides and other special tools and methods and 2) adherence to permits, regulations, laws and policies pertaining to APHIS-WS actions. The report prepared by the USDA Office of Inspector General (OIG) on its audit of the APHIS-WS PDM program reviewed the accuracy of recording field activities, among other issues. The audit concluded that APHIS-WS was generally in compliance with all applicable laws. Of almost 30,000 entries in the management system, 98% were correct with discrepancies of 2% identified including both under- and over-reporting of take. APHIS-WS is committed to and actively addressing OIG recommendations intended to further reduce discrepancies.

In addition, the following environmental resources are not evaluated in detail in this EA because the agency has found that these resources are not adversely impacted by the APHIS-WS program and WS-Arizona operations, based on previous PDM EAs prepared in the Western United States and in Arizona. They will not be discussed further in this EA.

- ***Floodplains (E.O 11988):*** WS-Arizona operations do not involve construction of infrastructure and would not impact the ability of floodplains to function for flood abatement, wildlife habitat, navigation, and other functions.

- ***Visual quality:*** WS-Arizona operations do not change the visual quality of a public site or area. Although physical structures may be recommended as part of technical assistance, they are not constructed by WS-Arizona and therefore not under the agency's jurisdiction.

- ***General soils*** (except for Issue E.1: the environmental fate of lead in soils): WS-Arizona operations do not involve directly placing any materials into the soils or causing major soil disturbance. Soil disturbance is minimized because vehicles are used on existing roads and trails to the extent practicable and there is no construction proposed or major ground disturbance.

Setting traps involves only minor surface disturbance, and equipment is set primarily in previously disturbed areas.

- ***Minerals and geology:*** WS-Arizona operations do not involve any contact with minerals or change in the underlying geology of an area.

- ***Prime and unique farmlands and other unique areas*** (except wilderness and wilderness study areas)**:** WS-Arizona operations do not involve permanently converting the land use of any kind of farmlands.

- ***Air quality:*** WS-Arizona's emissions are from routine use of trucks, airplanes, and very limited use of harassment devices using explosives, and therefore constitute a *de minimis* contribution to criteria pollutants regulated under the Clean Air Act (See Section 2.3.2 for discussion of climate change).

- ***Vegetation***, including timber and range plant communities: WS-Arizona operations do not change any vegetation communities or even small areas of plants.

- ***Environmental effects of the loss of individual animals:*** **C**omments on previous PDM EAs have urged APHIS-WS to analyze the environmental impacts of the loss of individual animals. Under the current and proposed alternatives, an individual predator or multiple predators in a specific area may be removed through WS-Arizona PDM activities. All WS-Arizona PDM activities are conducted under the authorization of and in compliance with Federal and state laws and in coordination with the AGFD and USFWS, as appropriate. Although we recognize that some individuals could find this loss distressing, analysis in Chapter 4 indicates the current and proposed actions involving only removal of individual offending animals or, especially under preventive treatment in an area, multiple predators of a species within a localized area, would not in any way have environmental impacts on any of the wildlife populations involved in WS-Arizona's operations, including ESA-listed species (Sections 2.2.2.2, 4.2.2, and Appendix A.

2.3.1. Wildlife Damage Management Should Be Conducted by Private Nuisance Wildlife Control Agents

Private nuisance wildlife control agents could be contacted to reduce wildlife damage for property owners or property owners could attempt to reduce their own damage problems. Some property owners would prefer to use a private nuisance wildlife control agent because the nuisance wildlife agent is located in closer proximity and thus could provide the service at less expense, they are not required to comply with NEPA, or because they prefer to use a private business rather than a government agency. However, some property owners would prefer to receive assistance from a government agency. In particular, county governmental agencies, large industrial businesses, airport managers, and municipalities may prefer to use APHIS-WS because of security and safety issues, legal requirements to be accountable to the public through NEPA compliance and reduced administrative burden.

2.3.2. 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 ten 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 that allow the agencies to monitor for and adjust to impacts of ongoing changes in the affected environment (Section 3.4). APHIS-WS would 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. WS-Arizona would supplement the analysis and/or modify program actions in accordance with applicable local, State and federal regulations including the NEPA if substantive changes in the potential environmental effects of program actions warranting revised analysis are identified. Established SOPs also include reporting all take to the USFWS and AGFD 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 size 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 would include review of federally-listed T/E species and consultation with the USFWS, as appropriate, to avoid adverse impacts on T/E species. As with any changes in need for action, WS-Arizona would 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 PDM program. In this way, we believe the Preferred Alternative accounts for is responsive to ongoing changes in the cumulative impacts of actions conducted in Arizona in accordance with the NEPA.

The CEQ has advised federal agencies to consider whether analysis of the direct and indirect greenhouse gas (GHG) emissions from their Preferred Alternatives may provide meaningful information to decision makers and the public (CEQ 2014). Based on their review of the available science, CEQ advised agencies that if a Preferred Alternative would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO2-equivalent GHG emissions on an annual basis the agencies should consider that a quantitative and qualitative assessment may be meaningful to decision makers and the public (CEQ 2014). APHIS has assessed the potential GHG impacts from the national APHIS-WS program and current and Preferred Alternatives in context of this guidance.

The average person in a home produces four metric tons of carbon dioxide equivalents (CDEs includes CO2, NOx, CO and SOx) annually (EPA 2010). Nationwide, APHIS-WS has 170 district and State Offices and this includes district offices with only one staff person. Each State Office would likely produce fewer CDEs annually than the average home because little electricity is used at night and on weekends.

APHIS-WS vehicles are used for a multitude of wildlife management projects, including current Arizona PDM Program activities. APHIS-WS cannot predict the fuel efficiency of each all-terrain vehicle (ATV) used in the field nor can it predict how often an ATV would be used. However, if a conservative estimate of 20 miles per gallon is used and consideration is given to total mileage being substantially less than the mileage calculated for normal vehicular use, the effects of ATVs on air quality would be negligible. APHIS-WS also cannot predict the fuel efficiency of each vehicle in the national program. However, APHIS-WS used the Federal Highway Administration (FHWA) estimated average combined fuel economy of cars and light trucks of 21.5 miles per gallon (mpg) in the discussion of alternatives. To establish baseline data on the National WS program, WS calculated the CDEs from its current fleet of passenger vehicles (1,665 leased and owned vehicles) using the average vehicle miles traveled per year as calculated by FHWA (2010)[6]. APHIS used the ratio of CO_2 equivalents (CDEs) to total greenhouse gas emissions for passenger vehicles to complete the calculation.[7] Current APHIS vehicle use for all wildlife management programs can contribute approximately 8,058 metric tons (MT) of CDEs each year.[8]

Nationwide, APHIS-WS either owns or leases ten different types of helicopters; their average fuel consumption is 24.88 gallons per hour (gph). Helicopters with this average fuel consumption emit approximately 0.24 MT/hr of CO_2 emissions.[9] APHIS-WS also owns or leases six different types of aircraft. Nationwide, APHIS-WS flew 10,426 hours (helicopter and fixed wing combined) of agency-owned aircraft in FY 2013 and flew an additional 4,225 hours under contract aircraft. If all flight hours were attributed to fixed-wing planes, the estimated CO_2 emissions would be 1,612 MT/year. If all flight hours were attributed to helicopters, the estimated CO_2 emissions would be 3,516 MT/year. Combining vehicle, aircraft, office and ATV use for FY 2013 and potential new vehicle purchases, the range of CDEs is likely to be 10,350 – 12,254 MT or less per year, which is below the CEQ's suggested reference point of 25,000 MT/year.[10]

One commenter suggested that WS should consider greenhouse gas emissions associated with livestock production as part of the emissions associated with the WS program. We do not concur that these emissions should be attributed entirely or in part to WS activities. The existence of the WS program is not essential to the survival of the livestock production industry and factors other than WS have been identified as the primary drivers for trends in the livestock industry. In a comparison of parts of the country with differing levels of coyotes and coyote predation on livestock (Berger 2006) concluded that

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[6] 11,493 miles per vehicle per year

[7] 0.985

[8] (8.92 × 10-3 metric tons/gallon of gasoline) x (19,135,845 miles traveled by APHIS-WS) x (1/21.5 mpg) x (1/0.985)

[9] Conklin and deDecker Aviation Information (https://www.conklindd.com/CDALibrary/CO2Calc.aspx) fixed-wing aircraft. Average fuel consumption rates for fixed wing piston engine aircraft is 12.9 gph (FAA 2005). Average CO_2 emissions for piston engine aircraft are 0.11 MT/hr (Conklin and de Decker 2015). Less than one percent each of NOx, CO, SOx, and other trace components are emitted from aircraft engine emissions (FAA 2005).

[10] CEQ issued a memorandum to heads of federal agencies and departments on February 28, 2011, providing draft guidance on when and how to analyze the environmental impacts of greenhouse gas emissions and climate change under NEPA. A suggested 25,000 metric tons of carbon dioxide equivalent emissions from the Preferred Alternative would trigger the need for a quantitative analysis.

government support of the predation management had not prevented declines in the sheep industry and that production costs and market prices explained most of their model variations in sheep numbers. These findings are not surprising given that conflicts with predators are not spread out evenly among producers and that many producers have little or no issues with wildlife predation on their livestock. Additionally, as noted in Section 2.1, livestock producers can and do take measures on their own to address predation on livestock without involvement of the WS program. Consequently, although WS actions are beneficial to individual producers, the size and extent of the livestock production industry as a whole is not dependent upon WS.

WS understands that climate change is an important issue. The WS program would continue to participate in ongoing federal efforts to reduce greenhouse gas emissions associated with program activities including compliance with Executive Order 1369 – planning for federal sustainability in the next decade. Given the information above, none of the alternatives proposed is anticipated to result in substantial changes that would impact national APHIS-WS greenhouse gas emissions. Consequently, WS-Arizona program activities likely to result from the Preferred Alternative would have a negligible effect on atmospheric conditions including the global climate.

2.3.3. Livestock Losses Are a Tax "Write Off"

Some people believe that livestock producers receive double benefits because producers have a partially tax funded program to resolve predation problems while they also receive deductions for livestock lost as a business expense on tax returns. However, this notion is incorrect because the Internal Revenue Service tax code (Internal Revenue Code, Section 1245, 1281) does not allow for livestock losses to be "written off" if the killed livestock was produced on the ranch. Most predation occurs on young livestock (lambs, kids, and calves) in Arizona. Additionally, many ewes, nannies, and cows added as breeding stock replacements to herds from the lamb, kid, and calf crop, and if lost to predation they cannot be "written off" because they were not purchased. These factors limit the ability of livestock producers to recover financial losses.

2.3.4. Livestock Losses Should Be an Accepted Cost of Doing Business

WS is aware of concerns that federal wildlife damage management should not be allowed until economic losses reach an identified threshold of loss or become unacceptable. Although some losses of livestock and poultry can be expected and are tolerated by livestock producers, APHIS-WS has the legal direction to respond to requests for wildlife damage management, and it is APHIS-WS policy to aid each requester to minimize losses.

2.3.5. No Wildlife Damage Management at Taxpayer Expense, Wildlife Damage Management Should Be Fee Based

WS is aware of concerns that wildlife damage management should not be provided at the expense of the taxpayer or that it should be fee based. APHIS-WS was established by Congress as the agency responsible for providing wildlife damage management to the people of the United States. Funding for APHIS-WS comes from a variety of sources in addition to federal appropriations. Such nonfederal sources include but are not limited to Arizona general appropriations, local government funds (state, county or city), livestock associations and related fees and taxes. Federal, state, and local officials have decided that wildlife damage management needs to be conducted and have allocated funds for these activities. Additionally, wildlife damage management is an appropriate sphere of activity for government programs, because wildlife management is a government responsibility. A commonly voiced argument for publicly funded wildlife damage management is that the public should bear the responsibility for damage to private property caused by "publicly-owned" wildlife.

2.3.6. Native American Indian Cultural Resource Concerns

Wildlife damage management activities on lands managed by Native American Indian tribal governments would only be conducted at the request of a tribe and, therefore, any tribe requesting assistance would discuss potential concerns with any potentially affected cultural or other resource. As discussed in Section 1.4.1, during the preparation of this EA, all federally recognized Native American Indian tribes in Arizona were offered the opportunity for consultation, comment, or involvement in the EA process. The Bureau of Indian Affairs has also been asked to be a consulting agency for this EA. No concerns were raised by tribes.

2.3.7. Effects of Livestock Grazing on Riparian Areas and Wildlife Habitat as a Connected Action to WS's PDM Activities

Some members of the public have suggested that livestock grazing is *connected* to WS PDM action, which implies that it either is an *interdependent part* of WS PDM and depends on such PDM for its justification, that it is *automatically triggered* by WS PDM, or that it *cannot and will not proceed* unless WS PDM occurs (40 CFR 1508.25). All of these assertions are false.

Livestock grazing in Arizona occurs on many private property areas, as well as on BLM and USFS grazing allotments, without any WS PDM actions conducted on those allotments in a given year. Therefore, livestock grazing is not automatically triggered by WS PDM, and it clearly can and does proceed in the absence of WS PDM assistance.

Some public commenters assert that WS PDM to protect livestock cannot or will not proceed unless livestock grazing is occurring. WS does not believe this view to be a logical one. If there were no raising of livestock at all in this country, then there would be no PDM activities to protect livestock. There would be no reason for WS to conduct PDM for livestock protection if there were no livestock to protect against predators. Furthermore, there would be no PDM actions if there were no predators of livestock. Normally, PDM activities will occur wherever livestock producers request PDM assistance whether it is on private land or on state or federal public lands and whether or not WS is specifically requested to do the PDM actions. Since federal agencies do not have the authority to regulate private land livestock grazing, such grazing and its effects are part of the existing human environment (*i.e.*, *environmental status quo*) and such private land livestock grazing is quite common and extensive.

Livestock grazing does not occur and does not proceed because WS PDM occurs. Predators oftentimes travel from an area of one land ownership where livestock are not present into an area of another land ownership where livestock are present to prey on the livestock. Therefore, there does not have to be any livestock grazing on BLM or FS lands to potentially still have some PDM activities on those lands for the purposes of protecting livestock on private lands that are in relative close proximity to or directly bordering on public lands.

Federal laws governing the management of lands administered by the BLM and USFS, including the National Forest Management Act, Multiple-use Sustained Yield Act of 1960, 16 USC § 528, and Federal Land Policy Management Act, 43 USC § 1732(b), require BLM and USFS to allow for and to manage livestock grazing on BLM and USFS lands. For areas of federally designated wilderness under the jurisdiction of the BLM and USFS, the Wilderness Act, Pub. L. 88-577, 78 Stat. 890, 16 USC §§ 1131 et seq., allows for the continuation of grazing operations in federally designated WAs where grazing took place prior to the area's designation as wilderness. Thus, BLM and USFS, and not WS, have the authority to regulate and restrict grazing and to control the effects of grazing on riparian areas and on rangeland and forest wildlife habitat in general on federal public lands. No federal agency has authority to restrict livestock grazing on nonfederal lands.

Livestock grazing activities that are authorized by federal land management agencies to occur on federal lands are subject to NEPA requirements. The BLM and USFS prepare NEPA documents covering their authorizations of livestock grazing on federal public lands and we refer the reader to environmental documents prepared by those agencies for further information and analysis of the environmental effects of grazing.

Improperly controlled livestock grazing can lead to undesirable indirect effects on certain wildlife species by causing changes in rangeland habitat, including riparian areas. Regulation or restriction of livestock grazing is outside the scope of decisions that WS has authority to make. Thus, livestock grazing on all land ownership classes where it now occurs (private, state or federal lands), and whatever impacts there might be from such grazing, are part of the *environmental status quo* whether or not WS conducts any PDM activities. As stated earlier, PDM methods used by WS actions have no direct effect on riparian areas, rangeland, or other types of habitat. Therefore, WS PDM activities do not contribute to any cumulative impact on riparian areas or other habitat areas that are being affected or have been affected by livestock grazing.

Although some persons may view WS PDM actions as causing indirect effects on rangeland and riparian areas by facilitating the continuation of livestock grazing in such areas, as discussed above, such livestock grazing now takes place and there is no reason to think it will not continue to take place, with or without PDM assistance from the WS program. For example, grazing occurs now on most BLM and USFS grazing allotments in the state without assistance from WS on those allotments. Thus, the majority of livestock grazing activity on public federal lands in Arizona is not receiving any WS-Arizona PDM assistance and such grazing is part of the existing *environmental status quo*.

As long as livestock producers experience serious economic losses from predators, some of them will continue to employ PDM actions to counter or prevent such losses whether or not WS-Arizona continues to conduct PDM actions. In the absence of any involvement by WS-Arizona, the livestock owners and managers or authorized state agencies will conduct PDM on their own. Currently, livestock producers, private resource owners, and state agencies that request WS-Arizona PDM actions in Arizona must cover about 50% of WS-Arizona's costs for providing the PDM service. Even if some livestock producers went out of business from the lack of receiving any PDM assistance and, thereby, from significant losses resulting from predation, that does not mean that livestock grazing would not continue. Some such producers would be expected to sell their ranches, including, where applicable, any associated federal grazing permits, to other producers that may have better economic ability to withstand predation losses. However, it is also possible that other such producers that go out of business may sell their properties to land developers, which can then lead to reductions in wildlife habitat because of rural land subdivision and residential housing construction. When that occurs, the inability to obtain adequate PDM services could have the unintended consequence of leading to reductions in wildlife species that formerly lived on, or otherwise depended on, the habitat that was lost to development. Loss of habitat because of human population growth and expansion of housing into traditional habitat areas has been a major concern of wildlife biologists in evaluating causes of long term declines in wildlife numbers since the middle part of the last century.

Like livestock grazing and its impacts on the environment, PDM by nonfederal (private or state) entities is part of the environmental status quo for the human environment in the absence of any federal PDM assistance and does not have to comply with the requirements and provisions of NEPA. However, such PDM actions by private or nonfederal parties could result in unacceptable and harmful impacts. We believe it is reasonable to expect that professional assistance by a federal government agency operating in compliance with all federal and state laws and government policies and guidelines is less likely to result in unintended adverse effects on the environment in general, and more specifically on non-target wildlife and HHS than would nonfederal entities. Evidence exists to suggest some private entities are even likely to resort to illegal chemical pesticide uses in attempts to resolve real or perceived wildlife damage problems (USFWS 1996b, 2003, Texas Department of Agriculture 2006, Porter 2004).

PDM actions by private or nonfederal parties are not governed or restricted by the same environmental laws by which federal government agencies must abide by such as NEPA and the preventive measures consultation requirements of Section 7 of the ESA. However, Private and nonfederal parties conducting PDM on federal land still are required to abide by environmental laws including Section 7 ESA consultation requirements. Thus, curtailing or greatly restricting WS-Arizona PDM assistance could lead to the unintended but real and significant effect of greater adverse environmental impacts caused by private or nonfederal parties performing PDM actions. It is apparent that, at least with respect to federal public lands, livestock grazing is regulated with the goal of reducing the severity of adverse impacts on wildlife and other environmental resources (see BLM and USFS EIS documents for each National Forest or Resource Management Area), just like WS-Arizona takes into account the impacts on wildlife and other environmental resources by its PDM actions.

It is certainly reasonable to assume that PDM by state or private entities would occur in the absence of assistance by WS-Arizona. This means that even if someone asserts that WS-Arizona PDM for livestock protection is *connected* to public land grazing, WS-Arizona has no ability to affect the environmental outcome because most such grazing will continue to occur on public lands anyway, and at least some level of PDM will most likely occur also, in the absence of any action by WS-Arizona. Thus, even if WS-Arizona decided to select the No Federal PDM Program Alternative (Alternative 1), such a decision would have virtually no meaningful effect in changing the *environmental status quo* with respect to the impacts of grazing and/or PDM actions. The federal land management laws such as the National Forest Management Act, Multiple-use Sustained Yield Act, Federal Land Policy Management Act, and Wilderness Act contain clauses protecting the rights of the states to maintain jurisdiction over the management of resident wildlife species[11]. It is our understanding that, unless regulated or restricted by the BLM or USFS, authorized Arizona state agencies such as the AGFD and

[11] Multiple Use and Sustained Yield Act of 1960, 16 USC § 528(stating that nothing in the act *"shall be construed as affecting the jurisdiction or responsibilities of the several states with respect to wildlife and fish on the national forests"*); Federal Land Planning Management Act, 43 USC § 1732(b) (emphasizing that *"nothing in this Act shall be construed as . . . enlarging or diminishing the responsibility and authority of the states for management of fish and resident wildlife"*). The National Forest Management Act of 1976 explicitly incorporated the Multiple-use Sustained Yield Act, 16 USC § 1604(e)(1). The Wilderness Act, 16 USC § 1133(d)(7), provides that *"nothing in this Chapter shall be construed as affecting the jurisdiction or responsibilities of the several states with respect to wildlife and fish in the national forests."*

ADA (or even private entities acting in accordance with state wildlife laws) could theoretically be authorized to control predators on BLM and USFS lands in the absence of any involvement by WS-Arizona.

2.3.8. Concerns that Killing Wildlife Represents "Irreparable Harm"

Some members of the public have suggested that the killing of any wildlife represents irreparable harm because of the loss of individual animals. Although an individual predator or multiple predators in a specific area may be killed by WS PDM activities, this does not in any way irreparably harm the continued existence of these species. Wildlife populations experience mortality from a variety of causes, including human harvest and depredation control, and have evolved reproductive capabilities to withstand considerable mortality by replacing individuals that are lost. Arizona's historic and current populations of big game animals, game birds, furbearers and predators, which annually sustain harvests of animals as part of the existing human environment, are obvious testimony to the fact that the killing of wildlife does not cause irreparable harm. Populations of some of these species are in fact much higher today than they were several decades ago (e.g. elk and mountain lions). The legislatively mandated mission of AGFD is to conserve Arizona's diverse wildlife resources and manage for safe, compatible outdoor recreation opportunities for current and future generations. Therefore, AGFD would be expected to regulate harvest of wildlife in the state to avoid irreparable harm. Our analysis herein shows that the species WS-Arizona takes in PDM actions have no negative impacts to maintaining sustainable and viable populations. Thus, losses due to human-caused mortality are not *irreparable.*

2.3.9. Concerns that WS Personnel Might Unknowingly Trespass

WS is aware that it is sometimes difficult to determine land ownership in some areas, and WS field employees make diligent efforts to ensure that they do not enter properties where they do not have permission. Landowners who request assistance from WS typically provide WS representatives with very specific information not only about the property boundaries of their own land, but about the boundaries of neighboring lands as well. WS aerial shooting activities are typically conducted with the aerial crew in radio contact with a WS representative on the ground who knows the property boundaries of the area being worked. Therefore, we do not expect that inadvertent trespass incidents would rise to the level of presenting any significant environmental effects.

2.3.10. Potential Effects on Wildlife from the Mere Presence of WS Personnel Conducting PDM

Public comments have raised the concern that the mere presence of WS personnel in the field during the spring months has the potential to cause harmful disturbance to wildlife, and could potentially cause some animals to be separated from their mothers or might cause the abandonment of nest sites. There are fewer than 25 WS field personnel in Arizona, which is only a minimal fraction of the thousands of public recreationists and other public land users that go onto public lands in any one year as part of the existing human environment. WS-Arizona abides by any area closures imposed by state or federal land or wildlife management agencies to protect sensitive wildlife species. We rely upon annual coordination with those same agencies to alert us to areas where this is of particular concern. In general, few if any such concerns have been raised by the responsible agencies because WS-Arizona personnel only work in a small proportion of the land area and spend little time in any particular area.

2.3.11. Effectiveness of the National APHIS-WS Program

2.3.11.1. Considerations for Evaluating Program Effectiveness

The purpose behind integrated wildlife damage management is to implement methods in the most effective manner while minimizing the potentially harmful effects on people, target and non-target species, and the environment. Defining the effectiveness of any damage management activity or set of activities often occurs in terms of losses or risks potentially reduced or prevented. Inherently, it is difficult to forecast damage that may have been prevented, since the damage has not occurred and therefore must be forecasted.

Effectiveness is based on many factors, with the focus on meeting the desired WDM objectives. These factors can include the types of methods used and the skill of the person using them, with careful implementation of legal restrictions and best implementation practices. Environmental conditions such as weather, terrain, vegetation, and presence of humans, pets, and non-target animals can also be important considerations.

To maximize effectiveness, field personnel must be able to consistently apply the APHIS-WS Decision Model Directive 2.201 to assess the damage problem, determine the most advantageous methods or actions, and implement the strategic management actions expeditiously, conscientiously, ethically, and humanely to address the problem and minimize harm to non-target animals, people, property, and the environment. Wildlife management professionals recognize that the most effective approach to resolving any wildlife damage problem is to use an adaptive integrated approach, which may call for the strategic use of several management methods simultaneously or sequentially (Courchamp et al. 2003).

APHIS-WS and professional wildlife managers acknowledge that the damage problem may return after a period of time regardless of the lethal and/or non-lethal strategies applied if the attractant conditions continue to exist at the location where damage occurred, predator densities and/or the availability of transient/juvenile animals are sufficient to reoccupy available habitats, and/or if predators cannot be fully restricted from accessing the problem area due to conditions and size of the damage site. However, effectiveness is determined by the ability to reduce the risk of damage or threats caused by predators at the time and, if possible, in the future.

The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels eventually does not mean management strategies were not effective for addressing the particular event, but that periodic lethal and/or non-lethal management actions taken during a critical time of the year in specific places may be necessary in specific circumstances. The rapid return of local populations to pre-management levels also demonstrates that limited, localized actions taken to resolve a particular damage problem have minimal impacts on the target species' population Sections 4.2.1and 4.2.2).

The use of non-lethal methods described in Chapter 3.1.5.4, such as harassment or fright methods, typically requires repeated application to discourage those animals from returning, which increases costs, moves animals to other areas where they could also cause damage, and is typically temporary if habitat conditions that attracted those predators to damage areas remain unchanged. Therefore, both lethal and some non-lethal methods often result in the return of the same or new animals to the area, unless the conditions are changed and/or the animals are physically restrained from the area, such as by fencing.

Commentors submitted publications for WS to review, stating they have demonstrated the effectiveness of nonlethal methods to protect livestock from predators. These publications include Treves and Karanth (2003), Sacks and Neale (2002), Morehouse and Boyce (2011), Shivik et al. (2003) and Lance et al. (2010). Treves and Kranath (2003) provides a literature review of past science and sociological factors on predator management, concluding that management is a political and scientific challenge and that the future of carnivore management is a mix of startecies "involving nonlethal modiciation of carnivore behaviors, a change in human behavior, prevention of conflicts through spatial separation, and the use of lethal controls where absolutely essential." These are all approaches or techniques that WS-Arizona proposed to use under alternative 5 to address predator-human conflicts in Arizona. Additionally, APHIS-WS has a research branch, the National Wildlife Research Center, which actively looks and tests new approaches to PDM, addressing the papers call for increased understanding of the conflicts. Sacks and Neale (2002) studied the feeding preferences of coyotes, and while it did not directly assess the use of any method for reducing predation, it the sheep in the trial were in fencing that were "no obstable for coyotes" and states that keeping sheep in a small area might be beneficial. Animal husbandry methods, such as penning or night shedding, are one of the many non-lethal methods that WS-Arizona recommends to ranchers experiencing predation. Morehouse and Boyce (2011) examined the diet of wolves in Alberta and recommended livestock carcasses be disposed of in a manner that does not attract wolves, or other carnivores, to areas where livestock could become targets. The "boneyards" in the study are also noted to be important food sources for wolves during the winter. This EA does not include any PDM for wolves in Arizona, however responsible disposal of dead livestock is a common practice and recommendation by WS-Arizona. Shivik et al. (2003) assessed different non-lethal stimuli, including fladry, lights with sirens, and electronic shock collars. They found that in multi-predator ecosystems, the lights and sirens repelled all "vertebrate consumers" for the 16-29 days of the treatements. Fladry was found to have limited effectiveness for wolves "but it does not seem to be as effective for other predatory species". In regards to the use of electronic shock collars on wolves, the study concluded "After four trials, we were unable to show conditioning aginst the food resourcee and submit that substantial lowgistical, animal care, and maintenance issues, and variations in wolf response to the electronic collar complicates application of this type of adversive condisiotning into management programs". This study showed that while non-lethal methods are limited, they are not without merit, and WS-Arizona recognizes that in it implication of integrated PDM. Lance et al (2010) determined "there is a high probability that electrified fladry is effective for excluding wolves from smaller pastures" for protection of livestock from wolves. While this is useful information, WS-Arizona is not conducting PDM for wolves under this EA, and electricfied fladry was not tested for other predator species.

The common factor when using any wildlife damage management method is that new predators will move into an area if the attractive conditions continue to exist as long as predator densities and/or the availability of transient/juvenile animals are sufficient. One of WS-Arizona objectives is to ensure that all PDM actions cumulatively would not cause adverse effects on statewide target predator populations, or on populations of non-target species (Sections 4.2.1 and 4.2.2). Therefore, WS-Arizona policy is not to cause population-wide or even localized long-term adverse impacts to the target species' populations (unless to meet AGFD management objectives), or any adverse impacts to populations of native non-target species.

Dispersing and relocating problem predators, particularly animals that have learned to take advantage of resources and habitats associated with humans, could move the problem from one area to another, or the relocated animal could return to its original trapping site. AGFD policy is to euthanize all captured adult coyotes and smaller predators threatening HHS and to never relocate problem animals, because of the healthy size of the populations statewide and the high risk of moving the problem along with the animal. These AGFD policies avoid causing damage problems in the receiving site, reduce the risk that the animal will return to its original home range, and avoid potentially causing the death of the animal due to occupied territories or unfamiliarity with the new location.

Based on an evaluation of the damage situation using the APHIS-WS Decision Model, the most effective methods should be used individually or in combination based on experience, training, and sound wildlife management principles. The effectiveness of methods are evaluated on a case-by-case basis by the field employee as part of the decision-making process using the APHIS-WS Decision Model for each PDM action and, where appropriate, field personnel follow-up with the cooperator.

2.3.11.2 US Government Evaluation of the Effectiveness of APHIS-WS PDM Activities

Different values can and do exist among wildlife management agencies, APHIS-WS cooperators, and animal rights and conservation groups regarding wildlife removals, especially lethal removals (for example, Lute and Attari 2016). For meeting various objectives, the government recently conducted two detailed audits of APHIS-WS PDM programs, including the effectiveness of the programs and compliance with federal and state laws and regulations. The audits found that the APHIS-WS PDM programs were both effective and cost-effective.

2.3.11.2.1. 2015 USDA Office of Inspector General Report for Program Effectiveness

In FY 2014, the USDA Office of Inspector General (OIG), conducted a formal audit of the APHIS-WS Wildlife Damage Management program (OIG 2015).

The primary objective of the audit was to determine if wildlife damage management activities were justified and effective.

The audit was conducted because the agency had received considerable media attention creating controversy among the general public, animal rights organizations, and conservation groups based on allegations of unsanctioned activities conducted by some of APHIS-WS field personnel. The OIG had received numerous hotline complaints and letters from the general public and animal rights and environmental groups alleging the use of indiscriminant methods capturing non-target species, animals not dying immediately with associated concerns about humaneness (especially being held in traps), and allegations of lack of agency transparency regarding its activities.

For the audit, OIG representatives:

- Observed 40 APHIS-WS field personnel from five states, with audit locations selected based on the high number of takes of selected predators, the most unintentional kills, and/or the most hours on the job with the fewest takes;
- Interviewed 15 property owners/managers and 27 state game and wildlife officials;
- Reviewed Cooperative Service Agreements;
- Sampled logbook entries and reconciled them with the MIS data from January 2012 through January 2014; and
- Reviewed NEPA documentation for predator control.

Auditors observed field personnel setting and checking traps, snares, M-44 devices, and conducting other typical field activities, and interviewed the employees regarding their use of the APHIS-WS Decision Model to assess predation, including auditor confirmation of predator kills of livestock. The auditors watched specifically for indiscriminant killing of non-target animals and suffering of captured animals not immediately killed by the field employees, and found that the field personnel were "generally following prescribed and allowable practices to either avoid or mitigate these conditions."

In cases where non-target animals were captured or animals not killed immediately, the field employee had followed prescribed agency practices, adhering to applicable laws and regulations. Auditors also observed two aerial shooting operations, one for coyotes and one for feral swine, with good coordination between aerial and ground crews and full adherence to applicable laws and regulations. Auditors observed that all producers visited were using some form of non-lethal predator management, such as fencing, guard animals, and human herders, and noted that producers, not APHIS-WS field personnel, most appropriately are responsible for implementing such methods because most available non-lethal methods focus on management of the conditions rather than management of the offending animal.

The audit found that operations involving field personnel and aerial shooting operations "revealed no systemic problems with the process or manner with which the APHIS-WS conducted its predator control program, complying with all applicable federal and state laws and regulations and APHIS-WS' directives associated with wildlife damage management activities." The auditors also recognized that "Federal law provides WS broad authority in conducting its program. It also allows WS to take any action the Secretary considers necessary with regards to injurious animal species, in conducting the program" (OIG 2015, Pg. 8).

Based on the interviews, the OIG concluded:

> "As one property owner put it, "WS [field specialists] are an absolute necessity for our business. The number of sheep they save is huge and we cannot function without them…WS personnel are professional and good at what they do." In support of this same point, a State game official we interviewed explained that WS provides help for wildlife and is run efficiently. A State agricultural official we interviewed characterized the collaboration of State and Federal programs to manage control of predators and protect domestic livestock and wildlife as 'seamless.' "

OIG had no findings or recommendations to improve the field operational and aerial shooting program actions and found them both to be justified and effective.

2.3.11.2.2. 2001 Government Accountability Office (GAO) Report to Congressional Committees

The US Government Accountability Office (GAO) is an independent, nonpartisan agency that works for Congress. Often called the "Congressional watchdog," GAO investigates how the federal government spends taxpayer dollars (http://www.gao.gov/about/index.html). At the request of Congress, the GAO conducted a review of the APHIS-WS' IPDM program in 2001 to determine:

- The nature and severity of threats posed by wildlife (is there a need for APHIS-WS programs?);
- Actions the program has taken to reduce such threats;
- Studies conducted by APHIS-WS to assess specific costs and benefits of program activities; and

- Opportunities for developing effective non-lethal methods of predator control on farms and ranches.

The GAO met with APHIS-WS personnel at the regional offices, program offices in four states, field research stations in Ohio and Utah, and the National Wildlife Research Center in Colorado. In each state visited, they interviewed program clients, including farmers, ranchers and federal and state wildlife management officials. To obtain information on costs and benefits, they interviewed APHIS-WS economists, APHIS-WS researchers and operations personnel, program clients, and academicians. They also interviewed wildlife advocacy organizations, including the Humane Society of the United States and Defenders of Wildlife, and conducted and an extensive literature survey.

The report summary (GAO 2001) states:

"Although no estimates are available of the total costs of damages attributable to them, some wildlife can pose significant threats to Americans and their property and can cause costly damage and loss. Mammals and birds damage crops, forestry seedlings, and aquaculture products each year, at a cost of hundreds of millions of dollars. Livestock is vulnerable as well. In fiscal year 2000, predators (primarily coyotes) killed nearly half a million livestock – mostly lambs and calves – valued at about $70 million. Some predators also prey on big game animals, game birds, and other wildlife, including endangered species…

"Wildlife can attack and injure people, sometimes fatally, and can harbor diseases, such as rabies and West Nile virus, that threaten human health…We identified no independent assessments of the cost and benefits associated with Wildlife Services' program. The only available studies were conducted by the program or with the involvement of program staff. However, these studies were peer reviewed prior to publication in professional journals. The most comprehensive study, published in 1994, concluded that Wildlife Services' current program, which uses all practical methods (both lethal and nonlethal) of control and prevention, was the most cost effective of the program alternatives evaluated. Other studies, focused on specific program activities, have shown that program benefits exceed costs by ratios ranging from 3:1 to 27:1 [depending on the types of costs considered].

"Nevertheless, there are a number of difficulties inherent in analyses that attempt to assess relative costs and benefits. Of most significance, estimates of the economic benefits (savings) associated with program activities are based largely on predictions of the damage that would have occurred had the program's control methods been absent. Such predictions are difficult to make with certainty and can vary considerably depending on the circumstances.

"Wildlife Services scientists are focusing most of their research on developing improved non-lethal control techniques. In fiscal year 2000, about $9 million, or about 75% of the program's total research funding (federal and nonfederal) was directed towards such efforts. However, developing effective, practical, and economical non-lethal control methods has been a challenge, largely for two reasons. First, some methods that appeared to be promising early on proved to be less effective when tested further. Second, animals often adapt to non-lethal measures, such as scare devices (e.g., bursts of sound or light)."

The GAO review found that most non-lethal control methods – such as fencing, guard animals, and animal husbandry practices – are most appropriately implemented by the livestock producers themselves, with technical assistance from APHIS-WS, and most cooperators are already using some non-lethal methods before they request assistance from APHIS-WS.

2.3.11.3. Conclusion

Two recent detailed and extensive government audits of the APHIS-WS IPDM program, one requested by Congress and one conducted by the USDA Office of Inspector General, found that the need exists for IPDM on public and private lands using both lethal and non-lethal methods as implemented by APHIS-WS when requested for protecting:

- Human health and safety, including threats from predators and zoonosis,
- Livestock, agricultural crops, and other assets and property, and
- Resources under the jurisdiction of federal and state wildlife agencies.

  The audits found that:

- Such programs are cost-effective and justified;
- The programs are conducted in compliance with federal and state laws and agency policies and directives; and
- The programs are both desired and effective in meeting the needs.

2.3.11.4. Sufficiency for Informed Decision-Making of Field Studies on Effectiveness of Lethal PDM for Livestock Protection

An analysis of effectiveness of each of the WS-Arizona alternatives considered in detail is found in Chapter 4. Additional consideration of effectiveness of PDM based on the literature and how it relates to predator population sustainability, mesopredator release and ecosystem function is found in Section 4.2.2.

A recent paper (Treves et al. 2016) criticizes research methods used for evaluating the effectiveness of lethal PDM for protection of livestock and recommends suspension of such PDM methods that do not currently have rigorous evidence for functional effectiveness until studies are conducted using what the authors call a “gold standard” study protocol. The “gold standard” protocol recommended by the authors is called the Before/After-Control/Impact (BACI) protocol, which uses a sampling framework to attempt to assess status and trends of physical and biological responses to major human-caused perturbations in the environment. It involves sampling in the area proposed for perturbation before the perturbation occurs and after the perturbation occurs, and comparing the results to each other and to those measured in a control area. This protocol is often used in controlled biomedical research and point-source pollution or localized restoration studies, where the human-caused perturbation is relatively localized and non-mobile.

In order to meet the “gold standard” requested by Treves et al. 2016, BACI is best applied using multiple control sites that are sufficiently similar to the perturbed site (Underwood 1992) in order to overcome inherent natural variability in ecological systems, a very difficult standard. Unreplicated sampling involved in the BACI model inherently does not provide the strong inferences (Underwood (1992) that Treves et al. (2016) requests for their “gold standard”.

In the case of predation management on livestock, finding multiple field study sites that not only prohibit predator management while also allowing livestock grazing is difficult. As experienced in Marin County, California, in the absence of professional predator removal, livestock producers often hire a commercial company or remove animals themselves, often using methods that are not selective for the offending animal (Shwiff et al. 2005, Larson 2006).

Depredation on livestock involves highly mobile animals capable of learning and behavior adaption, with seasonal and social biological variations, tested against highly variable livestock management practices and inherently highly variable conditions such as weather, unrelated human activities (such as hunting or recreation), and natural fluctuations in habitat and prey quality and abundance.

APHIS-WS understands and appreciates interest in ensuring PDM methods are as efficient and effective as possible. The APHIS-WS NWRC collaborates with experts from around the world to conduct these studies and findings are published in peer-reviewed literature. APHIS-WS supports the use of and uses rigorous, scientifically sound study protocols. APHIS-WS also realizes that field studies involve many variables that cannot be controlled and assumptions that must be acknowledged when trying to analyze complex ecological questions. Wildlife research is inherently challenging because scientists are not working in a "closed" system, such as a laboratory. Researchers must apply study protocols that are capable of differentiating between natural inherent fluctuations and statistically meaningful differences.

Two alternative field designs that are commonly used in wildlife research include a switch-back model and paired-block approach. In the case of a study of the effectiveness of predator management methods on addressing livestock depredation, a switch-back study design involves at least two study areas, one (or more) with predator removal and one (or more) without predator removal. After at least two years of data collection, the sites are switched so that the one with predator removal becomes the one without predator removal, and vice versa, with an additional two years of data collection. The paired-block design involves finding multiple sites that are similar that can be paired and compared. For each pair, predators are removed from one site and not from the other. Using study designs with radio collars on highly-mobile terrestrial predators with interacting social systems also provide a robust method for determining the actual movements, locations, periodicity and seasonality, activity type, social interactions, habitat use, scavenging behavior, and other important factors associated with individual animals, allowing statistical analysis for some study questions and providing the capability for clearer conclusions.

A detailed analysis conducted by APHIS-WS NWRC scientists finds that Treves et al. (2016) has misinterpreted and improperly assessed the quality and conclusions of many of the peer-reviewed articles included in their analysis, which causes us to question the authors' abilities to professionally critique such papers and reach such black-and-white conclusions and recommendations. The details of the evaluation of Treves et al. (2016) analyses and conclusions are found in Appendix C. This evaluation found that the authors:

- Selectively disregarded studies conducted in Australia, which are some of the more rigorous field studies on working livestock operations with free-ranging, native carnivores that assess the effectiveness of lethal control of predators to protect livestock. Given their explicit criterion to only use studies in their native languages, it is odd that they would purposefully exclude this body of rigorous science published in English;
- Incorrectly confused and combined unrelated papers, reaching unsupportable conclusions;
- Misrepresent the conditions and protocol quality associated with a study testing the effectiveness of fladry;
- Misinterpret study design and criteria used for selection of paired pastures, and incorrectly

understand the roles of dependent and independent variables;

- Make false equivalency regarding the use of government-conducted lethal PDM that focuses on removing the individual predators or small groups of predators identified as causing the depredation problem, and regulated public hunting, which is not intended to address predator-caused damage; and
- Use conclusions from studies that they identify as "flawed" for reaching their conclusions.

Underwood (1992) states: "BACI design, however well intentioned, is not sufficient to demonstrate the existence of an impact that might unambiguously be associated with some human activity thought to cause it…[because] there is no logical or rational reason why any apparently detected impact should be attributed to the human disturbance of the apparently impacted location…Thus, such unreplicated sampling can always result in differences of opinion about what the results mean, leaving, as usual, the entire assessment to those random processes known as the legal system."

Additional publications (Smith et al. (2015), Bergstrom et al. (2014[12]), Wielgus and Peebles (2014), Peebles et al. (2013), Harper et al. (2008), Berger (2006), Lambert et al. (2006), Muisiani et al. (2003), and Teichman 2016) were provided by commenters for consideration during the first public comment period and are discussed here.

WS has carefully reviewed these publications and determined that they do not demonstrate ineffectiveness of lethal control. Berger (2006) was discussed in Section 2.3.2. The study documented that factors, including market price of lambs have greater impact on the sheep industry as a whole than costs associated with predation on livestock. The study does not provide information on the efficacy of lethal methods for individual producers who are experiencing damage.

The Bergstrom et al. (2014) paper has limited utility relative to the analysis in the EA. Bergstrom et al. (2014) mistakenly asserts that long-term reduction of predator populations is the goal of all modern PDM programs. Under this premise, Bergstrom et al. (2014) contend that WS lethal removals of predators are ineffective because they are not of sufficient intensity to cause long-term population reductions. As stated throughout the EA and specifically at Section 2.3.14, the goal of WS-Arizona PDM actions is to reduce damage, not to cause long-term reductions in native predator populations (See also Responses 18 and 33). Data indicating that WS-Arizona's WS integrated PDM program including lethal methods can be effective is presented in the EA. Because Bergstrom et al. (2014) addresses the long-term reductions in predator populations, while the purpose and need of the EA, and the proposed alternatives, specifically contemplate short term reductions with impacts lasting less than one year, the Bergstrom et al. article is inapposite.

The Peebles et al. (2013) and Lambert et al. (2006) articles are also irrelevant to the analysis in the EA. Peebles et al. (2013) concludes that sport hunting is ineffective to reduce mountain lion predation on livestock because it increases the submale population which has correlated with human-mountain lion conflicts. However, Kertson *et al*. (2013), suggest that demographic class did not relate to human-mountain lion interaction. Sport hunting, as references in Peebles et al. (2013), is less focused on the individual animal than the targeted PDM conducted by WS-Arizona. When used to reduce wildlife conflicts, sport hunting (as evaluated by Peebles et al. 2013) is generally intended to reduce local or regional wildlife populations, and these management objectives are established and implemented by AGFD, not WS-Arizona. In contrast, WS-Arizona conducts lethal removal of mountain lions only to

[12] Commentor provided the citation as Bergstrom et al. 2013, however this is incorrect as the paper was not published in *Conservation Letters* until 2014.

remove the specific individual(s) addressed in the conflict (FY 2011-15 average < 1% of the estimated state-wide mountain lion population per year). WS-Arizona does not practice, and does not advocate, sport hunting as a method to reduce mountain lion predation on livestock. Lambert et al. (2006) evaluated the relationship between mountain lion complaints and mountain lion population size and concluded that an increase in complaints was not necessarily an indicator of an increasing mountain lion population. Changes in population age and sex structure resulting from hunting was only one of several hypotheses presented by the authors for the increase in conflicts with mountain lions. However, as with Peebles et al. (2013) the primary factor driving the shift in the lion population was extensive sport hunting. Data in EA Section 4.2.1 showed WS take of mountain lions ranged from 28 - 47 lions per year in contrast to 233 - 360 mountain lions per year by hunters. Future take of mountain lions for damage management by WS-Arizona is not anticipated to change substantially from past levels presented in the EA. Therefore, the proposed mountain lion take by WS-Arizona is not of sufficient magnitude to cause or contribute substantively to populations trends resulting from licensed hunting managed by the AGFD and will not result in an increase in conflicts with mountain lions.

Similarly, the reference to Smith et al. (2015) is not relevant to the EA because it makes a mistaken analogy to PDM. Smith et al. (2015) assesses the impact of human disturbance (development), not PDM, on mountain lion predation rates. Smith et al. notes that levels of chronic disturbance associated with development result in mountain lions not consuming all of their kills and an increase in the number of animals the lions killed to meet energetic demands. The study makes no reference to PDM for livestock protection as currently conducted by WS-Arizona.

Teichman et al (2016) concluded that "universal use of hunting as a tool for management of large predators" should be used cautiously. But it also supports WS-Arizona's approach of targeting specific, offending animals as "one route to addres large carnivore-human conflicts". WS-Arizona acknowledges that no one method, nonlethal or lethal, will be effective at all times or suitable for all situations. This is the primary reasoning behind WS' advocacy of Integrated Wildlife Damage Management alternatives that give preference to practical and effective nonlethal methods while still allowing access to the full range of legally-available PDM methods. Field personnel use the Decision Model (Slate et al. 1992, WS Directive 2.201) to determine the best approach to responding to or minimizing the potential for livestock losses and can develop effective site-specific management strategies that resolve conflicts while also minimizing risks of adverse impacts on the human environment.

Wielgus and Peebles (2014), Harper et al. (2008), and Musiani et al. (2005) are all specific to wolf damage management which is outside the scope of this EA. Nonetheless, we did review these studies for information which might be applicable to PDM as proposed in this EA. We have determined that all three studies are not of utility in assessing the efficacy of PDM actions conducted by WS-Arizona primarily because of disparities in the scale of the analysis and the scale of the intended impacts of PDM actions conducted by WS. Specifically, all three studies analyze impacts of wolf damage management actions at the regional scale. Use of lethal methods to reduce damage by and conflicts with predators as 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 behavior of mammalian predators and the targeted nature of the management effort, these removals are not intended or expected to have regional-level impacts on livestock losses (Bradley et al. 2015). Consequently, it is not surprising that studies conducted to assess the efficacy of lethal removals at the regional level such as Wielgus and Peebles (2014), Harper et al (2008) and Musiani (2005) have not detected reductions in losses. Additional problems with study design, data analysis and findings of Wielgus and Peebles (2014) have also been identified during review by the NWRC (Memo from J.

Young NWRC to J. Suckow, WS Western Regional Director, 8 July 2015). Difficulties with the analytical process used by Wielgus and Peebles (2014) were also identified by Poudyal et al. (2016). Consequently, we did not use findings from Wielgus and Peebles (2014) in the analysis.

Therefore, APHIS-WS has determined that it is fully appropriate to continue using existing tools and methodologies, and to continue developing and testing new ones to meet need for IPDM per its statutory mission.

2.3.12. Role of Cost-Effectiveness in PDM and NEPA

A common concern expressed by commenters about government-supported PDM is whether the value of livestock or game population losses are less than the cost of using at least some public funds to provide PDM services. However, this concern indicates a misconception of the purpose of PDM, which is not to wait until the value of losses is high, but to prevent, minimize, or stop losses and damage where it is being experienced, the property owner's level of tolerance has been reached, and assistance is requested. PDM would reach its maximum success if it prevented all losses or damage, which would mean the value of losses or damage due to predators would be zero. However, in the real world, it is not reasonable to expect zero loss or damage (see Section 1.2.1.1). Also, wildlife damage management involves not only the direct costs (costs of actual lethal and non-lethal management) but also the considerations of effectiveness, minimization of risk to people, property, and the environment, and social considerations (Shwiff and Bodenchuk 2004).

Evaluating the economic value of losses that would be avoided or minimized with implementation of a PDM program is inherently difficult and very complex (Shwiff and Bodenchuk 2004). Relevant scientific literature suggests that, in the absence of PDM, predation rates on livestock would likely increase (Bodenchuk et al. 2002).

Methodologies that attempt to evaluate the economic values of livestock losses and reducing those losses can depend on many variables, such as local market values for livestock, age, class and type of livestock preyed upon; management practices used; geographic and demographic differences; and applicable laws and regulations. However, attempting to evaluate the economic value of success of conservation projects, such as improving the number of surviving elk calves per 100 cows in an areas experiencing high predation in the spring, or the economic value of the predator itself is even more difficult, because wildlife populations have no inherent measurable monetary value, and any such value must therefore be evaluated indirectly, such as through willingness to pay for consumptive or non-consumptive recreation, for example (Section 2.3.12.4). Section 2.2.12.4 also discusses other factors, complexities, and methods involved in evaluating the economic values of PDM.

2.3.12.1. Does APHIS-WS Authorizing Legislation Require an Economic Analysis?

No. The statute of 1931(46 Stat. 1468; 7 USCA (U.S. Code) 8351-8352), as amended does not incorporate consideration of economic valuations and cost-effectiveness for the WDM program as part of decision-making (Section 1.6). In addition to authorizing the WDM services, it provides for entering into agreements for collecting funds from cooperators for the services the agency provides.

2.3.12.2. Does NEPA and the CEQ Require an Economic Analysis for Informed Decision-making?

Section 102(2)(B) of NEPA requires agencies to:

"[I]dentify and develop methods and procedures...which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations…"

NEPA ensures that federal agencies appropriately integrate values and effects that cannot be quantified from an effects or cost-effectiveness standpoint into decision-making. Such unquantifiable values can include, for example, the value of viewing wildlife, human health and safety, aesthetics, and recreation.

The CEQ regulations at 40 CFR §1502.23 takes a similar position in support of the law:

"If a cost-benefit analysis relevant to the choice among environmentally different alternatives is being considered for the proposed action, it shall be incorporated by reference or appended to the statement as an aid in evaluating the environmental consequences. To assess the adequacy of compliance with section 102(2)(B) of the Act the statement shall, when a cost-benefit analysis is prepared, discuss the relationship between that analysis and any analyses of unquantified environmental impacts, values, and amenities. *For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision."* (Emphasis added)

WS-Arizona has determined that there are important qualitative values that are relevant and important to its decision-making that are considered in this EA, but that those considerations will not be monetized. Estimates of non-monetary cost and benefit values for public projects that are not priced in private markets can be difficult to obtain, and methodologies can only produce implied monetary values that are subjective and require value judgments. Selecting an appropriate discount rate to measure the present monetary value of costs and benefits that will occur in the future is also difficult and subjective, with the level of the discount rate creating dramatically different project benefits.

In addition to cost-effectiveness, environmental protection, land management goals, presence of people and pets, and social factors are considered by the field employee using the APHIS-WS Decision Model whenever a request for assistance is received. These constraints may increase the cost of implementing PDM actions while not necessarily increasing its effectiveness, yet they are a vital part of the APHIS-WS program (Connolly 1981, Shwiff and Bodenchuk 2004). Connolly (1981) examined the issue of cost-effectiveness of federal PDM and concluded that public policy decisions have been made to steer the program away from being as cost-effective as possible, including the restriction of management methods believed to be highly effective but less environmentally or socially preferable, such as toxic baits, including traps and the livestock protection collar (LPC), which is highly specific to the offending animal (Shelton 2004). Also, state and local jurisdictions are limiting the methods available for PDM. Thus, the increased costs of implementing the remaining more environmentally and socially acceptable methods to achieve other public benefits besides resource and asset protection could be viewed as mitigation for the loss of effectiveness in reducing damage.

Services that ecosystems provide to resources of value to humans can be considered in qualitative and/or economic terms. The Memorandum entitled "Incorporating Ecosystem Services into Federal Decision Making" issued by the CEQ, the Office of Management and Budget (OMB) and the Office of Science and Technology Policy (OSTP) on October 7, 2015 (https://www.whitehouse.gov/sites/default/files/omb/memoranda/2016/m-16-01.pdf) does not require an economic test for the ecological services to be considered valuable.

The Memorandum states:

"[This memorandum] directs agencies to develop and institutionalize policies to promote consideration of ecosystem services, where appropriate and practicable, in planning, investments, and regulatory contexts. (Consideration of ecosystem services may be accomplished through a range of qualitative and quantitative methods to identify and characterize ecosystem services, affected communities' needs for those services, metrics for changes to those services, and, where appropriate, monetary or nonmonetary values for those services.)…Adoption of an ecosystem-services approach is one way to organize potential effects of an action within a framework that explicitly recognizes the interconnectedness of environmental, social, and, in some cases, economic considerations, and fosters consideration of both quantified and unquantified information."

Therefore, neither NEPA nor CEQ guidance requires economic analyses for informed decision-making unless relevant to the understanding differences among alternatives.

The qualitative considerations at issue in this EA are evaluated in Chapter 4 and the agency's decision based on all considerations, including non-quantifiable values, will be explained in the decision document.

2.3.12.2.1. Are the Recommendations of Loomis (2012) for Economic Analysis Applicable to APHIS-WS Activities?

A non-peer reviewed Issue Paper prepared by Loomis (2012) for the Natural Resources Defense Council (NRDC) "strongly recommended" that APHIS-WS improve its economic analysis methods for its IPDM programs. APHIS-WS disagrees with the author's conclusion and recommendations.

Loomis (2012) argues that APHIS-WS should apply the same economic approach required by Congress for large capital improvement projects using natural resources (such as water) by:

"honestly evaluating which programs are legitimately a high priority for funding [which] may aid Wildlife Services in dealing with USDA and US Office of Management and Budget…While economics should not be the only factor considered in natural resources management, economics is frequently an issue raised by one side or the other in these contentious debates over predator management. Having accurate and objective economic analysis can aid Wildlife Services in judging the validity of these claims."

Loomis (2012) questions the actual need for livestock protection from predators in support of agricultural profitability, and strongly recommends that economic analyses be conducted by APHIS-WS. His argument is based on policies of several federal agencies with substantially different missions and projects for preparing economic analyses as the basis for "strongly recommend[ing]" that APHIS-WS do the same.

The agencies the author uses as examples are those that either fund or construct major civil works actions (capital improvement projects) with long life spans, such as the US Army Corps of Engineers (USACE), the Federal Highway Administration (FHWA), the Bureau of Reclamation (BOR), Tennessee Valley Authority (TVA), and the Federal Emergency Management Agency (FEMA). Loomis (2012) especially uses the National Economic Development requirements for large water projects funded and/or constructed by BOR and USACE as the example for APHIS-WS use. However, Congress has specifically required that the BOR and USACE consider the National Economic Development (NED) for decision-making for their large civil works water projects (such as large dams, river management, etc.) that "necessarily confronts choices among possible alternative courses of actions that involve tradeoffs in economic and other opportunities" (USACE 2009). The NED is required because, as the report quotes from the USACE *Principals and Guidelines* "Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units… [with regards to selecting a particular plan for a particular water-related civil works project] "A plan recommending Federal action is to be the alternative plan with the greatest net economic benefit consistent with the Nation's environment (the NED plan)"… [which must be selected] "unless the Secretary of a department or head of an independent agency grants an exception when there is some overriding reasons for selecting another plan, based on other Federal, State, local and international concerns." This requirement assumes that "federal civil works investments should be considered only for project plans that maximize net economic benefits – measured in terms of a single index of monetary value – realized by the nation as a whole." Decision-making for USACE and BOR large water-related civil works projects is driven primarily by economic and public benefits considerations at the national level, with other factors given secondary consideration.

The NRCS, another example used by Loomis (2012), is required by Congress to conduct economic analyses for agency decision-making regarding whether to fund conservation projects, especially under Congressional statutes such as Farm Bills (NRCS Manual 200 Natural Resources Economic Handbook Part 613.0; http://directives.sc.egov.usda.gov/viewDirective.aspx?hid=37536). FHWA considers costs of various alternative ways of meeting highway transportation needs, but is not required to rely on the results of economic analyses for its decision-making.

It is clear that these examples of agency uses of economic analyses, most of which are Congressional statutory requirements for large civil works projects or other large Federally-funded projects, are not directly relevant to a "fee for service" agency such as APHIS-WS in which Congress has not required any economic test for its WDM services, and which is supported by both Congressional appropriations and cooperator contributions and funds. The analytic economic models and considerations required by Congress to be used for decision-making by federal agencies regarding large civil works/capital improvement) projects are not applicable for APHIS-WS decision-making at the national, regional, or local levels.

2.3.12.3. How Have Recent Studies Considered Economic Evaluation of WDM Activities?

Recognizing that many factors affect the viability and profitability of livestock operations, predation on livestock is clearly one. Livestock losses are also not experienced uniformly on all properties across the industry; a few producers often absorb the majority of losses, especially those on public rangelands and private properties adjacent to protected habitats (Shelton 2004).

A study in Wyoming of ranch-level economic impacts in a range cattle grazing system conducted by economics professors at the University of Wyoming (Rashford et al. 2010), indicates that predation on calves can have a substantial impact on ranch profitability and long-term viability through loss of calves available for sale, increased variable costs (such as hay and feeds, veterinary costs, fuel, equipment repair, trucking, and labor) per calf, and, anecdotally perhaps, weaning rates from predator harassment. The study found that increased calf loss "takes a larger toll on profits because it erodes the ranch's core profit center, calf sales…The results suggest that predation can have significant impacts on both short-term profitability and long-term viability depending on the mechanism [by which predation can affect profits]." The study identifies social and ecosystem benefits to keeping ranches in the western US viable and profitable through the open spaces and wildlife habitat they provide. The study concludes that "predator control activities would only need to reduce death loss due to predators or reduce predator impacts on weaning rates by approximately 1% to be to be economically efficient…The relationship between predation, ranch viability, and the ecosystem services provided may justify public spending on predator control." Further research is needed on whether these factors cumulatively impact ranch profitability.

The audit conducted by the GAO (2001) concluded, based on studies focused on specific APHIS-WS PDM activities in different areas of the country, they evaluated, that livestock PDM activities are economical, with benefit to cost ratios ranging from 3:1 (comparing the market value of all livestock saved in 1998 with the cost of all livestock protection programs in place) to 27:1 (comparing total savings with federal program expenditures, including a measure that shows the potential ripple effects on rural economies). PDM to protect wildlife shows a benefit to cost ratio of 2:1 to 27:1. Activities performed to protect human health and safety are impossible to quantify, but the value of a human life is incalculable. The GAO (2001), however, recognized that estimates of the economic benefits (savings) associated with program activities are based largely on predictions of the damage that would have occurred had the program's control methods been absent, with inherent uncertainties, substantial variations in circumstances, and inability to distinguish between the results of PDM activities and other factors such as weather, disease, and natural fluctuations in predator and prey populations.

Most economic analyses of the relationship of livestock profitability and predator control are conducted at the scope of contribution to local and regional economies. This approach dilutes the recognition that some ranch operations are impacted financially by predation at a higher rate than others, depending on factors such as livestock being grazed adjacent to quality predator habitat (such as ranches near federal lands resulting in "predator drift;" Shelton 2004), grazing overlapping with predator territories, and grazing in areas with high concentrations of unprotected livestock, especially during lambing and calving. Based solely on need expressed by livestock operators on public and private lands, APHIS-WS does not operate on every ranch operation, only those experiencing predation problems, and then only those requesting assistance from APHIS-WS. APHIS-WS operates PDM with paying cooperators at the individual ranch operation level, not the regional level, which is not reflected in typical economic analyses published in the literature (Rashford et al. 2010, Loomis 2012, for example). This approach also does not consider support for other needs for which APHIS-WS is routinely requested, such as threats to human/pet health and safety, operations at airports, risk of wildlife disease spread, and protection of property.

A team of economic specialists from the NWRC conducted an economic assessment of select benefits and costs of APHIS-WS in California (Shwiff et al. 2005). The assessment focused primarily on damage in agricultural areas because urban wildlife damage figures were not readily available. During the study year, cooperating California counties paid on average 57% of the cost of their WS-California specialists. Results of the study indicate that for every $1.00 California counties invest in APHIS-WS, they save between $6.50 and $10.00 in wildlife damage and replacement program costs (Shwiff et al. 2005). Considering the total cost of APHIS-WS field personnel, the benefits were found to be between $3.71 and $5.70 for every $1.00 of county investment.

Other studies have shown positive results for benefits to costs. An economic assessment of the California Cooperative Animal Damage Control program was completed for a 10-year period between 1980 and 1990. The results showed a cost to benefit ratio of 1:8 for direct producer benefits, and a cost to benefit ratio of 1:21 for the general public (USDA 1991). Schwiff and Merrill (2004) reported 5.4% increases in numbers of calves brought to market when coyotes were removed by aerial shooting. Wagner and Conover (1999) found that the percentage of lambs lost to coyote predation was reduced from 2.8% to less than 1% on grazing allotments in which coyotes were removed 3-6 months before summer sheep grazing.

Variables that would change the cost to benefit ratio of a damage management program include: local market values for livestock, age, class and type of livestock preyed upon, management practices, geographic and demographic differences, local laws and regulations and APHIS-WS polices, the skill and experience of the individual APHIS-WS employee responding to the damage request, and others.

2.3.12.4. What are the Various Factors and Methods for Evaluating Cost-Effectiveness?

Bodenchuk et al. (2002), Shwiff and Bodenchuk (2004), and Shwiff et al. (2005) describe the primary types of considerations for conducting economic analyses of PDM:

- **Direct Benefits:** These are typically calculated as the number of individual animals saved from predation, representing a cost savings, in that with predation management a certain number of losses or amounts of costs can be avoided. The dollar value of the species or animals saved represents the direct benefits of the program and the losses avoided by producers. However, determining the market value for livestock and wildlife species saved is difficult, with livestock usually valued using market price, which is typically conservative, and wildlife species using civil values. Number of animals lost in the absence of PDM activities is difficult to determine. Also reported losses are most likely substantially fewer than actual losses, as many losses are not reported to authorities, not all losses are found in the field, and many carcasses found are too consumed or decayed to make a clear determination of cause of death and species responsible.
- **Spillover Benefits (secondary, indirect, or incidental benefits):** These benefits are an unintentional side effect of the primary purpose of the PDM program, and may be evaluated using multiplier values from the direct benefits. Spillover benefits can include benefits to wildlife populations in the same geographic area. Indirect benefits can include benefits to local and regional economies.
- **Intangible Benefits:** Such benefits include increased cooperation from landowners as a result of the implementation of PDM, such as facilitating landowner participation in other conservation efforts or potentially minimizing amateur efforts to control predators, which may not be as selective or humane as those conducted by trained professionals.
- **Direct Economic Effects/Costs:** These costs reflect the value of losses to the livestock operator and the associated reductions in purchases for directly supporting those livestock as well as the costs of lethal and non-lethal PDM activities for protection of livestock and/or localized wildlife species, such as valued big game species, recently introduced native species, or ESA-listed species,.
- **Indirect Economic Effects:** These effects are generated as livestock loss alters producer purchases of supplies from other industries in the region and outside the region, resulting in additional jobs, increased income for the region, and greater tax revenues.

All of these factors are complicated, interrelated, and difficult to delineate and quantify. As different economic studies use different factors, values, and multipliers, they are very troublesome to make comparisons.

The following summarizes the types of economic analyses typically applied to PDM, especially associated with livestock contributions to regional economies (discussed in Schuhmann and Schwabe 2000, Shwiff et al. 2005, Rashford and Grant 2010, Loomis 2012, Shwiff et al. 2012):

- **Cost: Benefit Analysis:** Considers measures of costs that include financial costs (out of pocket expenditures such as for fencing and guard dogs) and opportunity costs (benefits that would not be availability to society based on predator control actions taken today) and measures of benefits as evaluated by a consumer's (increase in enjoyment/satisfaction) or producer's (increases in profit) willingness-to-pay (WTP) for one more unit of the identified "good", considered either on a personal level or societal level. On a personal level, the "good" is considered to have economic value if the individual person (recognizing that individuals have differing value systems) receives enjoyment/ satisfaction from the "good" and if the "good" is to some degree scarce. Opportunity costs must also be considered – costs/resources spent on a good that cannot then be used for another purpose. On a societal level, many public natural resources, such as wildlife, may not have a direct market value, but provide satisfaction and enjoyment to some (but not all) segments of society. This is a difficult and subjective analysis (despite its attempt at quantification), as the direct and indirect factors and discount rates included in such an analysis must be carefully considered and evaluated accurately for the contribution they play or this type of analysis can substantially misrepresent the actual situation and/or be readily disputed. See Section 2.3.12.2.1 for an explanation of how this approach is used for large capital improvement projects considered on a project-level basis but applied on a regional and national basis as the foundation for determining if and what level the federal government will provide Congressional appropriations. Congress requires this approach for several agencies for such capital improvement projects for setting federal policy in the large-scale public interest.
- **Willingness to Pay:** Studies have identified the willingness to pay (WTP) for non-market goods such as wildlife recreation (mostly hunting, fishing, and wildlife viewing) for individual species, and, to a substantially lesser degree, ecosystem services, such as clean drinking water, pollination and pest control for agriculture, and renewal of soil fertility. WTP can also be used to monetize existence or passive values, such as the value of knowing that a species exists somewhere in the wild, even if the individual never spends any money to actually experience it in the wild.

Methods used to determine WTP have included:

- **Recreational Benefits:** Considering the costs of travel to experience enjoyment of non-market recreational experiences (Travel-Cost Method; TCM), using a demand curve above actual travel costs obtained through surveys with recreationists, reflecting actual behavior. Shwiff et al. (2012) summarize the primary criticisms of TCM: assumptions that visitors' values equal or exceed their travel costs, because travel costs are not an accurate proxy for of the actual value of the good; values must also be assigned to the time individuals spend traveling to the site, including opportunity costs (time spent traveling cannot be spent doing some other activity) since each person values their time differently; human access to conservation sites may be limited (including access to private land) and individuals may not be aware or have a preference toward the species associated with a chosen recreation site; and if individuals are not willing or able to travel to the site to expend funds, then this method confers no value.

- **Existence/ Altruistic/Bequest Benefits** (depending on whether the benefit is enjoyed by the individual now or by other individuals now, or by other individuals in the future): Constructing a hypothetical or simulated market and surveying individuals if they would pay an increase in their trip costs or an increase in their taxes/utility bills/ overall prices for increasing environmental quality, including wildlife populations, recognizing that they higher the dollar amount respondents are asked to pay, the lower the probability that they would actually pay (Contingent Valuation Method; CVM). This includes situations in which individuals are willing to provide donations to environmental groups to protect resources that they care about but may never experience themselves. Shwiff et al. (2012) summarize the primary criticisms of CVM: the hypothetical nature of the questionnaires, the inability to validate responses, the high costs of conducting this type of survey, and the difficulty of identifying the target audience. Also, public goods such as wildlife to not lend themselves to this type of valuation and this valuation tends to understate the true non-market value.
- **Benefit Transfer to Other Locations:** Extrapolation of WTP results from one area to another, recognizing that the extrapolation may or may not be reasonable or applicable in another area depending on circumstances. Shwiff et al. (2012) summarize the primary criticisms of the benefit transfer method: the reliability of this methods may be inconsistent as this method depends on estimates created using the CVM or TCM methods; wildlife values in one area may be unique and simply transferring the value associated with a species in one location to the same species in another location does not capture local qualities; preferences and willingness to pay for those preferences may not account for all the values and benefits of wildlife conservation projects, including ecosystem services.
- **Regional Economic Analysis:** Shwiff et al. (2012) describe this method as including estimation of secondary benefits and costs associated with the conservation of wildlife species in units of measure that are important to the general public (revenue, costs, and jobs). Increasing wildlife populations (the primary benefit) may have secondary benefits such as increase consumptive and non-consumptive tourism, which can be estimated using multipliers to account for changes spread through economic sectors. Loomis and Richardson (2001) used WTP estimates obtained from CVM and TCM studies for estimating the value of the wilderness system in the US. This requires the use of computer models, which can translate conservation efforts into regional impacts on revenue and jobs. However, secondary benefits or costs cannot be incorporated into a cost-benefit analysis because losses in one region may become gains in another region, potentially leading to offsetting effects.

As Schuhmann and Schwabe (2000) conclude:

- "While these methods [CVM and TCM] are widely used, it is important to stress that none of the approaches mentioned is without its flaws. Indeed, there is continual debate on the validity and tractability of each method.
- "There is little uncertainty that wildlife-human conflicts impose significant costs on society. Yet, as most wildlife managers, hunters, and nature enthusiasts would agree, there is also enormous value associated with these same wildlife resources."

  In addition, the Paperwork Reduction Act of 1995 requires agencies to submit requests to collect information from the public to the Office of Management and Budget (OMB) for approval for surveys used for general-purpose statistics or as part of program evaluations or research studies. (https://www.whitehouse.gov/sites/default/files/omb/inforeg/pmc_survey_guidance_2006.pdf).

Therefore, any surveys conducted for the purposes of determining WTP and related questions must have all survey questions and designs approved by the OMB. Developing a high quality survey require professional assistance in designing, executing, and documenting their surveys. This requirements makes it very difficult and expensive to conduct public surveys.

2.3.12.5. What are the Economic Results of the Marin County CA Predator Damage Replacement Program Compared to the WS-California Program?

The Marin County, California PDM program is often cited as being a model for PDM programs because of its non-lethal only approach. APHIS-WS often receives comments asking for a similar program in other states. WS-Arizona has analyzed such an approach below.

2.3.12.5.1. What is the Marin County Predator Damage Replacement Program?

Following public opposition over the use of lethal methods to control coyote predation, the Marin County, California Board of Supervisors replaced a cooperative program with the California Department of Food and Agriculture and the U.S. Department of Agriculture with a county-administered, non-lethal program supervised by the County Agricultural Commissioner.

Under the current non-lethal Marin County Program, qualified ranchers are provided cost-share funding to assist in the implementation of non-lethal management methods to reduce depredation such as through new fence construction or improvements to existing fences, guard animals, scare devices, or changes in animal husbandry. The most commonly used methods by producers are guard dogs and fencing (Larson 2006). To qualify for the program, ranchers must have at least 25 head of livestock and must use two non-lethal methods to deter predation, as verified by the Marin County Agricultural Commissioner.

Initially, producers who qualified for the program could also receive compensation for livestock lost to predation. However, the program was unable to pay the cost of all losses to predation and, in 2003, compensation payments were capped at 5% of the number of adult animals in the herd. However, when the Marin County Department of Agriculture, in a December 2014 California Public Records Request, was asked for records reflecting whether and to what extent the Program addresses or pays for the depredation of, or damage caused by, coyotes, mountain lions (cougars), feral swine (wild hogs and boars), free roaming and/or feral dogs, gray fox, striped or spotted skunks, possums, and other common wild animals, Marin County indicated that the Livestock Protection Program was only a cost-share program to provide limited funds for purchasing fencing materials and guard animals.

Animal advocates have referred to the Marin County program as “a model program” that has successfully addressed and embraced ethical concerns, as well as the differing values of the ranching and animal protection communities (Fox 2001, Fox 2006). However, this positive opinion of the County program is not necessarily shared by Marin County or the greater California livestock community (Larson 2006).

Although Marin County’s program is discussed as a “non-lethal” approach and appears to be less lethal on its surface, a study evaluating the effectiveness of the Marin County program (Larson 2006) indicated that more coyotes have been killed during the implementation of the Marin County Program compared to the standard APHIS-WS cooperative program. This is due, in part, to the fact that landowners are not prohibited from killing coyotes on their land or hiring others to do so.

Individual producers and others working on their behalf routinely practiced snaring, calling and shooting, and denning in an effort to kill damage-causing coyotes. Larson (2006) also indicated that it is likely that some ranchers are taking more coyotes than when the WS-California program was in place, because WS-California personnel would recommend that landowners not take action in order to avoid creating animals that are wary of capture methods applied by non-experienced people.

Research conducted in nearby Mendocino County, California, and elsewhere indicates that territorial, dominant (alpha) coyote pairs, the most difficult to capture by snaring or trapping, cause the majority of livestock losses, especially when adults are raising (multiple authors cited in: Jaeger 2004, Sacks *et al*. 1999). Experienced field specialists from APHIS-WS are likely to be more effective at targeting specific problem coyotes than less experienced members of the public who are more likely to remove less problematic, but easier to capture or kill, juvenile and subordinate coyotes (Larson 2006). In addition, landowners are rarely trained, experienced experts in professional trapping techniques and are more likely to capture non-target species during their efforts (Larson 2006). Because the Marin County program has no means of collecting data from landowners on use of lethal methods or take numbers, there is no way to quantify the take of target and non-target animals (including state and federally listed threatened or endangered species) nor evaluate the environmental impacts of such take. The APHIS-WS program uses the MIS database to effectively track the equipment, and target and non-target take associated with all operational PDM projects.

A review of Marin County's budget over the first five years of the non-lethal program's implementation found that on average the program cost Marin County 1.2 times the amount that the cooperative APHIS-WS PDM program cost the county in its highest year (Larson 2006). These budget evaluations only record the county's cost for implementation, and do not capture the additional landowner costs associated with this program. The inability of the program to pay compensation for all livestock losses and the need to cap loss indemnity payments are also noteworthy.

The Marin County program is limited to providing financial compensation assistance with non-lethal PDM to protect sheep operations larger than a certain size. It does not address several of the needs for action that WS-Arizona works on as identified in Chapter 1, including protecting cattle and calves, work at airports, protection of public/pet health and safety, and protection of natural or commercial resources, including ESA-listed species. Furthermore, non-lethal methods do not always resolve predator damage problems, even for sheep operations.

Based on the limitations of the Marin County program noted by Larson (2006) and summarized above, such an alternative would fail to address all needs for action presented in Chapter 1. Moreover, APHIS-WS and WS-Arizona have no authority to implement such a program. The budgets and decisions of state, county, and local governments are outside of the authority and control of WS-Arizona and APHIS-WS. There is also no Congressional authority to provide such subsidies to cooperators; thus, a similar federal program is outside the authority of WS-Arizona and APHIS-WS. WS-Arizona has determined that detailed analysis of this alternative would not provide substantive new information to aid decision-making and will not be conducted at this time. A similar program could be implemented by local, county, or state governments in Arizona at their discretion.

2.3.12.6. What are Economic Concerns Commonly Expressed by Public Commenters to APHIS-WS PDM EAs?

Commenters often request economic analyses that incorporate the combination of the economic contributions of resource and agricultural protection programs and the economic contribution of wildlife-related recreation and values of the existence of wildlife, especially predators, on ecosystem services and recreation opportunities. Aspects of these values are included in this EA in the evaluation of impacts to target and non-target populations (Sections 4.2.1 and 4.2.2), ecosystem services and biodiversity (Section 4.2.2), sociocultural/wildlife values and impacts to recreation (Section 4.2.4).

Commenters to APHIS-WS PDM EAs commonly express concerns about the economic costs of PDM in relation to the economic values being protected, especially values related to livestock, and whether the use of public funds are appropriate to support private profits. These are discussed here and several are included in Section 2.3, Alternatives Not Considered in Detail.

2.3.12.6.1. Use of Taxpayer Funds for Private Profit, Livestock Losses Considered a Tax Write-off, and Livestock Losses Should Be an Accepted Cost of Doing Business

Some people and groups have commented that they do not want APHIS-WS to use taxpayer funds to benefit private commercial enterprises, such as livestock operations, and that producers should consider their losses to predators as a cost of doing business. Some believe that producers receive sufficient tax write-offs for their predation losses.

The national policy of using taxpayer dollars for subsidizing private or commercial profit, such as for protecting livestock from predators on private or public lands is established by Congress through statutes such as the Federal Land Policy and Management Act (FLPMA), the Multiple Use-Sustained Yield Act requiring multiple use of federal lands, including for livestock grazing, and the APHIS-Wildlife Services authorizing act (Section 1.5.1), and Congressional appropriations. As wildlife belongs to the American public and is managed for many uses and values by tax-supported state and federal agencies, it is national policy that some of the resolution of damage caused by those same species is also publicly supported. Federal and state funds also support research and management of wildlife-related diseases, especially those that can be transmitted to livestock, pets, and humans. Furthermore, APHIS-WS is a cooperatively funded program, and WS-Arizona is also funded by private and commercial entities that request its services.

APHIS-WS is not involved in establishing or approving national policies regarding livestock grazing on federal lands or supporting private livestock operations, but provides federal leadership in resolving wildlife-human conflicts and supporting coexistence of wildlife and humans. It is publicly accountable for the work that is requested by public and private entities and landowners, state and federal governments, tribes, and the public, and all activities are performed according to applicable laws and its mission and policies.

WS-Arizona is aware of beliefs that federal wildlife damage management should not be allowed until economic losses become “unacceptable,” (Section 2.3.12.6.1) and that livestock losses should be considered as a cost of doing business by producers. WS-Arizona receives requests for assistance when the operator has reached their tolerance level for damage or worries about safety and health, as well as in circumstances where the threat of damage is foreseeable and preventable. This tolerance level differs among different people and entities, and at different times. Although some losses can be expected and tolerated by agriculture producers and property owners, WS-Arizona is authorized to respond to requests for assistance with wildlife damage management problems, and it is agency policy to respond to each requester to resolve losses, threats and damage to some reasonable degree, including providing technical assistance and advice. The APHIS-WS Decision Model (APHIS-WS Directive 2.201) is used in the field to determine an appropriate strategy on a case-by-case basis. The APHIS-WS authorizing legislation does not require an economic analysis at any scale of operation (Section 3.1.5.3 and 2.3.12.2).

Some people believe that livestock producers receive double financial benefits when APHIS-WS provides services to producers because producers have a partially tax-funded program to resolve predation problems while they also receive deductions for livestock lost as a business expense on tax returns. However, this idea is incorrect because the Internal Revenue Service does not allow for livestock losses to be deducted if the killed livestock was produced on the ranch and not purchased from an outside source (IRS 2016). In the western United States, a large proportion of predation occurs to young livestock (lambs, kids, and calves), and many adult ewes, nannies, and cows are added as breeding stock replacements to herds from the year's lamb, kid, and calf crop. Any of these animals lost to predation cannot be "written off" since they were not purchased. These factors limit the ability of livestock producers to recover financial losses through tax deductions.

This issue is appropriately addressed through political processes at the state and federal levels.

2.3.12.6.2. Compensation for Losses or Damage Should Replace APHIS-WS PDM

Wildlife is typically managed by the state, regardless of land ownership. Some states have established programs to partially accept monetary responsibility for some types of wildlife damage. However, there is currently no system in place to equitably distribute the costs of wildlife damage between all consumptive and non-consumptive user groups. It is under these circumstances where a particular state or county may provide for compensation for wildlife damage (for example, Bruscino and Cleveland 2004).

Arizona's policy regarding compensation for losses of Mexican wolf depredation on livestock is set by state law (ARS § 17-491, 17-492 and 17-493) which establishes and implements procedures to compensate landowners, lessees or livestock operators for depredation on livestock, and to administer the Livestock Compensation Fund. The mission of the State of Arizona Livestock Loss Board is:

"To address the economic impacts of wolves on individual producers by reimbursing confirmed and probable wolf caused losses, help to reduce their losses by approving projects and funding programs that will discourage and prevent wolves from killing livestock, provide funding for Pay for Presence, and seek appropriate levels of secure funding to support the actions of the Board."

Arizona has no other legal process for paying compensation for losses caused by any other predator. APHIS-WS has no legal authority or jurisdiction to provide financial compensation for losses.

The Agricultural Act of 2014 (2014 Farm Bill, H.R. 2642) has provisions for the federal government to provide indemnity payments to eligible producers on farms that have incurred livestock death losses in excess of the normal mortality, as determined by the Secretary of Agriculture, due to attacks by animals reintroduced into the wild by the Federal Government (such as wolves) or protected by Federal law (such as animals protected under the Migratory Bird

Protection Act or the Endangered Species Act). Payments are equal to 75% of the market value of the applicable livestock on the day before the date of death. The Secretary of Agriculture or designee makes that determination. None of the predators considered in this EA are applicable under this statute.

Bulte and Rondeau (2005) also argue that compensating producers for livestock losses may also result in decreased producer efforts to prevent damage, unless the producer is incentivized by making compensation connected to conservation outcomes as well.

This issue is appropriately addressed through political processes at the state and federal levels.

2.3.12.6.3. Livestock Producers Should Pay All Costs of PDM

The Act of 1931(46 Stat. 1468; 7 U.S.C. 8351-8353), as amended, authorizes the Secretary of Agriculture to make expenditure of resources for the protection of agricultural resources. Congress makes annual allocations to APHIS-WS for the continuing federal action of WDM, including PDM. Congress further establishes that APHIS-WS may receive and retain funds provided by other entities (e.g., States, industry, public and private funds) and use them towards those programs from which funds were received. In Arizona, this funding is made up of about 54% from Congressional appropriations, 21.4% from federal and state interagency agreements, and 24.6% from private or commercial cooperators. Cooperators pay the costs of non-lethal actions taken, even when recommended by WS-Arizona personnel, and a substantial proportion of the cost for WS-Arizona efforts, including WS-Arizona administrative overhead. WS-Arizona programs are cost shared for livestock management from 50% to 100% reimbursed by producers.

This issue is appropriately addressed through political processes at the state or federal levels.

2.3.12.6.4. A Program Subsidizing Non-lethal Methods Implemented by Resource Owners Should Replace APHIS-WS PDM

APHIS-WS has no legal authority or jurisdiction to provide for financial subsidies for resource owner implementation of non-lethal methods such as fencing or guard animals. WS-Arizona may rarely loan harassment equipment on very limited circumstances. The State of Arizona also provides no subsidies. Subsidies for use of non-lethal methods to selected types of livestock producers is currently offered in Marin County, California by the County to some degree, but the costs and effectiveness are not clearly known (Shwiff et al. 2005, Shwiff et al. 2006; Sections 2.3.12.4 and 2.3.12.5).

This issue is appropriately addressed through political processes at the state and federal levels.

2.3.12.6.5. Incorporate the Environmental Costs of Livestock Grazing on Public Lands into Cost Analyses

Commenters have requested that APHIS-WS consider the environmental costs of grazing on public lands and other activities in cost analyses. As stated earlier, APHIS-WS has no authority to address national policy set by multiple Congressional statutes regarding livestock grazing on federal lands, nor annual appropriations related to livestock grazing and other uses on public lands, or private lands, for that matter. APHIS-WS only responds to requests for assistance, and uses the APHIS-

WS Decision Model to determine appropriate responses, considering factors that include social and environmental considerations and the specific circumstances and species associated with the damage, in addition to efficacy and costs.

Therefore, this issue is not pertinent to APHIS-WS decision-making, and is appropriately addressed through the political process at the Congressional level.

2.3.12.6.6. No Federal Funds Should Be Used to Support State PDM Needs for Protection of Game Species

AGFD has identified limited circumstances for which PDM for protection of native game species of mule deer, elk, and bighorn sheep, especially related to mountain lion predation, would meet Department objectives (Section 1.2.4). AGFD conducts administrative removals of offending animals itself, it can hire WS-Arizona, it can use commercial wildlife damage management companies, or it can certify, train, and use volunteer agents, especially for the use of pursuit dogs per state law.

In the past, AGFD has requested PDM services from WS-Arizona to reduce predation to local populations of pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), and mule deer (*Odocoileus hemionus*), especially on spring ranges for pronghorn and deer (predation on calves and fawns), and, where needed, for vulnerable bighorn sheep populations. WS-Arizona ultimately decides when it is appropriate to enter into agreements with AGFD to assist with meeting state game management objectives.

This issue is appropriately addressed through the political process at the state and Congressional levels.

2.3.12.6.7. APHIS-WS Should Be Financially Liable for Pet Dogs that Are Incidentally Killed During Operations

WS Directive 2.340 addresses requests for assistance associated with feral (an ownerless or homeless wild dog), free-ranging (dogs that have owners but not under the owner's direct control), or hybrid dogs (a canid that is the progeny of a domestic dog and a wild wolf or coyote that is either feral or free-ranging). In Arizona, the primary responder to damage caused by dogs is either a local animal control authority or the County animal control. However, WS-Arizona can respond upon request for assistance with dogs causing damage to agriculture, livestock, airports and airfields or harming human health or safety. These harms may be caused by feral or free-ranging dogs. WS-Arizona will conduct dog damage management in coordination with and after obtaining concurrence from State, local, or tribal authorities with jurisdiction over dog control, either by type of damage or on a case-by-case basis, as appropriate. Arizona ARS §11-1005 provides for counties and cities to pass ordinances prohibiting dogs from running at large, including pets. ARS §§3-1311 provides for liability against dog owners for dogs engaged in chasing, killing or wounding livestock and ARS §3-1311 allows for liability for damages to the owners livestock killed or wounded, as well as allows any person who discovers a dog killing, wounding or chasing livestock, or discovers a dog under circumstances which show conclusively that it has recently killed or chased livestock, may pursue and kill the offending dog. The primary concern, however, is when WS-Arizona field personnel incidentally take a pet dog while attempting to take another target species. APHIS-WS Directive 2.340 states: "Where WS personnel determine that a captured dog is a pet, WS personnel shall inform the land/resource owner as soon as is practicable….This policy does not in any way preclude WS personnel from appropriately defending themselves, their working animals, or restrained animals captured pursuant to official WS actions, from dog attacks." WS-Arizona field personnel take appropriate actions to avoid incidental take of pet dogs and do not set devices that could capture dogs in recreational areas whenever possible. All capture traps are set to minimize the risk of damage to the animal (Section 3.3 and 4.2.4). If the dog has identification allowing determination of the owner, the owner is informed as soon as possible. If not, then the dog is released on site or taken to the local animal shelter.

There is no legal authority for financial liability against APHIS-WS personnel when operating consistent with federal and state law and APHIS-WS Directives.

2.3.12.6.8. PDM Should be Funded Through a State Head Tax

It is the policy of the Federal government that a livestock head tax for funding PDM must be established voluntarily and through authorities other than the Federal government. Although there is interest in Arizona, this authority does not yet exist in the state.

This issue is appropriately addressed through the political process at the state or county level.

2.3.13. Producer-Provided Data is Biased and Should Not be Used to Justify PDM

During the previous public review of the draft EA, commenters expressed concern that ranchers often intentionally overestimated the extent of their livestock losses in order to justify more control work. Pearson (1986), however, reported on several studies that indicated little or no bias occurred in ranchers reporting loss and Shelton and Klindt (1974) found that some ranchers underestimated their losses due to some husbandry practices. Schaefer et al. (1981) investigated sheep predation and determined that: 1) producers correctly assessed the cause of livestock death more than 94% of the time; and 2) the results of two types of loss surveys yielded similar results. For example, average losses attributed to predation by Idaho sheep producers in 2011 and 2012 amounted to about 25% of the total reported death loss. However, through intensive monitoring conducted during a study on three typical range sheep operations in southern Idaho, Nass (1977) found that predation was actually responsible for 56% of the total death losses. This data suggests that attributing an average of 25% of total death losses to predation is not unrealistic and may even suggest that Idaho sheep producers could be underestimating their predation losses. Regardless, the need for action in this EA is not solely based on rancher-supplied data. Chapter 1 Section 1.2 provides a range of information on the need for action including losses verified by WS-Idaho employees, losses reported to WS-Arizona and information from scientific literature. WS does not initiate PDM actions at any site without verifying the species involved and the need for action. Most reports that show livestock loss are generally derived from NASS surveys of livestock producers. Within their Statement of Commitment to Scientific Integrity, they state:

> Federal statistical agencies (or units) whose principal function is the collection, analysis, and dissemination of information for statistical purposes have set for themselves a high standard of scientific integrity…. These agencies embrace a common set of professional standards and operational practices designed to ensure the quality, integrity and credibility of their statistical

activities. Implementation of these professional standards involves a wide range of managerial and technical challenges.

To address these challenges, the National Research Council of the National Academies (NRC) has developed practical guidance in its publication, Principles and Practices for a Federal Statistical Agency. The principal statistical agencies use this volume to guide their strategic planning, daily operations, and interactions with stakeholders (NASS 2016b).

CHAPTER 3: ALTERNATIVES

The varied nature and diversity of requests for PDM assistance requires WS-Arizona to be diverse, dynamic, and flexible. In this EA, the alternatives that WS-Arizona considers must encompass the varied and diverse needs of PDM and be applicable throughout Arizona. In previous EAs for PDM in Arizona (WS 1996, 1999a), there were five alternatives considered relevant to WS-Arizona PDM activities. This EA will revisit these same alternatives for consideration in this statewide EA:

Alternative 1: No Federal PDM program – WS-Arizona would conduct no PDM in Arizona. This includes both technical assistance and operational PDM.

Alternative 2: Technical Assistance only - WS-Arizona would provide advice or guidance on PDM techniques and methods, but would not conduct any direct operational PDM when attempting to assist in resolving damage complaints.

Alternative 3: Nonlethal required before lethal control - resource owners required to use nonlethal techniques prior to WS-Arizona implementing lethal PDM methods to resolve a damage problem.

Alternative 4: Corrective PDM only when lethal PDM methods are used - livestock depredation or other resource damage by predators must have occurred before the initiation of lethal control. No preventive lethal PDM would be allowed.

Alternative 5: Continue the current Federal PDM program (No Action/ Preferred Alternative) - No Action Alternative as defined by CEQ for ongoing programs, allows the current program to continue in Arizona as conducted under the existing EAs (WS 1996, 1999a) but a new statewide EA would replace the existing EAs (WS 1996, 1999a). WS-Arizona would continue to provide PDM statewide within the scope of the analysis herein.

3.1 DESCRIPTION OF THE ALTERNATIVES

3.1.1. Alternative 1 - No Federal WS-Arizona PDM

This alternative would consist of no federal involvement in PDM in Arizona. Neither operational management nor technical assistance with the PDM methods described under Alternative 5 would be provided by WS-Arizona. No supporting research on PDM methods would be conducted. Information on future developments in nonlethal and lethal management techniques that result from the WS National Wildlife Research Centers ongoing research would also not be available to producers or resource owners. Under this Alternative, PDM would be handled by Tribes, AGFD, ADA, private resource owners and managers, private contractors, or other non-federal government agencies. Arizona state agencies (ADA and AGFD), and private entities or organizations conducting PDM may increase their efforts in proportion to the reduction of federal services. ADA's and AGFD's portion of the cooperative program with WS-Arizona would probably still provide some level of PDM, but without federal involvement. AGFD currently uses houndsmen and hires coyote trappers outside of WS on an annual basis.

3.1.2. Alternative 2 - Technical Assistance Only

This alternative would allow WS-Arizona to provide technical assistance with PDM techniques, such as guard dogs, frightening devices, harassment, fencing, exclusion, animal husbandry, modification of human behavior, habitat modification, cage traps, foothold traps, foot snares, and chemical methods available for the public. WS-Arizona would also loan equipment used for nonlethal PDM. Lethal PDM methods for the protection of resources would not be applied by WS-Arizona, except that technical assistance could include potentially assisting some resource owners in safely implementing PDM.

3.1.3. Alternative 3 - Nonlethal Required before Lethal Control

This alternative would require that: 1) resource owners show evidence of sustained and ongoing use of nonlethal or husbandry techniques aimed at preventing or reducing damage from predators, prior to receiving the services of WS-Arizona, 2) WS-Arizona Specialists would use or recommend appropriate nonlethal methods in response to a confirmed damage situation prior to using lethal methods, and 3) lethal techniques would only be used when the use of husbandry or nonlethal techniques has failed to keep resource losses below an acceptable level as indicated by the cooperator. State agencies, producers or non-WS agents would still have the option of implementing lethal PDM measures on their own and WS-Arizona would continue to recommend lethal PDM methods when and where appropriate.

3.1.4. Alternative 4 - Lethal PDM Methods are Used only for Corrective PDM

This alternative would allow PDM only where predation on livestock or other damage from predators has occurred. Incumbent in this alternative is WS-Arizona verification of the loss and the species responsible. Lethal PDM by WS-Arizona would be limited to an area near the loss to maintain the integrity of the corrective only situation. The full variety of mechanical and chemical methods described in Alternative 5 would be available, once damage had been verified by WS-Arizona and the responsible species identified. Producers or other non-WS-Arizona agents could still implement any legal nonlethal or lethal methods they determine to be practical and effective.

3.1.5. Alternative 5 - Continue the Current Federal Arizona PDM Program Under Statewide EA (No Action/Preferred Alternative)

3.1.5.1. Summary of the Preferred Alternative

The Preferred Alternative in this EA, continuing the current WS-Arizona PDM program of activities for the protection of livestock, crops, property, natural resources, and HHS as outlined in prior separate WS-Arizona EAs (1996, 1999a), is the No Action Alternative. The No Action Alternative is a procedural NEPA requirement (40 CFR 1502.14(d)), and is a viable and reasonable alternative that could be selected. It serves as a baseline for comparison with the other alternatives and, as a result, receives an in depth analysis. In this EA, the No Action Alternative is consistent with CEQ's definition and is equivalent to the current program as conducted under the two existing EAs and supplement (WS 1996, 1999a).

The previous EAs (WS 1996, 1999a) analyzed possible environmental impacts of the WS-Arizona Program on public and non-public lands.

This EA combines all PDM activities, whether on public or non-public lands, into one analysis. A statewide analysis is advantageous because estimates for predator species populations and most harvests and monitoring PDM effects on wildlife populations are statistically more reliable. In addition, AGFD provides its data on a statewide basis. This EA contains SOPs developed in response to issues that arose since the time the existing EAs (WS 1996, 1999a) were written.

The objective of PDM under the preferred alternative is to minimize loss or the risk of damage to the resources from predators by responding to all requests with technical assistance (advice or demonstrations) or operational management. WS-Arizona employees would continue to provide technical assistance to resource owners covering a variety of methods that can be used to resolve problems where it is appropriate for the resource owners to resolve the problem or part of the problem themselves. WS-Arizona would also continue to assist resource owners through educational programs on damage identification, prevention, and management, and by providing information on sources of supply for PDM products such as pyrotechnics and propane cannons or by temporarily loaning supplies such as cage traps[13].

Operational PDM has primarily been provided in situations that require the use of methods that are difficult or prohibited for the public to implement, especially those that involve lethal PDM methods, and where WS-Arizona's expertise in PDM is of value. Operational PDM efforts often require costly expenditures for supplies and staff hours and, therefore, are generally limited to situations where cooperative funding is available. Resource owners that are provided operational PDM are also encouraged to use additional management strategies and sound husbandry practices, when and where appropriate, to further reduce damage.

Under the Preferred Alternative, an IWDM approach would be used, which encourages use of all effective legal methods, used alone or in combination, to meet the needs of the requesters for reducing damage from predators. Most wildlife damage situations require professional expertise, an organized management effort, and the possible use of several PDM methods. WS-Arizona personnel, who are trained professionals and equipped to handle most damage situations, use IWDM to be most effective. The resource, species, location and the type of damage, and the available biologically sound, cost-efficient, legal IWDM methods are analyzed by WS-Arizona personnel using the WS Decision Model (Slate et al. 1992) to determine the action(s) necessary to reduce predator damage.

The Preferred Alternative would continue to allow the use of all legal and appropriate methods to reduce predator damage when requested. A wide range of PDM methods is available for resource owners and WS-Arizona personnel; these are described in Chapter 3. PDM methods fall into different categories including cultural practices (*i.e.*, shed lambing and guard animals), habitat and behavior modification (*i.e.*, exclusion, chemical repellents, and hazing with pyrotechnics), and operational management (*i.e.*, traps, shooting, and toxicants). Operational management is primarily lethal management when nonlethal methods failed to reduce damage to acceptable levels, but some of them (*e.g.*, hand-capture, use of foothold traps/snares, cage traps) may also be used nonlethally and the animal could be relocated from the damage situation if approved by AGFD, USFWS, and/or tribes and the landowner where the animal would be moved.

[13] WS technical assistance is educational, informational, advisory or consultative in nature and is categorically excluded from the need to prepare an EA or EIS (7 CFR 1b.3(a)).

Under the preferred alternative, PDM would be conducted in Arizona when and where requested, on private and non-private lands, after a request for assistance has been received and after an Agreement for Control between WS-Arizona and the land owner or manager, or a WS-Arizona workplan (WP) is completed with the appropriate land management agency. PDM, as conducted by WS-Arizona, would comply with all applicable federal, state, tribal and local laws and current MOUs between WS-Arizona and the various management agencies. WS-Arizona personnel communicate with other agency personnel as required and when necessary.

The primary objective of PDM for WS-Arizona is to respond to 100% of the requests for assistance through technical assistance or operational PDM and reduce damages. All new cooperators are provided applicable information on nonlethal methods that could effectively reduce predator damage.

3.1.5.2. Proposed Action as the "No Action" Alternative

The CEQ, in its 40 Most Asked Questions regarding the consideration of the "no action" alternative for project- and programmatic-level NEPA reviews states:

"In situations where there is an existing program, plan, or policy, CEQ expects that the no-action alternative …would typically be the continuation of the present course of action until a new program, plan or policy is developed and decided upon." (46 Fed. Reg. 18026 (March 23, 1981).

Therefore, the current program, with natural fluctuations in PDM actions, locations, and tempo, is also the no action alternative. The impacts of all other alternatives considered in detail will be compared to the impacts of the current program, acting as the no action alternative.

3.1.5.3. Details of the Preferred Alternative

PDM provided by WS-Arizona personnel can be conducted on public, private, state, tribal, other lands or any combination of these land classes where agreements or WPs for PDM are in place. Currently in Arizona, about 70% of requests for WS-Arizona PDM come from livestock and other agricultural producers associated with both private and public lands. Some of these requests come from public entities such as county and state governmental agencies or Tribes. WS-Arizona also receives requests, from private individuals, for PDM assistance to protect property, natural resources, and HHS. WS-Arizona provides PDM assistance to livestock and other resource owners within the fiscal constraints of the program. The current PDM program on private lands is governed by WS-Arizona policy and a specific private property agreement for that particular property specifying methods to be used and species to be targeted. While the majority of livestock owners are based on private land, many of them graze livestock on or adjacent to public lands for some portion of the year and these livestock can encounter depredation from predators that originate from the public lands. WPs are in place between WS-Arizona and the land management agency for the purpose of conducting PDM and reducing damages on public lands managed by the agency.

Current program activities on federally-administered lands (USFWS, DOD, BLM and USFS) are defined specifically in WPs. WS-Arizona follows all laws and regulations applicable to PDM on these lands, such as the limited use of traps, snares and pesticides. WS-Arizona provides information on proposed PDM activities to the cooperating agencies (BLM, USFS, ADA, ASLD, and AGFD). These agencies are responsible for reviewing Preferred Alternatives to assess their compatibility with established RMPs or LRMPs. It is the land management agency's responsibility to clearly show where a Preferred Alternative would likely conflict with land use plans. Maps are used to delineate areas where PDM restrictions or limitations are needed to avoid conflicts with land uses. The WP and WS Decision Model (Slate et al. 1992, Secion 1.4.2) provide further site-specific planning mechanisms to evaluate and monitor PDM activities for a given public land area.

3.1.5.3. Selection of an Integrated Wildlife Damage Management (IWDM) Strategy Using the APHIS-WS Decision Model

For all alternatives in which WS-Arizona provides requested services, WS-Arizona uses the APHIS-WS Decision Model (Figure 2; WS Directive 2.201) as part of Integrated PDM for evaluating the situation and determining the most effective strategy to address the situation.

The Decision Model is not a written documented process for each incident, but rather a mental problem-solving process. This process is similar to adaptive management strategies used by all wildlife management professionals when addressing a wildlife damage problem, including biologists who work for some of the lead and cooperating agencies for this EA. To use an analogy, it is also similar to assessment processes used by fire departments when they arrive on a scene and determine the most effective and safe strategy for resolving the situation. WS-Arizona employees are trained and experienced in IWDM, and they respond to a request and assess the problem using the APHIS-WS Decision Model.

Under the APHIS-WS Decision Model, in accordance with agency directives and policy, APHIS-WS field personnel assess the problem and evaluate the appropriateness of available damage management strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical and effective for the situation are incorporated into a management strategy. After the selected strategy has been implemented, the property owner monitors and evaluates the effectiveness, sometimes with WS-Arizona assistance. If needed, management strategies are then adjusted, modified, or discontinued, depending on the results of the evaluation.

The thought process and procedures of the APHIS-WS Decision Model include the following steps (Figure 2, Secion 1.4.2):

1. **Receive Request for Assistance:** WS-Arizona only provides assistance after receiving a request for such assistance. The employee can respond by providing professional technical assistance, information, recommendations, and advice at any time, on-site or through verbal or written communication. If the requester needs further on-site active assistance, the WS-Arizona specialist and the requester will agree to the level of service and enter into a work agreement.
2. **Assess Problem:** Once on site, the WS-Arizona field specialist makes a determination as to whether the assistance request was within the authority of WS-Arizona. If an assistance request is determined to be within agency authority, the specialist gathers and analyzes damage information in the field to determine applicable factors, such as what species was responsible for the damage, the type of damage, the extent of damage, and the magnitude of damage. Other factors that WS-Arizona's employees often consider include the current economic loss or current threat, such as the threat to human safety, the potential for future losses or continued damage, the local history of damage in the area, environmental considerations, and what management methods, if any, were used to reduce past damage and the results of those actions.

3. **Evaluate Management Methods:** Once a problem assessment is completed, the field specialist conducts an evaluation of available management methods to recommend the most effective strategy, considering available methods in the context of their legal and administrative availability and their acceptability based on biological, environmental, social, and cultural factors.
4. **Formulate Management Strategy:** The field specialist formulates a management strategy using those methods that the employee determines to be practical and effective for use, considering additional factors essential to formulating each management strategy, such as available expertise, willingness of the property owner, legal constraints on available methods, costs, and effectiveness.
5. **Provide Assistance:** After formulating a management strategy, technical assistance and/or direct operational assistance to the requester is provided as appropriate (see WS Directive 2.101).
6. **Monitor and Evaluate Results of Management Actions:** When providing direct operational assistance, effectiveness of the management strategy is monitored, primarily by the cooperator, with assistance by WS-Arizona when appropriate. Monitoring is important for determining whether further assistance is required or whether the management strategy resolved the problem and if additional work is necessary.
7. **End of Project:** When providing technical assistance, a project normally ends after the WS-Arizona field specialist provided recommendations and/or advice to the requester. A direct operational assistance project normally ends when WS-Arizona's field specialist is able to eliminate or reduce the damage or threat to an acceptable level to the requester or to the extent possible. Some damage situations may require continuing or intermittent assistance from WS-Arizona and may have no well-defined termination point, as work must be repeated periodically to maintain damage at a low level, such as coyote control when new animals move into a vacant territory that overlaps with livestock use, or safety operations at airports.

The most effective approach to reducing wildlife damage is to integrate the use of several methods simultaneously or sequentially. 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 philosophy behind IWDM is to implement effective management techniques in a cost-effective manner while minimizing potentially harmful effects on humans, target and non-target species, and the environment. IWDM draws from the largest possible array of options to create a strategy appropriate for the specific circumstances. IWDM may incorporate cultural practices, habitat modification, animal behavior, local population reduction, or any combination of these, depending on the characteristics of the specific damage problems.

WS-Arizona uses an adaptive IWDM approach, sometimes called Integrated Pest Management (WS Directive 2.105), in which a combination of methods are considered and may be used or recommended to reduce wildlife damage. These methods may include alteration of cultural practices and habitat and behavioral modification to prevent or reduce damage. The reduction of wildlife damage may also require that a local population of offending animal(s) be reduced through lethal means. However, killing the offending animal(s) is only one strategy considered by WS-Arizona in developing management approaches. The alleviation of wildlife damage is the main focus of WS-Arizona, whether addressed by WS-Arizona professionals or other individuals, and consists of one or a combination of three basic strategies:

- Physical separation of the resources and the species in order to minimize the damage
- Manage the resource being damaged so it is more difficult for the wildlife species to cause the damage
- Manage the wildlife species responsible for, or associated with, the damage so the species cannot continue to cause damage.

WS-Arizona personnel apply IWDM approaches in PDM activities using the WS Decision Model (Slate et. al. 1992, WS Directive 2.105, 2.201, 2.201) and described in Chapter 1 of this EA. The Decision Model describes the procedures used by WS-Arizona personnel to determine the appropriate combination of management strategies or methods applied to specific damage problems. Using the general process depicted in the Decision Model (Figure 2), consideration is given to the following factors before selecting or recommending control methods and techniques:

- Species responsible for damage
- Magnitude, geographic extent, frequency, and duration of the problem
- 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 management
- Prevention of future damage (lethal and nonlethal techniques)

The current WS-Arizona wildlife damage management approach includes the following general components:

- **Collaboration and Project Identification**

APHIS-WS State programs enter into cooperative partnerships in all aspects of operational wildlife damage management when requested by agency partners, tribes, and private entities. These projects are initiated and funded (partially and/or entirely) by partner agencies, tribes, and other cooperators who have experienced predator damage or are working on research pertaining to PDM. Cooperative partnerships may be developed to implement PDM activities in targeted areas and for targeted resource protection, such as agricultural areas, areas with threatened or endangered species and other natural resources, urban/suburban areas to reduce property damage, or other locations to address specific damage needs, such as protection of human health and safety (Sections 1.6).

- **Technical Assistance**

Property owners or managers requesting assistance from WS-Arizona are provided with information regarding the use of effective and practical non-lethal and lethal techniques and/or IPDM strategies, including advice, training, and, to a limited degree, loan of equipment.

When legal, property owners or managers may choose to implement WS-Arizona's technical assistance recommendations on their own, use contractual services of private businesses, use volunteer services of private organizations, use the services of WS-Arizona (direct operational assistance), take the management action themselves without consulting another private or governmental agency, or take no action.

- **Operational Assistance**

WS-Arizona wildlife damage management activities involve an integrated approach that incorporates the direct use and/or recommendation for use of a range of non-lethal and lethal techniques. These techniques can be used alone or in combination to meet the need of each situation.

Property owners or managers may choose to take lethal management action themselves when authorized by law without consulting another private or governmental agency recommendations on their own. They can also use contractual services of private businesses, use volunteer services of private organizations, requests assistance from AGFD and/or its agents, request to use the services of WS-Arizona (direct operational assistance), or take no action.

- **Preventive (Proactive) Damage Management**

USDA APHIS defines Preventive Damage Management as: "applying management strategies before damage occurs, based on historical problems and data. Many resource management strategies and physical exclusion methods are intended to prevent damage from occurring. For example, fencing is often used to keep predators out of livestock pastures to prevent predation. When requested, WS personnel provide information and conduct demonstrations, or take action to prevent future losses from recurring" (https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_program_overview/ct_management_approaches).

Preventive IPDM is a strategy that applies lethal and/or non-lethal PDM action before expected damage occurs, based on historically recurring problems. Most non-lethal methodologies, whether applied by WS-Arizona or resource owners, are used to prevent damage from occurring and therefore fall under this category of PDM methods. When requested, WS-Arizona personnel can provide information, conduct demonstrations, or take direct action to prevent additional losses from recurring.

For example, in areas where substantial livestock depredations have occurred on lambing or calving grounds in the past, WS-Arizona may provide technical assistance in the form of information about livestock guarding animals, fencing, or other husbandry techniques. Additionally, if requested and appropriate, WS-Arizona may conduct lethal predator management by removing multiple predators (coyotes only, as defined and authorized in ARS § 17-302, 3-1311, and 3-2405) in a specific area before lambing or calving begins in an attempt to preemptively prevent continued depredation.

The rationale for conducting preventive damage management differs little in principle from holding controlled hunts for deer or elk in areas where agricultural damage has been a historical problem. By reducing the number of predators, specifically coyotes, operating in a territory near livestock, the risk of damage at the time is potentially reduced. Rather than requesting assistance from WS-Arizona, property owners may request AGFD and/or its agents, and/or AGFD-certified commercial companies to conduct such activities.

- **Corrective PDM**

USDA APHIS defines Corrective Damage Management as: "applying management strategies to stop or reduce current losses. As requested and appropriate, WS personnel provide information, conduct demonstrations, or take action to prevent future additional losses. Corrective actions may include a combination of… wildlife damage management approaches, technical assistance, and operational damage management assistance" (https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_program_overview/ct_management_approaches).

When appropriate, WS-Arizona also provides damage management assistance (operational assistance) using lethal and non-lethal methods within an IPDM strategy. Resource managers and others requesting operational assistance are provided with information regarding the use of effective nonlethal and lethal techniques, including recommendations as to effective long-term strategies for reducing risk of wildlife damage. For example, in areas where verified livestock depredations are occurring, WS-Arizona field specialists may provide information about livestock guarding animals, fencing or husbandry techniques, and/or conduct operational, often lethal, damage management activities to stop the losses.

Many lethal and non-lethal methods are intended to be both short-term and long-term tools for reducing damage that is already occuring. They can also be used to prevent damage from reoccurring in areas with historical. However, these methods cannot ensure predators do not return once those methods are discontinued. Property owners may request AGFD and/or its agents, and/or AGFD-certified commercial companies or conduct such activities themselves rather than requesting assistance from WS-Arizona.

- **Carcass Disposal**

All carcass disposal by WS-Arizona is conducted following policies consistent with APHIS-WS Directives 2.510 and 2.515 (Section 3.3.1) and Arizona state law.

- **Monitoring**

WS-Arizona, in coordination with AGFD when appropriate, monitors the results and impacts of its program. The impacts discussed in this EA are monitored and evaluated in two ways:

1) WS-Arizona determines if any additional information that arises subsequent to the NEPA decision from this EA would trigger the need for additional NEPA analysis. WS-Arizona reviews implementation results and the related NEPA documents as needed to ensure that the need for action, issues identified, alternatives, regulatory framework, and environmental consequences are consistent with those identified in this EA.

2) WS-Arizona, in coordination with AGFD when appropriate, monitors impacts on target and non-target predator populations through its MIS database. The MIS information is used to assess the localized and cumulative impacts of WS-Arizona activities on specific target predator and non-target wildlife populations. WS-Arizona provides detailed information on animals removed, as appropriate, to AGFD to assist those agencies with managing species and resources under their jurisdictions.

WS-Arizona can use and/or recommend many methods, including combinations of methods for IPDM strategies.

WS-Arizona, AGFD and/or its agents, AGFD-certified commercial companies, or the property owners themselves may implement PDM methods. Implementing non-lethal methods such as husbandry or structural barriers are generally the responsibility of the property owners. Depending on the circumstances of a particular PDM situation, lethal methods may be needed to address the immediate problem during the time period while non-lethal methods are implemented. The design of the APHIS-WS Decision Model (Section 1.4. Figure 2), which provides for the consideration of lethal and non-lethal methods, allows WS-Arizona to use and recommend the most effective and practical methods available, while accounting for the many legal, logistical, biological, ethical, and environmental variables in each unique damage situation.

Detailed descriptions of lethal and non-lethal methodologies are found in Appendix A; brief summaries are included below.

- **Non-lethal methods**

Non-lethal methods can be used to disperse, prevent or restrict access or otherwise make an area unattractive to predators causing damage, thereby reducing the risk that predators can cause damage or threats at the site and immediate area. Non-lethal methods are given priority by WS-Arizona field specialists when addressing requests for assistance, when applicable and effective (WS Directive 2.101). However, non-lethal methods are not necessarily used to resolve every request for assistance if deemed inappropriate or potentially ineffective by WS-Arizona's personnel under the APHIS-WS Decision Model within the practices of IPDM (Section 1.4, Figure 2). WS-Arizona personnel may recommend that lethal methods be used initially to resolve the immediate problem while non-lethal methods are implemented, such as fence construction.

Non-lethal methods used or recommended by WS-Arizona may include habitat management, husbandry, hazing, fencing, aversive/harassment devices, herding, and livestock guard animals. WS-Arizona may occasionally loan harassment equipment such as propane cannons and pyrotechnics to livestock producers. In many situations, the implementation of non-lethal methods, such as construction of fencing, is the responsibility of the requestor to implement. Many of these methods require regular maintenance and/or human presence to be effective. For dispersing predators, the proper timing is essential. Using methods soon after damage begins or soon after threats are identified increases the likelihood of success.

In most situations, a cooperating entity has already tried reasonable non-lethal methods to resolve damage prior to contacting WS-Arizona for assistance. In those cases, the methods used by the requester were either unsuccessful or the reduction in damage or threats had not reached a level that was tolerable to the requesting entity. In those situations, WS-Arizona could use other non-lethal methods, attempt to continue the use of the same non-lethal methods, and/or recommend or use lethal methods. Typically, the implementation of non-lethal methods, such as exclusion-type barriers, is the responsibility of the requester, which means that, in those situations, the only options available to WS-Arizona field specialist involve the use of lethal methods, if determined to be appropriate and potentially effective under the APHIS-WS Decision Model.

- **Lethal methods**

After receiving a request for assistance and conducting a field review, trained and certified WS-Arizona personnel may determine that lethal methods are appropriate. Lethal methods are often used to reinforce non-lethal methods, to remove animals that have been identified as causing damage or posing a threat to human safety, and/or to reduce the risk of depredation reoccurring in an area where it has occurred in the past. The use of lethal methods results in temporary and small local reductions of the numbers of predators in the area where damage or threats are occurring or are expected to reoccur. The number of animals removed from the area using lethal methods under this alternative is dependent on the number of predators involved with the associated damage or threat, the potential for reoccurrence of depredation, especially on livestock or ESA-listed species, and the effectiveness of methods used.

Lethal methods used by WS-Arizona employees include ground shooting, aerial shooting, snaring, live trapping, such as using snares, nets, cage traps, and foothold traps (followed by mechanical or chemical euthanasia) or methods such as chemical toxicants when lawful. WS-Arizona employees follow the American Veterinary Medical Association (AVMA 2013) euthanasia recommendations for free-roaming and captured animals in program activities, where practical and effective (APHIS-WS Directive 2.505, and Sections 3.3.1 and 4.2.4), and use the most humane and rapid methods available under the circumstances and per the APHIS-WS Decision Model (Sections 1.4).

Aerial shooting with fixed-wing aircraft is generally one of the most effective control methods where terrain is relatively flat, and it is the preferred method because of its selectivity, accessibility, effectiveness and ability to traverse rough terrain during winter weather. In addition, it provides the greatest area of coverage needed to protect livestock resources. Other control methods, such as foothold traps, snares, M-44s and ground shooting, can also be used in combination with 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, as heat reduces coyote activity and vegetative ground cover greatly hampers visibility. High temperatures, which reduce air density, affect low-level flight safety and may further restrict aerial shooting activities. Other restrictions include higher elevations, dense vegetation cover, and rugged terrain.

WS-Arizona responses to requests for preventative aerial shooting have occurred in 8 of the 15 counties in Arizona. Work has primarily been conducted in Apache, Cochise, Coconino, Graham, Mohave, Navajo, Pima, and Yavapai Counties. Aerial shooting occurs only on lands where it is authorized and when under agreement, including BLM lands, USFS lands, State lands, private lands, and tribal lands. PDM assistance has been for protection of livestock (i.e. calves), natural resources (i.e. antelope), and to conduct surveys (i.e. feral swine) on USFS, BLM, State Land, private properties and tribal lands in Arizona.

Any strategy involving reducing the number of predators in a particular area during a regulated hunting/trapping season is the responsibility of AGFD as authorized by state law.

The current WS-Arizona program is or may be conducted on private, public, tribal, and other lands where a request has been made, the WS-Arizona employee has determined that the problem is caused by a predator, and appropriate agreements for assistance have been finalized. All management actions comply with appropriate federal, state, territorial, tribal, and local laws (Section 1.6.2, 3.3.1, and 3.3.4).

- **Methods that May Be both Lethal and Non-Lethal**

Some methods may be either a lethal or non-lethal strategy, or a combination of both. For example, foothold and cage traps may be used to capture animals for relocation or for euthanization upon capture, depending on the circumstances, species, policy and regulatory requirements, and management objective. APHIS-WS policy also discourages relocation of captured offending animals for the same reason (APHIS-WS Directive 2.501; Section 3.3.1). Relocation of captured problem animals is also opposed by the American Veterinary Medical Association, the National Association of State Public Health Veterinarians and the Council of State and Territorial Epidemiologists because of the risk of disease transmission among wild mammals. Therefore, many animals captured using non-lethal methods are often euthanized per state and APHIS-WS policy.

- **Protective Measures**

See Section 3.3 for list of protective measures, including APHIS-WS Directives, state law and regulation, ESA terms and conditions and measures pertinent to this alternative.

3.1.5.4. Management Methods

WS-Arizona personnel use a wide range of PDM methods. The strategies for determining which method(s) to use are based on applied IWDM principles. WS-Arizona uses or recommends three general strategies to reduce wildlife damage: resource management, physical exclusion, or wildlife management. For each approach, specific methods or tactics are available for PDM, including many that are specific to individual species.

WS-Arizona provides technical assistance most often for resource management and physical exclusion methods, and less often for wildlife management such as harassment and cage traps. WS-Arizona assistance may include on-site instruction on the use of some PDM techniques. WS-Arizona operational management efforts can include any of the PDM methods, but primarily involve site-specific hands-on wildlife management that involve safety concerns or are difficult for much of the public to implement on their own.

In Arizona, WS uses or recommends a wide variety of methods for PDM. WS-Arizona may not consider some techniques that are suggested for use by resource owners, by other entities or individuals to stop predator damage if they are biologically unsound, legally questionable, or ineffective.

The methods WS-Arizona may use for PDM include:

- Resource Management
  - Habitat Management
  - Animal Husbandry Techniques
  - Guard Animals
  - Modification of Human Behavior
- Physical Exclusion
  - Fencing
  - Netting
- Wildlife Management
  - Frightening Devices

- Chemical Repellents
- Capture or Take Methods
- Foothold Traps
- Quick-Kill Traps
- Cage Traps
- Net Guns
- Snares
- Catch-poles
- Handheld nets
- Denning
- Shooting
- Aerial Shooting
- Hunting Dogs
- Relocation
- Immobilizing and Euthanizing Chemicals
- Medication Chemicals
- Pesticides
- M-44/Sodium Cyanide
- Large Gas Cartridges

Each of the WS-Arizona PDM methods listed above is discussed in more detail below.

Resource Management

Resource management is a general approach that includes a variety of practices that may be used by agriculture producers and other resource owners to reduce their exposure to potential predator depredation. Implementation of resource management practices is appropriate when the potential for depredation can be reduced without increasing the cost of production significantly or diminishing the resource owner's ability to achieve land management and production goals. Changes in resource management are usually not conducted operationally by WS-Arizona, but are typically implemented by producers. Many of these techniques can require the producer to devote significant time and initial expense towards implementation, but they can be very effective in PDM (Knowlton et al. 1999, Conover 2002, Mitchell et al. 2004).

Habitat Management. Localized habitat management is often an integral part of resource management when conducting PDM. The type, quality, and quantity of habitat are directly related to the wildlife produced in or attracted to an area. Habitat can be managed to not produce or attract certain wildlife species. Limitations of habitat management are determined by the characteristics of the species involved, the nature of the damage, economic feasibility, and other factors. Legal constraints may also exist which preclude altering particular habitats.

Most habitat management recommended by WS-Arizona is aimed at reducing wildlife aircraft strike hazards at airports (*i.e.*, managing brush and grass cover at airports to reduce field rodent populations which are a prey-base attractant) or reducing cover for predators near lambing or calving pens and grounds to reduce predation. This second activity is particularly important in PDM because predators are more likely to be successful if the area is conducive to ambush or allows the predator to approach prey under the cover of dense brush. Removal or thinning of the brush can discourage predator activity. Opening the area also allows for better monitoring and increases the efficiency of other PDM methods such as shooting if they become necessary. WS-Arizona provides recommendations at airports to modify habitat, but generally does not directly engage in habitat management. WS-Arizona generally does not modify habitats nor recommend any sort of habitat modifications in T&E species habitat.

Animal Husbandry Techniques. This method includes modifications in the level of care and attention given to resources, shifts in the timing of breeding and births, selection of less vulnerable resources to be produced, and the introduction of human custodians (herders) to protect livestock. The level of care or attention given to livestock may range from daily to seasonal. Generally, as the frequency and intensity of livestock handling increases, the degree of protection also increases (Robel et al. 1981). In operations where livestock are left unattended, the risk of depredation is greatest. The risk of depredation can be reduced when operations permit nightly gathering so livestock are unavailable during the hours when predators are most active. It is also possible to reduce predation of sheep by concentrating sheep in smaller areas (Sacks and Neale 2002). The risk of depredation is usually greatest with immature livestock. This risk diminishes as age and size increase and can be minimized by holding pregnant females in pens or sheds to protect births and by holding newborn livestock in pens for the first two weeks. Shifts in breeding schedules can also reduce the risk of depredation by altering the timing of births to coincide with the greatest availability of natural prey to predators or to avoid seasonal concentrations of predators. The use of herders can also provide some protection from predators, especially herders accompanying bands of sheep on open range where they are highly susceptible to predation.

Guard Animals. Guard animals are used in PDM to protect a variety of resources, primarily livestock, and can provide adequate protection at times. Guard animals such as dogs, burros, and llamas have proven successful in sheep and goat operations. However, the effectiveness of guarding animals may not be sufficient in areas where there is a high density of wildlife to be deterred, where the resource is widely scattered, or where the guard animal to resource ratios are less than recommended. Some guard animals intended to be used for protection against small to medium size predators like coyotes may be prey to larger predators like mountain lions and black bears. WS-Arizona often recommends the use of guard dogs, but does not have an operational guard dog program.

Modification of Human Behavior. Many wildlife species adapt well to human settlements and activities, but their proximity to humans may result in damage to structures or threats to HHS. Many people who are not directly affected by problems caused by wildlife enjoy wild animals and engage in activities that encourage their presence. WS-Arizona often provides advice to alter human behavior to resolve potential conflicts between humans and wildlife. For example, WS-Arizona may talk with residents of an area to suggest eliminating feeding wildlife in parks, recreational sites, or residential areas to reduce damage by certain predators such as coyotes and raccoons. Humans can also inadvertently provide food to wildlife from improper garbage disposal or leaving pet food outdoors, so this practice is also discouraged.

WS-Arizona also receives calls about species such as large carnivores that are not causing damage but their mere presence is sometimes perceived as a threat even though the animal is in its natural habitat.

WS-Arizona personnel provide educational information and reassurance to those who may be fearful of these animals about these species as another aspect of modification of human behavior.

Physical Exclusion

Physical exclusion methods are designed to restrict the access of wildlife to resources. Methods such as fencing and netting can provide effective prevention of wildlife damage in many situations.

Fencing. Fences are widely used to prevent damage from predators. Exclusionary fences constructed of woven wire or multiple strands of electrified wire can be effective in keeping predators from some areas such as a sheep pasture or an airport. The size of the wire grid and height of the fence must be able to keep the predators out. In addition, an underground apron of fencing in the shape of an "L" going outward helps make a fence more wildlife proof. The "L" also keeps out predators that dig crawl holes under the fence. However, fencing has limitations. Even an electrified fence is not always wildlife-proof and the expense of the fencing can often exceed the benefit. If large areas are fenced, wildlife being excluded has to be removed from the enclosed area to make the fence useful. Some fences inadvertently trap, catch or affect the movement of non-target wildlife and may not be practical or legal in some areas.

Netting. Netting consists of placing wire-mesh nets or heavy duty plastic, around or over resources that have a high value or are likely to be damaged. Netting is typically used to protect areas such as livestock pens, fish ponds and raceways, and structures. Complete enclosure of ponds and raceways to exclude all predatory wildlife such as raccoons typically requires wire mesh secured to frames or supported by overhead wires. Gates and other openings must also be covered with netting. Complete enclosure of areas with netting can be very effective at reducing damage by excluding problem species, but can be costly.

Wildlife Damage Management

Reducing wildlife damage through wildlife damage management is achieved through the use of many different techniques as discussed below. The general objective of wildlife damage management is to alter the behavior of or repel the target species, remove specific individuals from the population, or extirpate exotic species populations to eliminate or reduce the potential for loss or damage to resources.

Frightening Devices. Harassment and other methods to frighten animals are probably the oldest methods of combating wildlife damage. Devices to frighten animals may be either auditory or visual and provide short-term relief from damage. A number of sophisticated techniques have been developed to scare or harass wildlife from an area. The use of noise-making devices (electronic distress sounds, alarm calls, propane cannons, and pyrotechnics) is the most popular. Other methods include harassment with visual stimuli (*e.g.*, flashing or bright lights, scarecrows, human effigies, balloons, mylar tape, and wind socks), vehicles, or people. Some methods use a combination of stimuli such as a siren and strobe light to frighten predators from the immediate vicinity of the damage prone area.

Frightening devices are used to repel predators from areas such as airports or livestock bedding areas where they are a damage risk. The success of frightening methods depends on an animal's fear of, and subsequent aversion to offensive stimuli (Shivak and Martin 2001). A persistent effort is usually required to effectively apply frightening techniques and must be sufficiently varied to prolong their effectiveness. Over time, animals often habituate to scare tactics and ignore them (Dolbeer et al. 1986, Graves and Andelt 1987, Bomford 1990). In addition, in many cases animals frightened from one location become a problem at another. Several of these devices, such as scarecrows and propane exploders, are automated. For the most part, however, scaring devices are directed at specific target species and operated by private individuals or WS-Arizona Specialists working in the field.

Other frightening methods in use are rubber bullets and bean bags that are shot from shotguns or paint balls that are shot from paint ball guns. Rubber bullets, paint balls, and bean bags do not kill or pass through an animal, but are intended to shock them enough so the animal avoids a particular activity again. Rubber bullets, paint balls, and bean bags are used target-specifically and have been used mostly for nuisance predators (*i.e*., garbage can bears). When a predator associates being shot with raiding a garbage can or other nuisance activity, it is hoped that they will avoid that activity in the future.

As with other PDM efforts, these techniques tend to be more effective when used collectively in a varied regime rather than individually. However, the continued success of these methods frequently requires reinforcement by limited shooting (see discussion on shooting under Capture or Take Methods below) or other local population reduction methods.

Chemical Repellents. Chemical repellents are nonlethal chemical formulations used to discourage or disrupt particular wildlife behaviors. Chemical repellents for the most part are nontoxic to the intended target species, non-target species, and the environment. They are categorized by their delivery mechanism: olfactory, taste, and tactile. Olfactory repellents must be inhaled to be effective. These are normally gases, or volatile liquids and granules, and require application to areas or surfaces that need protecting. Taste repellents are compounds (*i.e*., liquids, dusts, granules) that are normally applied to trees, shrubs, and other materials that are likely to be eaten or gnawed by the target species. Tactile repellents are normally thick, liquid-based substances which are applied to areas or surfaces to discourage travel of wildlife by causing irritation such as to the feet.

The only repellents available for predators are unrestricted chemicals such as tobacco dust and capsaicin from hot pepper that are sold overt-the-counter to the general public to repel dogs and cats from areas such as flower beds or gardens where they are not wanted. Most repellents are ineffective or are short-lived in reducing or eliminating damage caused by wildlife and are infrequently used by WS-Arizona.

Capture or Take Methods. Several methods are available to capture or take offending predators as part of a wildlife management strategy. The appropriateness and efficacy of any of the techniques described below will depend on a variety of factors.

Foothold Traps are versatile types of traps used by WS-Arizona to live-capture many species. Traps are placed in the travel lanes of the targeted animal, using location to determine trap placement rather than attractants, are known as blind sets. More frequently, traps are placed as baited or scented sets. These trap sets use an attractant consisting of visual attractants (*e.g.* dirt hole) or food bases, such as fetid meat, urine, or musk, to attract the target animal. In some situations a draw station, such as a carcass, animal parts, or a large piece of meat, is used to attract target predators. In this approach, one to several traps are placed in the vicinity of the draw station. WS Directive 2.450 states that foot-hold traps or snares (cable device) are not to be set closer than 30 feet from any exposed animal carcass or part thereof, having meat or viscera attached, including remains of animals previously removed from traps or snares (cable device) that may attract raptors or other nontarget animals. If an animal carcass could be dragged or moved by scavengers to within 30 feet of set foot-hold traps, snares (cable device), the carcass will be secured to restrict movement (WS Directive 2.455, Scents, Baits, and Attractants). These restrictions do not apply to animal carcasses used to attract bear or mountain lion to approved capture devices or to foot-hold traps set for the purpose of live-capturing birds, as approved by the WS State Director.

Advantages of the foothold trap include: 1) able to be set under a wide variety of conditions; 2) target species could be relocated after capture; 3) non-target species captures can be released if it is deemed that they will survive; 4) most traps have padded jaws to reduce foot damage (Olsen et al. 1986, Olsen et al. 1988) to predators in accordance with WS-Arizona policy, and 4) pan-tension devices used by WS-Arizona on traps for coyotes and other large predators reduce the probability of capturing non-target animals smaller than the target species (Turkowski et al. 1984, Phillips and Gruver 1996).

Disadvantages of using foothold traps include difficulty keeping them in operation during rain, snow, or freezing weather, and a lack of selectivity where non-target species are of a similar or slightly heavier weight as the target species (animals much larger than the target species usually can pull themselves free from foothold traps). The use of foothold traps also requires more time and labor than many other methods, but they are indispensable in reducing many depredation problems. Foothold traps do have the potential to take some T&E species in Arizona and therefore, may affect them. Additionally, the type of attractant, bait or visual lure, used at a trap set could increase the risk to particular non-target species. For example, baits made with fish oil, anise oil, catnip, and fresh meat, or visual attractants such as pieces of fur, feathers, shiny metal, or fabric are generally attractive to bobcats (potentially the intended target), but would also be more conducive to capturing other felids not intended to be captured.

Before foothold traps are used, their limitations must be considered. ARS 17-301 limits the use of foothold traps, and some other types of traps, to private lands. It is unlawful to take wildlife with any leghold trap, any instant body kill gripping design trap, or by a poison or a snare on any public land, including state owned or state leased land, lands administered by the United States Forest Service, the Bureau of Land Management, the National Park Service, the United States Department of Defense, the state parks board and any county or municipality. However, this subsection also does not prohibit the use of the devices prescribed in this subsection by federal, state, county, city, or other local departments of health which have jurisdiction in the geographic area of such use, for the purpose of protection from or surveillance for threats to human health or safety, and does not prohit the use of snares, traps not designed to kill, or nets to take wildlife for scientific research projects, sport falconry, or for relocation of the wildlife as may be defined or regulated by the Arizona game and fish commission or the government of the United States or both.

Injury to target and non-target animals, including livestock, may occur, but can be reduced by implementing Best Management Practices for Trapping in the United States (AFWA 2006). These include a variety of measures aimed at preventing injury such as, using padded or offset jaws, using the proper trap size and length of anchor chain for the target species, using an appropriate number of swivels, and checking traps daily. Capture of non-target species may occur but can also be reduced by implementing a variety of avoidance techniques. Various pan tension devices can be used to prevent smaller non-target animals from being captured in the trap. Trap placement and bait selection can minimizeing non-target capture. Foothold traps usually permit the release of non-target animals. Foothold traps may pose a potential threat to a few T&E species but measures are in place to protect these species, such as the use of padded jaws and daily trap checks or not using foothold traps in occupied habitat.

Quick-Kill Traps are rarely used in PDM, but when used, their use is primarily for smaller predators. The most common quick-kill traps used in PDM are the smaller Conibear® for predators such as weasels at poultry facilities or skunks and raccoons in cubbies. The Conibear® consists of a pair of rectangular wire frames that close like scissors when triggered, killing the captured animal with a quick body blow. Conibear® traps have the added features of being lightweight and easily set. WS policy prohibits the use of quick-kill traps with a jaw spread exceeding 8 inches (*i.e.,* 330 Conibear®) for land sets to prevent capture of non-target species. Conibear® traps, depending on where they are placed, could impact non-target species. With the passage of Proposition 201, use of this method in Arizona has been prohibited on public land and restricted to use in limited situations on private lands.

Cage Traps come in a variety of styles that can be used to capture animals ranging in size from mice to deer. While they are usually impractical in capturing most large animals, large cage traps work well for capturing bears and suburban mountain lions, provided the traps can be transported by vehicle to the damage sites. Cage traps are mostly ineffective for coyotes. The most commonly known cage traps used in the current WS-Arizona program are box traps. Box traps are usually rectangular and made from wood or heavy gauge wire mesh. These traps are used to capture animals alive and can often be used where many lethal or more dangerous tools would be too hazardous. Box traps are well suited for use in residential areas.

Cage traps have a few drawbacks, they can be large and heavy, and may be avoided by some species. Cage traps usually work best when baited with foods attractive to the target species. However, some non-target animals become trap happy and purposely enter the trap to eat the bait, making the trap unavailable to catch target animals. This can make a cage trap less effective. Cage traps should not be set in direct summertime sunlight and and must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions. Another potential problem with the use of cage traps is that some animals struggle to escape and may become injured. The benefit, however, is that non-target species can be released during trap checks and are usually unharmed.

Net Guns of various sizes have occasionally been used by WS-Arizona to catch target predators from aircraft or on the ground, primarily for research purposes. Nets are shot from a rifle with prongs, go about 20 yards, and wrap around the target animal. They are used mostly used in research to sample or equip animals with radio telemetry devices. Net guns would most likely be used in PDM with an applicable permit, to assist in capturing particular species such as wolves for management purposes (i.e., returning them to appropriate habitat) or to capture feral dogs for placement in an animal control shelter.

Snares made of wire or cable are among the oldest existing PDM tools. They can be used effectively to catch most species, but are most frequently used to capture coyotes, foxes, mountain lions and bears. They are lighter and easier to use than foothold traps and are not generally affected by inclement weather. Snares may be used as either lethal or live-capture devices depending on how or where they are set. Snares set to capture an animal by the neck are usually lethal but stops (devices to keep the snare loop from tightening to the extent that kills the animal) can be attached to the cable to make the snare a live capture device. Snares can incorporate a breakaway feature to release larger non-target wildlife (Phillips 1996). Snares can be effectively used wherever a target animal moves through a restricted lane of travel (e.g., crawls under fences, trails through vegetation, or den entrances). When an animal moves forward into the loop formed by the cable, the noose tightens and the animal is held.

The foot snare is a spring-powered nonlethal device, activated when an animal places its foot on the trigger. Foot snares are used effectively to capture large predators such as mountain lions and black bears. Several foot snare designs have been developed to capture smaller predators such as coyotes and bobcats. In some situations, using snares to capture wildlife is impractical due to the behavior or morphology of the animal, or characteristics of the particular location of the wildlife damage situation. Snares are set in locations where the likelihood of capturing non-target animals is minimized. The use of snares on public lands is prohibitted per (ARS 17-301 (D)) with the exception of use for the purpose of protection from, or surveillance for, threats to human health and safety or for scientific research projects. Foot snares, as permitted by R12-4-307, can be used on private and tribal lands.

Catch-poles are made of a hollow pipe with an internal cable or rope that forms an adjustable noose at one end that can be tightened to capture a predator. By pulling on the free end of the cable or rope, the size of the noose is reduced sufficiently to hold an animal. Catch-poles can be used to retrieve diseased or trapped animals and are also used to safely handle a predator or non-target animal to remove it from a trap without danger to or from the captured animal. Catch-poles can also be used to catch free-roaming feral dogs.

Handheld Nets are made of a hollow pipe handle with a circular end on which a net is attached to one side. Handheld nets can be used to capture a diseased animal, an animal in a confined space or a free-ranging feral animal. Handheld nets are nonlethal tools that can also be used to safely remove an animal from a trap.

Denning is the practice of seeking out the dens of depredating coyotes or foxes, excavating them, and euthanizing the young, the adults, or both to stop or prevent depredations. Denning is very target-specific and is most often used in open terrain where dens are comparatively easy to find. Denning is used in coyote and fox damage management efforts, but is fairly limited because dens are often difficult to locate and den use by the target animal is restricted to about 2 to 3 months during the spring. Coyote depredations on livestock and poultry often increase in the spring and early summer due to the increased food requirements needed to feed pups (Till and Knowlton 1983, Till 1992). The removal of pups often stops depredations, even though the adults are not taken (Till and Knowlton 1983). When the adults are taken at or near a known den location, it is customary to euthanize the pups to prevent their starvation because they would be unable to survive on their own. Using this method, pups are killed in the den with a CO-producing fumigant (discussed under Pesticides (Large Gas Cartridges) below

Shooting is conducted with rifles, shotguns, pistols, and air guns and is very selective for the target species. Shooting is limited to locations where it is legal and safe to discharge firearms. Shooting is rarely used as the sole PDM method in operational management because opportunities to shoot target animals are random and unpredictable. This is especially problematic for nocturnal species. To increase effectiveness, shooting predators is frequently performed in conjunction with calling, particularly for coyotes, bobcats, and foxes. Vocal calls, handheld mouth-blown calls, and electronic calls can be used to mimic target species (e.g., coyote howls and raccoons fighting) or prey (e.g., injured jackrabbit and chicken) vocalizations. Trap-wise coyotes are often vulnerable to calling.

Shooting in conjunction with night vision equipment including goggles or scopes is sometimes used in areas where traditional methods are unsuccessful or where chronic livestock depredation is occurring. Most livestock predators are nocturnal and are easier to take at night. This method is especially effective in public areas with high daytime use where problems with predators are occurring and the use of other PDM methods would make it unsafe for the public during daylight hours.

As discussed above in the Frightening Devices section, lethal reinforcement through shooting is often necessary for successful frightening programs, though this is most often used for flocking birds rather than predators.

Aerial Shooting (i.e. shooting from an aircraft) is a commonly used coyote damage management method and on a limited basis for feral dogs on all lands where authorized and deemed appropriate. Local depredation problems (particularly lamb and calf predation by coyotes) can often be resolved quickly through aerial shooting. It is especially effective in removing offending coyotes that have become bait-shy to trap sets or are not susceptible to calling and shooting. Aerial shooting consists of visually sighting target animals in the problem area and shooting them with a shotgun from an aircraft. Aircraft are used to intercept and shoot coyotes at locations where they have killed livestock. Aircraft are also used in searching for coyote dens. This method may also be used to reduce local coyote populations in lambing and calving areas with a history of predation (Smith et al. 1986, Phillips and White 2003, Brown and Conover 2011).

Aerial shooting is species-selective and can be used for immediate damage relief, providing weather, terrain, and cover conditions are favorable. Good visibility and relatively clear and stable weather conditions are required for effective and safe aerial shooting. Summer conditions limit the effectiveness of aerial shooting as heat reduces coyote activity and visibility is greatly hampered by vegetative ground cover. High air temperature influences air density which affects low-level flight safety and may also restrict aerial shooting activities.

Fixed-wing aircraft are useful over flat and gently rolling terrain. However, due to their maneuverability, helicopters have greater utility and are more effective over brush covered ground, timbered areas, steep terrain, or broken land where animals are more difficult to spot. In broken timber or deciduous ground cover, aerial shooting is more effective in winter with snow cover or in early spring before the leaves emerge. Aerial shooting is most effective when ground support crew’s direct aircraft by radio to the general location of animals which have been located by eliciting coyote howls using sirens, calls, or recorded coyote howls. WS aircraft guidelines have been implemented to ensure that aerial shooting programs are conducted in a safe and environmentally sound manner and in accordance with federal and state laws. Pilots and aircraft must be certified under established WS program procedures. Only properly trained and certified WS personnel are approved as aerial shooting crew members. Aerial shooting is generally perceived by the public as being more desirable than poisons, since shooting is selective and results in quick death. However, there is an inherent risk to aerial shooting crews. Aerial shooting has a negligible effect on the environment.

Caine et al. (1972) rated aerial shooting as *very good* in effectiveness for problem solving, safety, and lack of adverse environmental impacts. Connolly and O'Gara (1987) documented the efficacy of aerial shooting in taking confirmed sheep-killing coyotes. Wagner (1997) found that aerial shooting may be an especially appropriate tool as it reduces risks to non-target animals and minimizes contact between damage management operations and recreationists. Wagner (1997) also stated that aerial shooting was an effective method for reducing livestock predation and that aerial shooting 3 to 6 months before sheep are grazed on an area was cost-effective when compared with areas without aerial shooting.

Trained Dogs WS-Arizona personnel often use trained dogs as a wildlife management tool to include wildlife hazing, wildlife and invasive species detection, animal retrieval, decoying, trailing, and animal scent and sign detection. A trained dog is proficient in a specific set of skills necessary to perform specific functions in a manner that is responsive to its handler's commands (WS Directive 2.445, April 19, 2016).

Trailing Dogs or tracking dogs are commonly used to track and tree target wildlife species such as black bears, mountain lions, bobcats, and raccoons. Though not as common, they are sometimes trained to track coyotes (Rowley and Rowley 1987, Coolahan 1990). Dogs commonly used are different breeds of hounds such as blue tick, red-bone, black and tan, and Walker. They become familiar with the scent of the animal they are to track and follow, and the dogs strike (howl) when they detect the scent. WS personnel typically find the track of the target species at fresh kills or drive through the area of a kill site until the dogs strike. WS personnel then put their dogs on the tracks of the predator. Typically, if the track is not too old, the dogs can follow the trail and tree the animal. The animal usually seeks refuge (tree) up a tree, in a thicket on the ground, on rocks or a cliff, or in a hole. The dogs stay with the animal until the WS Specialist arrives and dispatches, tranquilizes, or releases the animal, depending on the situation.

Although tracking/trailing dogs are trained not to follow the scent of non-target species, the possibility exists that dogs could switch to a fresher trail of a non-target species while pursuing the target species. This can occur with any animal that they have been trained to follow, and can also occur with an animal that is similar to the target species. For example, dogs on the trail of a mountain lion could switch to a jaguar, if they cross a fresher jaguar track. With this said, tracking/trailing dogs could potentially have an impact on non-target species, though this risk can be minimized greatly by WS personnel looking at the track prior to releasing the hounds and calling the dogs off a track if it is determined that they have switched tracks.

Decoy Dogs are frequently used in coyote damage management in conjunction with calling. Dogs are trained to spot, lightly engage, and lure coyotes into close shooting range for WS personnel. Decoy dogs are especially effective for territorial pairs of coyotes. Decoy dogs are typically medium sized dogs such as mountain curs that are trained to stay relatively close to the WS Specialist. These dogs typically get close to coyotes but return when the coyotes start chasing them.

Relocation is the capturing of an animal with one of the nonlethal take methods and moving the animal to a new site, far enough away so that the animal will not return. WS-Arizona typically does not recommend relocation of common or dangerous wildlife (see Relocation Rather than Killing Problem Wildlife). Relocation is an important method for wildlife management, especially for the propagation of T&E or sensitive species. The Tribes, AGFD or USFWS would establish policies and make most decisions relating to wildlife relocation taking into account population goals, behavior, and social organization for the different species.

Chemical Immobilizing and Euthanizing Drugs are important tools for managing wildlife. Under certain circumstances, WS-Arizona personnel are involved in the capture of animals where the safety of the animal, personnel, or the public are compromised and chemical immobilization provides a good solution to reduce these risks. Chemical immobilization has often been used to take black bears, mountain lions, coyotes, and raccoons in residential areas where HHS is at risk. WS-Arizona employees who use immobilizing drugs are certified for their use and follow the guidelines established in the WS Field Operational Manual for the Use of Immobilization and Euthanasia Drugs.

Ketamine is an immobilizing drug (*e.g.*, Ketaset®) which is a general, fast acting, anesthetic (loss of sensation with or without loss of consciousness) that produces catatonia (lack of movement, activity, or expression) and profound analgesia (insensibility to pain without loss of consciousness), but not muscle relaxation. Xylazine (*e.g.*, Rompum®) is another immobilizing drug that has potent sedative (tending to calm, moderate, or tranquilize nervousness or excitement) and analgesic properties for sedation, anesthesia, analgesia, and muscle relaxation. This drug has been found ideal for large animals. WS often uses a combination of Ketamine/Xylazine 5:1, especially for smaller animals, because it improves muscle relaxation and visceral (bodily organs) analgesia, and emergence from anesthesia is smoother. Telazol® is another immobilizing drug that is used that contains tiletamine (a dissociative anesthetic drug that disrupts the central nervous system to produce a cataleptic state) combined with zolazepam (a muscle relaxant that when combined with tiletamine produces a state of immobility, muscle relaxation, freedom from reflex movement, and analgesia).

Immobilizing drugs are most often used in Arizona to remove animals from cage traps to be examined (*e.g.*, for disease surveillance), to place a radio-collar on an animal or in areas such as urban, recreational, and residential areas where the safe removal of a problem animal is most easily accomplished with a drug delivery system (*e.g.*, darts from rifle, pistol, blow guns, or syringe pole). Immobilization is usually followed by release (*i.e.*, after radio collaring a mountain lion for a study), relocation, or euthanasia.

Euthanasia of immobilized animals is performed with drugs such as Beuthanasia-D® or Euthasol® which contain forms of sodium phenobarbital (a drug that causes rapid anesthetic action and cerebral death) in combination with phenytoin sodium (a drug that produces cardiovascular collapse or central nervous system depression). The combination of these two drugs results in the rapid, humane death of an animal. Euthanized animals are disposed of by incineration or deep burial to avoid secondary hazards.

Immobilizing and euthanizing drugs used in WS-Arizona PDM are monitored closely and stored in locked boxes or cabinets according to WS policies, and Department of Justice (DOJ) or Drug Enforcement Administration (DEA) guidelines. Most drugs fall under restricted-use categories and must be used under the appropriate license from the DOJ, or DEA. Since the use of immobilizing drugs requires the user to be in close quarters to the target animal, the risk of take of non-target species is nullified.

Chemical Medication Drugs are used by WS nationally to treat animals that are infected with a disease or other malady, or to prevent the spread disease (e.g., rabies). WS-Arizona is involved in disease surveillance, monitoring, and management programs to assist in minimizing the spread of disease and reduce HHS risk. This may require that medication be given to wildlife through injections, or via oral or topical applications. Oral treatments, if not administered directly by a tube, are often contained in sachets disguised in baits acceptable by the target animal. Risk assessments on drugs being used in the field are completed prior to their use. The risk assessments include potential side-effects to T&E species found in the range of their use.

WS-Arizona is using an oral rabies vaccine that is a genetically engineered recombinant vaccinia-rabies glycoprotein (Raboral V-RG, Merial Inc.) vaccine. It is currently licensed for use in raccoons in the United States and Canada and approved for experimental use in gray fox and coyotes in Texas and Arizona. WS in Arizona began using this vaccine in experiments in FY05. The vaccine has been extensively evaluated in the laboratory for safety in more than 50 vertebrate species with no adverse effects, regardless of inoculation route or dose. WS-Arizona uses Imrab3®, Merial Inc. in rabies outbreaks to vaccinate raccoons, skunks, and gray foxes. Imrab3® is another vaccine that is registered for use in small predators such as ferrets. Being vaccines, they are expected to have no adverse effects on non-target species and negligible on treated animals. Drugs used for rabies are evaluated in a separate EA (USDA 2010) but information is provided here in order to communicate all aspects of methods, including drugs, used by WS-Arizona.

Pesticides are used in PDM because they are often very effective at reducing or stopping damage. Some pesticides are specific to certain taxonomic groups (*e.g.*, birds *vs.* mammals), but many pesticides are not species specific. Pesticide use may be hazardous to non-target species unless they are used with care by knowledgeable personnel following all required label restrictions and precautions. The proper placement, size, type of bait, and time of year are keys to selectivity and successful use of pesticides for PDM. When a pesticide is used according to its Environmental Protection Agency (EPA) registered label, it poses minimal risk to people, the environment, and non-target species. WS-Arizona personnel are required by policy to adhere to label requirements and any associated literature that accompanies the label for pesticide products. WS-Arizona personnel that use pesticides must be certified as chemical applicators and are required to adhere to all certification requirements set forth by EPA and ADA. EPA pesticide registration requires rigorous risk analyses to determine potential effects on humans and the environment including risks to non-target species. Suitable pesticides for reducing predator damage are limited. Proposition 201 prohibits the use of pesticides on public lands in Arizona, with some exemptions for rodents.

The pesticides used by WS-Arizona in PDM are as follows:

M-44/Sodium Cyanide (EPA. Reg. No. 56228-15) is used in the M-44 device, a spring-activated ejector device developed specifically to control coyotes and other canids. WS Directive 2.415 establishes guidelines for the use of the M-44 device by WS personnel. The M-44 is selective for canids, which are members of the dog family, due to their feeding behavior (scavenging) and because they include attractants that are relatively canid-specific. When properly used, the M-44 presents little risk to humans and the environment, and provides an additional tool to reduce predator damage. M-44 sodium cyanide capsules labeled with EPA registration No. 56228-15 and M-44 devices may only be used for control of coyotes, red and gray foxes, and wild dogs that are vectors of communicable diseases or suspected of preying upon livestock, poultry, and federally designated threatened and endangered (T/E) species.

M-44s will not be placed within 0.5 mile of occupied residences except for those belonging to a cooperator who has requested the use of M-44s and has signed a Work Initiation Document. Within properties where its use is authorized, the M-44 device shall not be used in areas where exposure to the public and family and pets is probable per Use Restriction 8(2). WS will notify the owner or lessee occupying any residence at or near 0.5 mile perimeter of an M-44 device of their use in the area. Notification must be in a manner that ensures that the message was delivered and receipt acknowledged.

The M-44 is a mechanical device that ejects sodium cyanide powder into the mouth of an animal that pulls up on it. The M-44 is made of four parts and is set with special pliers. The M-44 device consists of: (1) a capsule holder wrapped with fur, cloth, or wool; (2) a capsule containing 0.8 gram of powdered sodium cyanide; (3) an ejector mechanism; and (4) a 5-7 inch hollow stake. The hollow stake is driven into the ground, the ejector unit is cocked and placed in the stake, and the capsule holder containing the cyanide capsule is screwed onto the ejector unit. A fetid meat or other suitable bait is spread on the capsule holder. An animal attracted by the bait will try to pick up or pull the baited capsule holder. When the M-44 device is pulled, a spring-activated plunger propels sodium cyanide into the animal's mouth. Toxic symptoms may occur when sodium cyanide is swallowed, inhaled as a dust, or absorbed through the skin. When it comes in contact with carbon dioxide (CO_2) or acids, it forms hydrogen cyanide gas (HCN). HCN is highly and quickly toxic by contact, ingestion, or inhalation of vapors at which time it enters the bloodstream. HCN is an asphyxiant that prohibits the use of oxygen which affects cellular activities and functions of all tissues in the body. The body is unable to use oxygenated blood (arterial blood). The body will respond to cyanide poisoning with a variety of symptoms depending on the amount of exposure. The characteristic response is a rapid loss of consciousness and cessation of breathing except with the mildest of exposures. After ingestion of a large dose of sodium cyanide, the target species may become unconscious within a few seconds.

WS-Arizona personnel must be certified to use the M-44. M-44's must be used in accordance with the EPA pesticide label including the 26 Use Restrictions, Wildlife Services Implementation Guidelines, and NEPA documents and decisions. Bilingual warning signs in English and Spanish shall be used in all areas containing M-44 devices. All such signs shall be removed when M-44 devices are removed. In case of accidental exposure to users, M-44 users carry an antidote kit which consists of six amyl nitrite pearls while setting out or checking the devices. Any toxic or adverse human effect which occurs to WS personnel, cooperators, or the public involving the use, storage, or disposal of sodium cyanide is to be immediately reported to the State Director. Although the M-44 is selective for canids, WS-Arizona takes some non-targets other than canids on rare occasions. Proposition 201 precludes the use of M-44s on public lands. In addition, locations of T&E species such as Mexican wolves and jaguars limits where the devices can be used. The Arizona Program has not used an M-44 since 2012.

Large Gas Cartridges (EPA. Reg. No. 56228-21) are fumigant devices that emit gases to take burrowing wildlife and reduce damage associated with them. In PDM, WS only uses gas cartridges in coyote, fox, and skunk dens. The WS Program's Pocatello Supply Depot manufactures gas cartridges especially formulated for fumigation of dens. These are very efficient and inexpensive.

When ignited, the cartridge burns in the den of an animal and produces large amounts of CO, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and CO exposure kills the animals in the den. CO euthanasia is recognized by the American Veterinary Medical Association (1987, 2013) as an approved and humane method to kill animals. WS-Arizona would only use gas cartridges in dens that show signs of active target animal use. Therefore, these are mostly very target-specific and will have no effect on non-target species.

3.2. ALTERNATIVES AND STRATEGIES CONSIDERED BUT NOT ANALYZED IN DETAIL

Commenters responding to previous APHIS-WS PDM EAs have requested that APHIS-WS consider the following alternatives.

The CEQ regulations at 40 CFR §1508.14 state that agencies "shall rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated."

By definition, a "reasonable" alternative must be one that meets the underlying need for action or goal:

- "proposal exists at that stage in the development of an action when an agency…has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal…" (40 CFR §1508.23).
- "The statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." (40 CFR §1502.13)

Guidance in the CEQs "40 Most Asked Questions" states that reasonable alternatives must emphasize what the agency determines "is 'reasonable' rather than on whether the proponent or applicant likes…a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical or economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant."

Consistent with NEPA regulations and CEQ guidance, WS-Arizona reviewed alternatives and ideas proposed in comments to APHIS-WS PDM EAs, and, in this section, identify and briefly describe those that are determined by the agency as not reasonable per the CEQ criteria, and provide the agency's rationale for not considering them in detail in this EA.

3.2.1. Use of Only Technical Assistance Only by WS-Arizona

WS-Arizona would only respond to requests for assistance through providing recommendations involving lethal and/or non-lethal methods; WS-Arizona would not conduct any operational assistance. Since this does not allow for any non-lethal operational assistance, this alternative is not considered in detail.

3.2.2. Use of Only Lethal Methods by WS-Arizona

Under this alternative, WS-Arizona would only provide technical and operational assistance using lethal PDM techniques. Prohibiting WS-Arizona from using or providing technical assistance on effective and practical non-lethal PDM alternatives is not effective, not ethically acceptable to wildlife professionals, and is contrary to agency policy and directives (WS Directive 2.101), in which APHIS-WS gives preference to the use of non-lethal methods before lethal methods when practical and effective.

In some situations, non-lethal methods can supplement, reduce, or eliminate the need for lethal control, and may provide a more effective short-term or long-term solution to PDM problems than lethal methods. For example, the use of guard dogs may be effective at reducing predation rates of livestock, or installing proper fencing when practical can protect resources and exclude some predators from areas. In other circumstances, lethal methods best and most effectively resolve the damage in a timely manner. Also, at times lethal methods may not be available for use due to safety concerns or local ordinances prohibiting the use of some lethal methods.

The option to consider both lethal and non-lethal methods as part of the APHIS-WS Decision Model (Section 2 .5.1.2) allows WS-Arizona to use the most effective and practical methods available, while accounting for the many legal, logistical, biological, ethical, and environmental variables in each unique damage situation. Finally, most members of the public that comment on APHIS-WS NEPA documents feel strongly that there be more emphasis on using non-lethal methods to resolve damages, which is already APHIS-WS policy (WS Directive 2.101).

For these reasons, this alternative is not considered in detail.

3.2.3. Use of Only Non-lethal PDM Technical Assistance

WS-Arizona would provide only non-lethal technical assistance and non-lethal operational assistance. WS-Arizona would not implement nor advise others on the use of lethal methods.

Non-lethal technical assistance is included in Alternative 2 considered in detail in this EA (Section 4.2.1.2), as well as included in Alternatives 3 and 4 to a lesser degree. If the requester has taken all reasonable non-lethal actions and the problem still persists, it is not logical that the WS-Arizona specialist would not also provide professional advice regarding effective lethal methods that are legal for the requester to use in Arizona. Therefore, considering this alternative in detail would be redundant and would not be reasonable, logical, or professional.

Therefore, this alternative will not be considered in detail.

3.2.4. WS-Arizona Verifies that All Possible Non-lethal Methods are Exhausted Before Implementing Lethal Operations

This alternative is similar to Alternative 3. However, in Alternative 3, only reasonable non-lethal methods applicable to the circumstances must be used and shown not to be effective in all cases. This alternative has been requested by various commenters, and requires that all non-lethal methods be used before any lethal operations can be implemented, including non-lethal methods that are not appropriate for the circumstances. This would result in the loss of substantial time, resources, and money for both the requester and WS-Arizona in implementing and monitoring all these non-lethal methods, and potentially result in large financial losses for the requester and/or a high risk of human/pet health or safety risks, and /or major losses to ESA-listed species. Alternatives 3 and 4 considered in detail (Sections 4.2.1.3 and 4.2.1.4) provide reasonable and viable approaches for addressing the needs of requesters and concerns of commenters without incurring unreasonable and unacceptable risks and losses.

Therefore, this alternative will not be considered in detail.

3.2.5. Use a Bounty System for Reducing Animals Causing Damage

Bounty systems involve payment of funds (bounties) for killing animals considered "undesirable," and are usually proposed as a means of reducing or eliminating any species that causes damage to human-valued assets, especially predators.

The only state that has an active bounty on predators, in this case coyotes, is Utah, for an experimental program for protection of mule deer, based on legislation passed in 2012 (https://wildlife.utah.gov/hunting-in-utah/hunting-information/762; viewed 12/9/2016).

APHIS-WS has no authority to establish a bounty system for population control, suppression, or extirpation, which falls to the states. Over half the states have either outlawed bounties, repealed bounty laws, or have no statutory involvement in bounties (http://www.bornfreeusa.org/b4a2_bounty.php; viewed 12/9/2016).

The circumstances surrounding the removal of animals using bounties are typically arbitrary and unregulated because it is difficult or impossible to ensure animals claimed for bounty are not taken from outside the area where damage is occurring, as most state or local level bounty legislation that exists is regional or state-wide. Bounties can become a costly endeavor, do not effectively provide relief, and may encourage fraudulent claims.

Therefore, this alternative will not be considered in detail.

3.2.6. Provide Compensation for Losses

This compensation alternative would require the establishment of a system to reimburse resource owners for predation or other losses. Currently, AGFD, ADA, nor the tribes do not compensate ranchers for predation from wildlife including black bear and/or mountain lion livestock losses, but allow the removal of the offending animal providing they provide reasonable evidence of predation. However, the AZGFD has established the Livestock Loss Board pursuant to Arizona Revised Statutes 17-491, 17-492 and 17-493 to establish and implement procedures to compensate landowners, lessees or livestock operators for wolf depredation on livestock.

APHIS-WS has no legal authority or jurisdiction to provide for financial compensation for losses. None of the predators included in this EA are covered by compensation allowances under the Agricultural Act of 2014 (aka the 2014 Farm Bill). Difficulties with compensation programs are discussed in Bulte and Rondeau (2005) in Section 2.3.12.6.2. This issue is better addressed through the political process at the county or state level.

Therefore, this alternative will not be considered in detail.

3.2.7. Livestock Producers Should Exceed a Threshold of Loss Before PDM Actions are Taken

As explained in Section 1.2.1.1., two independent government audits, one conducted at the request of Congress, the other conducted by USDA and based on complaints from the public and animal welfare groups, found that, despite cooperator implementation of non-lethal actions such as fencing and herding, a need exists for APHIS-WS' program of direct and sometimes lethal PDM activities. The appropriate level or threshold of tolerance before using non-lethal and lethal methods differs among cooperators, their economic circumstances, and the extent, type, duration, and chronic nature of damage situations (Section 1.1.2.). On public lands, a history of loss may be sufficient for determining that preventative work would be appropriate. On private land, the landowner/resource owner determines when the level of tolerance has been reached and may take any lethal and/or non-lethal action determined appropriate that is legal per state and federal law.

The number of variables involved in determining the point at which a private entity or a government wildlife agency, for example, requests assistance from APHIS-WS for PDM preclude the ability or requirement to set a pre-determined threshold before a need is determined to exist and lethal and/or non-lethal action is requested and taken. WS-Arizona is not responsible for or required to assess the economic value of a particular loss or threat of loss before taking a PDM action, and WS-Arizona policy is to respond regardless of the requestor's threshold of loss.

Therefore, this alternative is not considered in detail.

3.2.8. Use Regulated Hunting and/or Trapping to Reduce Predator Damage

AGFD can and has used regulated hunting and trapping by private individuals as an effective population management tool in areas where predators are causing damage and/or adversely affecting wildlife populations managed by AGFD. State-sponsored hunting and trapping programs can be one of the most efficient and least expensive techniques for managing populations over broad areas, but not necessarily within localized predator damage problem spots.

This alternative is not necessarily effective for addressing localized predator damages and threats at the time the problem is occurring. Evidence exists that humans are not effective at ecologically replacing carnivore functions because human hunting is usually conducted in the fall and winter, when damage often occurs in the spring and early summer; age and sex of animals targeted by hunters is typically different than those targeted by carnivores; and roads and other infrastructure often important for effective hunting is not needed for hunting by carnivores (Ray et al. 2005). In addition, regulated hunting and trapping is often not allowed in urban or suburban areas because of safety concerns and local ordinances (Timm and Baker 2007).

However, WS-Arizona may certainly recommend to AGFD that a hunting or trapping season and an increase in regulated harvests may be helpful in reducing depredation in certain areas, if appropriate.

Since this alternative is not within the authority of APHIS-WS to implement, it will not be considered in detail.

3.2.9. Live-Trap and Relocate Individual Predators Causing Damage

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Predators would be live-captured using immobilizing drugs, live-traps, cages, or nets. All predators live-captured through direct operational assistance by WS-Arizona would be relocated. The relocation of bears and mountain lions by WS-Arizona would only occur as directed and in coordination with the tribe, AGFD, and/or as authorized by state law.

Relocating problem bears or mountain lions, particularly animals that have learned to take advantage of resources and habitats associated with humans, could move the problem from one area to another, or the relocated animal could return to its original trapping site. AGFD or tribes generally do not authorize the relocation of problem predators because of the high risk of moving the problem along with the problem animal.

Relocation is also discouraged by APHIS-WS policy (APHIS-WS Directive 2.501) because of concerns with spreading the damage problem to other areas, spreading disease, concern with the animal returning to the capture site, and concern that the animals may fail to survive in the new area.

Therefore, this alternative is not considered in detail.

3.2.10. Managing Predator Populations through the Use of Reproductive Inhibitors

Methods for reproductive control for wildlife include sterilization (permanent) or chemical contraception (reversible). Sterilization in the field can be accomplished through surgical sterilization (vasectomy, castration, and tubal ligation) and chemical sterilization. Contraception can be accomplished through: 1) hormone implantation (synthetic steroids such as progestins), 2) immunocontraception (contraceptive vaccines), and 3) oral contraception (progestin administered daily). Contraception requires that each individual animal receive either single, multiple, or even daily treatment to successfully prevent conception.

Research into the use of these techniques consists of laboratory/pen experimentation to determine and develop the sterilization or contraceptive material or procedure, field trials to develop the delivery system, and field experimentation to determine the effectiveness of the technique in achieving population reduction. Prior to implementation, chemical contraception products must be registered and approved by the appropriate federal and state regulatory agencies. Research into reproductive control technologies has been ongoing, and the approach will probably be considered in an increasing variety of wildlife management situations by wildlife management agencies.

Bromley and Gese (2001a,b) conducted studies to determine if surgically-sterilized coyotes would maintain territorially and pair bond behavior characteristics of intact coyotes, and if predation rates by sterilized coyote pairs would decrease. Their results suggested that behaviorally, sterile coyote pairs appeared to be no different than intact pairs except for predation rates on lambs. Reproductively intact coyote packs were 6 times more likely to prey on sheep than were sterilized packs (Bromley and Gese 2001b). They believed this occurred because sterile packs did not have to provision pups and food demands were lower. Therefore, sterilization could be an effective method to reduce lamb predation if enough alpha (breeding) pairs could be captured and sterilized. During Bromley and Gese studies (2001a,b), they captured as many coyotes as possible from all packs on their study area; they controlled coyote exploitation (mortality) on their study area, and survival rates for coyotes were similar to those reported for mostly unexploited coyote populations, unlike most other areas. However, the authors concluded that a more effective and economical method of sterilizing resident coyotes was needed to make this a practical management tool on a larger scale (Bromley and Gese 2001b).

Jaeger (2004), Mitchell et al. (2004), and Shivik (2006) also describe the problems with chemical or physical sterilants for alpha coyotes for reducing livestock depredation during the denning season. The primary problems involve identifying and capturing the alpha pair, which are very difficult to capture, rather than beta and transient animals, which do not perform the depredations within packs with stable social structures. Capturing and sterilizing all animals, hoping that the alpha individuals are included, is extremely expensive and time-consuming.

Currently, no reproductive inhibitors are available for use to manage most large mammal populations (Mitchell et al. 2004). Given:

- The costs associated with live-capturing and performing physical sterilization procedures on large mammals;

- The need for at least one and possibly multiple captures of individual animals for application of chemical contraception;
- The lack of availability of chemical reproductive inhibitors for the management of most mammal populations;
- Lack of research on the environmental effects of chemical sterilants and chemical contraception;
- The level of unknowns and disagreements within the professional wildlife management community regarding practicality of use, effectiveness, and potential impacts;
- The considerable logistic, economic, safety, health, and socio-cultural limitations to the use of fertility control on free-ranging predators.

If a reproductive inhibitor becomes available to manage a large number of mammal populations and has proven effective in reducing localized predator populations, the use of the inhibitor could be evaluated under the proposed action as a method available that could be used in an integrated approach to managing damage. APHIS-WS will monitor new developments and, where practical and appropriate, could incorporate reproductive control techniques into its program after necessary NEPA review is completed.

However, at this point, WS-Arizona would neither use nor recommend the use of reproductive inhibitors to reduce or prevent reproduction in mammals responsible for causing damage. Use and effectiveness of reproductive control as a wildlife population management tool is limited by population dynamic characteristics, such as longevity, age at onset of reproduction, population size, and biological/cultural carrying capacity; habitat and environmental factors such as isolation of target population, cover types, and access to target individuals); socioeconomic; and other factors.

Therefore, this approach is not considered for further analysis in this EA.

3.2.11. Use Only Non-lead Ammunition

Effects on various resources from the use of lead ammunition are discussed in Section 4.2.2 of the EA. APHIS-WS' use of lead ammunition is a small fraction of total lead contamination from many sources. WS-Arizona will use non-lead shot statewide for aerial shooting and non-lead ammunition north of Interstate 40.

WS-Arizona will follow Department of Interior USFWS policies for regarding use of lead ammunition for management and research activities on all lands under their jurisdiction. USFWS recently issued and rescinded a policy on lead ammunition use on the National Wildlife Refuge System (Memorandum, Director USFWS, dated October 3, 2016, FWS/ANRS-NRCP/063775). While this policy is no longer in place, WS-Arizona will comply with future policies and land manager requests for non-lead ammunition. WS-Arizona continues to review the availability and performance of non-lead ammunition options relative to program safety and ammunition performance needs and, as effective ammunition becomes available, will consider its use where appropriate. However, as the impacts of using non-lead ammunition would be less than that evaluated in Section 4.2.2, this EA would still be valid if WS-Arizona began using more non-lead ammunition.

3.2.12. Conduct Short-Term Suppression of Populations with Goal of Long-Term Eradication

An eradication alternative would direct all WS-Arizona's program efforts toward long-term elimination of selected predator populations wherever a cooperative agreement has been initiated with WS-Arizona.

Eradication of a native predator species is not a desired population management goal of state or federal agencies and is outside the authority of APHIS-WS. WS-Arizona does not consider eradication or suppression of native wildlife populations a responsible or effective strategy for managing predator damage because APHIS-WS policy and authority is to manage offending animals or multiple animals within the area of damage. AGFD has the authority to manage population levels of regulated species of wildlife through hunting and trapping seasons and depredation permits. WS-Arizona may assist AGFD as its agent for meeting specific AGFD management objectives when requested (Section 1.6.1), but that type of activity is generally in small areas for protection of specific subpopulations of selected animals consistent with AGFD management objectives set with public input.

Therefore, this alternative will not be considered in detail.

3.2.13. Conduct Biological Control of Predator Populations

The introduction of a species or disease to control another species has occurred throughout the world. Unfortunately, many of the introduced species become invasive species and pests themselves. For example, in Hawaii, the Indian mongoose (*Herpestes auropunctatus*) was introduced to control rats (*Rattus* spp.), but caused declines in many native Hawaiian species instead, primarily because the target species were nocturnal and mongoose are diurnal. WS-Arizona is not authorized to conduct this type of work and would not use this method for PDM.

Therefore, this alternative is not considered in detail.

3.2.14. Use Lithium Chloride as an Aversion Agent for Coyote Depredating on Sheep

Lithium chloride has been tested as a taste aversion agent to condition coyotes to avoid livestock, especially sheep. Despite extensive research, the efficacy of this technique remains unproven and is highly variable (Conover et al. 1977, Sterner and Shumake 1978, Burns 1980, Burns and Connolly 1980, Burns 1983, Horn 1983, Johnson 1984, Burns and Connolly 1985). Some studies report success using lithium chloride (Gustavson et al. 1974, 1982; Ellins and Martin 1981; Gustavson et al. 1982, Forthman-Quick et al. 1985), while other studies have shown lithium chloride to be ineffective especially in field situations (Conover et al. 1977; Burns 1980, 1983; Burns and Connolly 1985) and controlled experiments (Sterner 1995). The General Accounting Office (GAO) (2001) reported "…while the coyotes learned not to eat lambs, they still killed them."

In addition, lithium chloride is currently not registered by EPA for use by WS-Arizona or AGFD, and therefore cannot be used or recommended for this purpose. If a product containing lithium chloride is registered in Arizona to manage predator damage and if the product is proven effective in reducing predation rates, the use of the lithium chloride could be subsequently evaluated as an available method that could be used to managing damage. If WS-Arizona considers using a product containing lithium chloride, WS-Arizona would update its NEPA analysis accordingly.

Therefore, this alternative is not considered in detail.

3.2.15. All Losses Confirmed by an Independent Entity (Not WS-Arizona)

Some commenters request that all livestock losses be confirmed by an entity independent of WS-Arizona prior to WS-Arizona taking any action, especially lethal action.

In order to accurately identify the species, and even the animal(s) that has caused a damage or depredation situation, the on-site verification must occur quickly after that event has occurred before the evidence is degraded or removed/consumed by a returning predator. Action to remove the offending animal must also occur quickly, in order to actually address the specific animal, and not, for example, a scavenger. Waiting for an independent entity to verify a depredation event and the animal(s) creating it may result in the inability to verify at all. Also, no entity with the expertise, experience, training, and resources exists in Arizona, other than commercial enterprises that focus on predators less than or equal to the size of coyotes.

In addition as coyotes are regulated in Arizona as "predators," private landowners or managers may take predators in protection of property. This requirement is also outside the scope of this EA as WS-Arizona has no authority to implement an independent process for verifying livestock losses.

Requiring entities other than WS-Arizona to confirm losses could delay responding to requests for assistance. Such a delay could result in individuals deciding to take action, which may result in more predators taken than the offending animal, such as scavengers or other predators in the area, or the offending species. It could also prevent resolution of the problem because the remaining evidence might be too degraded for anyone to make a reliable determination of the cause.

Therefore, this alternative will not be considered in detail.

3.2.16. Producers Avoid Grazing Livestock in Areas of Predator Activities and Ensure Herders Constantly Present

APHIS-WS does not have authority to require ranchers where and how ranchers graze or their livestock on private or federal land. However, WS-Arizona may make reasonable recommendations on animal husbandry methods to reduce risk of depredation.

Producers, to the extent practicable, work to avoid grazing livestock near predator dens and rendezvous sites. However, producers have no control over whether or not predators establish dens or rendezvous sites near their livestock, and with some common predators, such as coyotes, it may be virtually impossible to avoid grazing "near" dens, especially for producers grazing on private lands. Producers may not have the option to move their livestock elsewhere either because they have limited access to substitute grazing lands or because the land management agency establishes the timing and movements for permitted livestock. To minimize environmental concerns on grazing lands, cattle are not maintained in tight herds as it often is with bands of sheep, further limiting options to move livestock. In dry years, in order to minimize risk of adverse effects on range, producers may spend shorter times in any given area but they then need to use all or most portions of their allotments instead of avoiding areas with a history of predator conflicts.

WS-Arizona also does not have authority to require ranchers to hire herders for livestock, although it might recommend that strategy as part of technical assistance using the APHIS-WS Decision Model. Nonetheless, sheep producers routinely use herders with their animals to keep them together in a band and moving through the grazing areas; herders are seldom used for cattle operations on public lands because the risk of predation is lower once calves reach a certain size. Due to the dispersed nature of cattle grazing, herders are not an effective management strategy, but range riders can help reduce risks of predation by moving cattle away from areas of high predation risk and promptly identifying animal health and predation incidents so they can be addressed to minimize livestock losses (Parks and Messmer 2016).

WS-Arizona responds to requests for PDM assistance from producers with large herds/flocks that graze on open range and producers with small herds/flocks in fenced pastures. Use of herders and range riders (Parks and Messmer 2016) represents a substantial financial obligation and may not be cost effective for producers with smaller herds/flocks. For producers with small flocks in fenced pastures, it may be better to incur a one-time investment in installing quality fencing that would last for years than the annual expense of a herder.

Instead of mandating a specific set of management alternatives for all producers, the APHIS-WS Decision Model and IPDM process would be used by WS-Arizona under alternatives that involve some level of WS-Arizona involvement in PDM.

3.2.17. Use Bear Repellents

Capsaicin (concentrated red pepper spray) has been tested and used effectively on black bears, primarily as an emergency personal protective repellent primarily by recreationists in the backcountry. The spray range on most products is less than 30 feet, so capsaicin is only effective in close encounters and is not appropriate for long-term management of bear damage or threats to public and pet safety. The use of capsaicin pepper spray is not effective PDM tool and, since it must be used at close range to the depredating animal, may be extremely dangerous.

Therefore, this alternative is not considered in detail.

3.2.18. Livestock Producers Pay 100% of WS-Arizona Assistance Involving Lethal Removal

The intent of this alternative is to ensure that lethal removal is not subsidized by federal taxpayer funds, thereby encouraging livestock producers to decide whether their funds are more effective if applied to non-lethal methods.

Under all alternatives in which WS-Arizona provides lethal and/or non-lethal assistance, preference is already given to non-lethal methods in accordance with WS Directive 2.101. In many instances, WS-Arizona is contacted after entities have unsuccessfully attempted to resolve their damage or threats on their own with non-lethal and/or lethal methods. APHIS-WS is authorized by federal law and funded by both Congressional appropriations and funds provided by entities that enter into cooperative agreements with APHIS-WS state offices for assistance.

WS-Arizona already provides technical support to all requesters and operational support (Alternative 5), including lethal assistance to some degree under all alternatives as determined appropriate, except Alternative 1 and 2.

Therefore, this alternative is contrary to agency policy and will not be considered in detail.

3.2.19. WS-Arizona Prohibited from Operating on Federal Lands

The USFS and BLM recognize the importance of effective PDM actions on lands under their jurisdiction. USFS and BLM maintain MOUs with APHIS-WS at the national level (Section 1.6.). These MOUs provide for direct requests from livestock permittees or state agencies to the respective APHIS-WS state agency for preventive and corrective assistance.

Per the national interagency MOUs, the agencies meet annually to cooperatively develop work plans, including designating appropriate restrictions to ensure that PDM actions do not conflict with land use plans.

Producers leasing grazing allotments on federal lands, natural resource managers working to protect sensitive or ESA-listed species, and federal agency officials responding to threats to human/pet health or safety associated with predators on federal lands that they manage have legal access to the same types of damage management methods as would be used by WS-Arizona.

IPDM can and is being conducted on federal lands by entities other than WS-Arizona. Public hunting as regulated by AGFD legally occurs on public lands unless otherwise restricted (such as in national parks). ARS §17-301, makes it unlawful to take wildlife with any leghold trap, any instant kill body gripping design trap, or by a poison or a snare on any public land, including state owned or state leased land, lands administered by the United States forest service, the federal bureau of land management, the national park service, the United States department of defense, the state parks board and any county or municipality.

Some predator species, such as coyotes, may be taken by the public, permittees, or other agencies experiencing depredation in the same manner as actions by WS-Arizona (except for the use of M-44s) without any requirement to report take to AGFD. Depending on the training and experience of the individuals conducting the work, selectivity of these actions for target species and target animals, especially older territorial adult coyotes that are typically more difficult to capture than younger individuals, may be lower than for a program conducted by trained personnel from WS-Arizona (Sacks et al. 1999, Larson 2006).

This issue is outside the scope of APHIS-WS authority. Therefore, this alternative is not considered in detail in this EA.

3.2.20. No PDM Predator Control Within any Designated Wilderness Areas or Wilderness Study Areas (WSAs)

WS-Arizona does not currently conduct activities in wilderness or WSAs but may receive requests for assistance (Alternative 5). The level of PDM activities that is expected to occur in designated wilderness areas, proposed wilderness areas, and WSAs is either none, or so minor that the effects of any of the alternatives that involve no WS-Arizona lethal work would not likely be significantly different from the effects of a "No Control in Wilderness Areas" alternative. Some wilderness, proposed wilderness and WSAs in Arizona have historic grazing allotments. The minor amount of PDM activities that could be conducted by WS-Arizona in wilderness, proposed wilderness, or WSAs conforms to legislative guidelines and MOUs between APHIS-WS and the responsible land management agencies.

WS-Arizona and the land management agency meet annually to review work plans that delineate what, when, why, where, and how IPDM would be conducted. In wilderness areas, APHIS-WS uses the minimum lethal management necessary when conducting PDM activities per BLM and FS policy. Also, to the extent possible, the control of predators causing livestock loss is limited to the individual(s) causing the damage (corrective rather than preventive actions).

WS-Arizona will work with the appropriate land management agency to meet the non-impairment criteria for wilderness characteristics and therefore do not adversely affect wilderness characteristics. Also, Federal legislation for designation of each wilderness area specifically addresses restricted and allowable actions. Some USFS and BLM land management plans also address PDM on lands under their jurisdiction, as appropriate.

This alternative is better addressed through the political process at the federal level or directly with the appropriate USFS or BLM office. Therefore, this alternative is not considered in detail.

3.2.21. WS-Arizona Contracts PDM Activities to the Commercial Sector or Defers All PDM Activities to AGFD

This alternative requires WS-Arizona to award and oversee contracts for PDM activities to the commercial/private sector; WS-Arizona would not conduct any technical or direct lethal or non-lethal assistance. All legally authorized methods would also be authorized in such contracts. WS-Arizona would retain contracting responsibilities, provide oversight to ensure that PDM is implemented according to the statement of work, and document target and non-target take as reported by the contractor. As the authorized federal agency, WS-Arizona would continue to be responsible for environmental and NEPA compliance. Private contractors would not be contracted to use M-44s.

AGFD provides a list of licensed businesses who have been issued a Wildlife Service License from AGFD, and who are authorized to remove and relocate nuisance wildlife or give advice to resolve conflicts with wildlife for a fee. AGFD is often the first to be requested and to respond to damage caused by bears and mountain lions, and can either do the work itself, hire commercial companies, enter into an agreement with WS-Arizona, and/or train and certify volunteers with pursuit dogs. Any PDM work not conducted or authorized by WS-Arizona or by another federal agency would not require compliance with NEPA.

WS-Arizona does not contract its authorized activities to other entities, including commercial entities. AGFD and its agents may already be hired directly by requesters to conduct PDM activities. WS-Arizona would not assume any responsibility or liability for actions conducted by any other entity.

Therefore, this alternative will not be considered in detail.

3.2.22. Modify Habitats to Reduce Predation

WS-Arizona may recommend habitat modification as part of its technical assistance activities (WS-Arizona does not conduct this type of activity itself) in all alternatives having WS-Arizona involvement. The land/resource owner is responsible for ensuring that any necessary permits are acquired prior to taking any such action on their private land. Also, federal and state land management agencies have the authority to conduct habitat management.

As this strategy is already included in all the alternatives considered in detail, except the "No Program" alternative (Alternative 1, this alternative will not be considered further as an independent alternative.

3.2.23. Make Supplemental Payments to Livestock Producers

The Marin County, CA experiment is commonly cited as an example of using supplemental payments to compensate producers for livestock losses. Following public opposition over the use of lethal methods to control coyote predation, the Marin County, California Board of Supervisors replaced a cooperative program with the California Department of Food and Agriculture and the U.S. Department of Agriculture with a county-administered, non-lethal program supervised by the County Agricultural Commissioner.

Under the current non-lethal Marin County Program, qualified ranchers are provided cost-share funding to assist in the implementation of non-lethal management methods to reduce depredation such as through new fence construction or improvements to existing fences, guard animals, scare devices, or changes in animal husbandry. The most commonly used methods by producers are guard dogs and fencing (Larson 2006). To qualify for the program, ranchers must have at least 25 head of livestock and must use two non-lethal methods to deter predation, as verified by the Marin County Agricultural Commissioner.

Initially, producers who qualified for the program could also receive compensation for livestock lost to predation. However, the program was unable to pay the cost of all losses to predation and, in 2003, compensation payments were capped at 5% of the number of adult animals in the herd. However, when the Marin County Department of Agriculture, in a December 2014 California Public Records Request, was asked for records reflecting whether and to what extent the Program addresses or pays for the depredation of, or damage caused by, coyotes, mountain lions feral swine (wild hogs and boars), free roaming and/or feral dogs, gray fox, striped or spotted skunks, possums, and other common wild animals, Marin County indicated that the Livestock Protection Program was only a cost-share program to provide limited funds for purchasing fencing materials and guard animals.

Animal advocates have referred to the Marin County program as “a model program” that has successfully addressed and embraced ethical concerns, as well as the differing values of the ranching and animal protection communities (Fox 2001, Fox 2006). However, this positive opinion of the County program is not necessarily shared by Marin County or the greater California livestock community (Larson 2006).

Unlike Arizona, Marin County does not have prevalent mountain lion or black bear populations or conflicts with these species and livestock. Between 1972 and 2013, only 4 depredation permits were issued for mountain lion in Marin County and none were taken (CDFG 2015; https://www.wildlife.ca.gov/Conservation/Mammals/Mountain-Lion; viewed 12/2/2016). Similarly, between 2006 and 2011, no permits were issued for black bears in Marin County (CDFG 2015; https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=112007&inline; viewed 12/2/2016). In contrast, WS-Arizona 215 complaints per year each for mountain lion and 40 complaints per year for black bear across the State of Arizona. WS-Arizona recorded an annual average take of 36 mountain lions and 7 bears statewide between FY11 and FY15.

Although Marin County’s program is discussed as a “non-lethal” approach and appears to be less lethal on its surface, a study evaluating the effectiveness of the Marin County program (Larson 2006) indicated that more coyotes have been killed during the implementation of the Marin County Program compared to the standard APHIS-WS cooperative program. This is due, in part, to the fact that landowners are not prohibited from killing coyotes on their land or hiring others to do so. Individual producers and others working on their behalf routinely practiced snaring, calling and shooting, and denning in an effort to kill damage-causing coyotes. Larson (2006) also indicated that it is likely that some ranchers are taking more coyotes than when the WS-California program was in place, because WS-California personnel would recommend that landowners not take action in order to avoid creating animals that are wary of capture methods applied by non-experienced people.

Research conducted in nearby Mendocino County, California, and elsewhere indicates that territorial, dominant (alpha) coyote pairs, the most difficult to capture by snaring or trapping, cause the majority of livestock losses, especially when adults are raising (multiple authors cited in: Jaeger 2004, Sacks et al. 1999). Experienced field specialists from APHIS-WS are likely to be more effective at targeting specific problem coyotes than less experienced members of the public who are more likely to remove less problematic, but easier to capture or kill, juvenile and subordinate coyotes (Larson 2006). In addition, landowners are rarely trained, experienced experts in professional trapping techniques and are more likely to capture non-target species during their efforts (Larson 2006). Because the Marin County program has no means of collecting data from landowners on use of lethal methods or take numbers, there is no way to quantify the take of target and non-target animals (including state and federally listed threatened or endangered species) nor evaluate the environmental impacts of such take. The APHIS-WS program uses the MIS database to effectively track the equipment, and target and non-target take associated with all operational PDM projects.

A review of Marin County's budget over the first five years of the non-lethal program's implementation found that on average the program cost Marin County 1.2 times the amount that the cooperative APHIS-WS IPDM program cost the county in its highest year (Larson 2006). These budget evaluations only record the county's cost for implementation, and do not capture the additional landowner costs associated with this program. The inability of the program to pay compensation for all livestock losses and the need to cap loss indemnity payments are also noteworthy.

Although Alternatives 1 through 5 allow for use of lethal methods in an IPDM strategy for protection of livestock (any lethal control under Alternative 1 would be conducted by entities other than WS-Arizona), these alternatives do not require the use of lethal methods for all livestock protection projects. WS-Arizona could implement a non-lethal only program for protection of livestock if requested by a cooperator under Alternatives 3, 4, and 5 (WS-Arizona would not be involved with PDM in Alternative 1, and would not be able to conduct operational non-lethal control under Alternative 2).

The Marin County program is limited to providing financial compensation assistance with non-lethal PDM to protect sheep operations larger than a certain size. It does not address several of the needs for action that WS-Arizona work on as identified in Chapter 1, including protecting cattle and calves, work at airports, for public/pet health or safety, or to protect natural or commercial resources, including ESA-listed species (Sections 2.2.2.2, 4.2.2, and Appendix A), nor do non-lethal methods always resolve the predator management problem, even for sheep operations.

Based on the limitations of the Marin County program noted by Larson (2006) and summarized above, the failure of the program to address all needs for action presented in Chapter 1, and the fact that APHIS-WS has no control over the authorities, decisions, and budget of state, county, and local governments, nor Congressional authority provide subsidies to any cooperators, WS-Arizona has determined that detailed analysis of this alternative would not provide substantive new information to aid decision-making and will not be conducted at this time.

For more information on the Marin County program, see Section 2.3.12.5.

3.2.24. Suspend Lethal Removal of Predators to Protect Livestock Until More Rigorous Scientific Testing Shows Individual Methods to be Effective at Reducing Predation

See Section 2.3.11.4 and Appendix C for detailed discussions of the Treves et al. (2016) recommendations.

3.3. PROTECTIVE MEASURES TO AVOID OR REDUCE ADVERSE EFFECTS

The measures listed in this section improve the safety, selectivity, and efficacy of PDM activities, and reduce or eliminate unwanted environmental effects. WS-Arizona PDM activities have incorporated these measures into the current program, and these measures are also incorporated into any other described alternative in which some level of operational WS-Arizona activities would occur (Alternatives 2, 3, 4, and 5), as relevant. For example, APHIS-WS policies involving lethal take included in its directives would not apply to alternatives in which WS-Arizona would not take lethal action, although the agency could recommend such actions under technical assistance.

While the following measures are implemented by WS-Arizona, not all procedures pertain to the prevention or minimization of environmental impacts, such as personnel safety procedures for firearms. However, all the measures included in this section address issues considered in detail in Chapter 4 (Section 4.2).

The measures in this section are organized into four major parts:

A. APHIS-WS policies included in formal directives, categorized into sixteen topics

B. WS-Arizona formal and informal consultations with the USFWS

C. Additional measures

D. Relevant State of Arizona laws and regulations

3.3.1. APHIS-WS Policies in Formal Directives

Individual measures in *italics* are direct quotes from APHIS-WS policies and formal directives.

A1. APHIS-WS Administrative Policies

WS Directive 2.101: Preference for Non-Lethal Methods When Appropriate
WS Directive 4.130: Requests for Assistance
WS Directive 1.210: Compliance with Federal, State, and Local Laws and Regulations

a.	*Technical and direct control assistance may involve the use of either lethal or non-lethal methods, or a combination of the two. Preference is given to non-lethal methods when practical and effective.* (WS Directive 2.101)
b.	*Wildlife damage management services are provided only in response to requests for assistance.* (WS Directive 2.201)
c	*All employees (Federal and non-Federal) are responsible for conducting official duties in compliance with all Federal laws, and also applicable State and local laws that do not directly and substantively conflict with and frustrate WS' Federal statutory authorities. In a situation requiring a variance from a State of local law or regulations that does not directly and substantively conflict with and frustrate WS Federal statutory authorities, either a State or local authority agrees to carry out the action in cooperation with WS or a written authorization or concurrence must be obtained from the appropriate State or local authority.* (WS Directive 2.210)

A2. APHIS-WS Policies Regarding Capture Devices

WS Directive 2.450: Traps and Trapping Devices

a.	*All employees whose duties involve animal capture should participate in a WS approved trapper education course as recommended by Best Management Practices guidelines.*

	State Directors may provide for continuing trapping education for appropriate employees at district state, or regional meetings.
b.	*Use of all traps, snares (cable device), and other animal capture devices by WS personnel will comply with applicable federal, state, and local laws and regulations related to animal capture for managing wildlife damage.* [also WS Directive 2.210 "Compliance with Federal, State, and Local Laws and Regulations."*]*
c.	*All traps and trapping devices will be set in a manner which minimizes the chances of capturing non-target species. If possible, non-target animals that are captured will be released.*
d.	*If an animal that appears to be a licensed pet is captured, reasonable efforts will be made to notify the owner, seek veterinary care if necessary, or deliver the animal to appropriate local authorities.*
e.	*Animals targeted for lethal control in direct control projects will be dispatched immediately, removed from capture devices, and properly disposed* (also WS Directives 2.205 "Euthanizing Wildlife" [Part A9 below], 2.510 "Fur, Other Animal Parts and Edible Meat", and 2.515 "Disposal of Wildlife Carcasses") [Part A8 below]
f.	*Captured animals intended for release, relocation, or captivity will be handled and transported appropriately to achieve project objectives* (also WS Directive 2.501 "Translocation of Wildlife")
g.	*Foot-hold traps or snares are not to be set closer than 30 feet from any exposed animal carcass or part thereof, having meat or viscera attached, including remains of animals previously removed from traps or snares (cable device) that may attract raptors or other non-target animals. If an animal carcass could be dragged or moved by scavengers to within 30 feet of set foot-hold traps, snares (cable device), the carcass will be secured to restrict movement (*also WS Directive 2.455, "Scents, Baits, and Attractants"*). These restrictions do not apply to animal carcasses used to attract bear or mountain lion to approved capture devices.*
h.	*The use of foot-hold traps and spring activated leg snares (cable device) must incorporate pan-tension devices as appropriate to prevent or reduce the capture of non-target animals, unless such use would preclude capture of the intended target animals.*
i.	*Foot-hold traps with inside jaw spread greater than 5 ½ inches, when used in restraining sets, are limited to types with smooth, offset jaws that may or may not be laminated or to padded-type jaws. Foot-hold traps with teeth or spiked jaws are prohibited. WS Regional Director may authorize use of modified jaw protrusions on traps for the purpose of reducing injuries to target animals.*
j.	*If it is necessary to use foot-hold traps or snares (cable device) under fence lines, reasonable efforts to be taken to obtain approval from adjacent landowners where applicable; judgment should be used to avoid capture of livestock and other domestic animals.*
k.	*The use of break-away locks or stops is encouraged when livestock, deer, or other large animals may be exposed to snare (cable device) sets.*
l.	*Capture devices should be set to minimize visibility of captured animals.*
m.	*Foot-hold traps (long-spring or coil spring) will not be used to take bear.*

A3. Use of Firearms

WS Directive 2.615: WS Firearm Use and Safety

a.	All WS-Arizona use, storage, and transportation of explosives will be in compliance with applicable Federal, state, and local laws and regulations, employees will be trained and certified per WS Directive 2.615 "Firearms Use and Safety" and WS Directive 2.625 "Pyrotechnics, Rocket Net Charges and Incidental Explosive Materials" and its Attachment 1 for safe and secure storage and transportation of the materials.
b.	*Shooting a firearm, projectile or pyrotechnic out of a vehicle is permitted as long as the firearm or device is not loaded (a cartridge in the chamber) until the muzzle is safely out of the window of the vehicle and a clear line of fire is established. The muzzle of the firearm or device may not be retrieved back into the vehicle until the device has no live round in the chamber.*
c.	*Whether a firearm is being stored in an office, vehicle, home, camp, or any other location, the maximum level of security available should be employed. Security devices may range from gun safes, vaults, locking gun racks, to cables through the receiver or frame opening locked to an immovable object.* All firearm storage will be per this Directive.
d.	*All WS personnel, regardless of employment status, and official volunteers who are required or requested to use firearms in the conduct of official duties must adhere to all basic rules of firearm safety, and will be provided firearm safety and handling training per the WS Firearms Safety Training Manual. Aerial crewmember training will consist of instruction from the WS Firearm Safety Training Manual as well as additional specialized instruction that may be contained in the WS Aviation Operations Manual, the WS Aviation Safety Program Manual, and the WS Aerial Operation Crew Member Training Manual.*

A4. Use of Explosive Materials

WS Directive 2.625: Pyrotechnics, Rocket Net Charges, and Incidental Explosive Materials

a.	*All WS use, storage, and transportation of explosives will be in compliance with applicable Federal, state, and local laws and regulations. Employees assigned to use pyrotechnic pistols or other launching devices will receive safety training in their use as required by WS Directive 2.615 "Firearms Use and Safety."*
b.	All storage and transportation of pyrotechnics, rocket net charges and incidental explosive materials will be conducted per the standards in Attachment 1 of WS Directive 2.625.
a.	*All WS use, storage, and transportation of explosives will be in compliance with applicable Federal, state, and local laws and regulations. Employees assigned to use pyrotechnic pistols or other launching devices will receive safety training in their use as required by WS Directive 2.615 "Firearms Use and Safety."*

b.	All storage and transportation of pyrotechnics, rocket net charges and incidental explosive materials will be conducted per the standards in Attachment 1 of WS Directive 2.625.
a.	*All WS use, storage, and transportation of explosives will be in compliance with applicable Federal, state, and local laws and regulations. Employees assigned to use pyrotechnic pistols or other launching devices will receive safety training in their use as required by WS Directive 2.615 "Firearms Use and Safety."*

A5. Use Hazardous Materials and Pesticides

WS Directive 2.465: Accountability and Oversight of Hazardous Materials and Pesticide Use
WS Directive 2.401: Pesticide Use

a.	*During the fiscal year, at least one annual physical inventory will be conducted by the hazardous material user and one reviewing official (i.e., District Supervisor, Assistance District Supervisor, collateral duty safety officer) designated by the State Director. All hazardous materials discrepancies will be resolved by the pesticide user and/or the reviewing official at the time of the physical inventory, if possible. All discrepancies will be corrected in the MIS CMITS database within 30 days. Some of the subject matter that will be reviewed regarding hazardous materials is as follows: security, storage, warning signs, inventory, receipt and transfer of documentation, handling, disposal of pesticides, I&E [immobilization and euthanasia] drugs, pyrotechnics, etc.* (WS Directive 2.465)
b.	*WS activities will be in compliance with applicable Federal, State, Tribal, and local laws and regulations pertaining to pesticides, including application, certification, storage, transportation, shipment, disposal, and supervision, or when recommending the use of restricted-use pesticides. Restricted use pesticides used or recommended by WS personnel must be registered by the US Environmental Protection Agency (EPA) and the appropriate State regulatory agency.* (WS Directive 2.401)
c.	*For field applications, where other decontamination equipment of sufficient quantity and type is not readily available, WS personnel must carry a decontamination kit containing at least one quart of water, coveralls, disposal towels, and soap. Incidents and/or accidents resulting from the use of pesticides must be immediately reported to the appropriate supervisor and the WS Safety and Health Council. The WS Safety and Health Council is responsible to investigate and/or coordinate the investigation of any incident or accident related to the use of pesticides. WS personnel are required to report to the State Director, any knowledge of adverse incidents involving APHIS registered products.* (WS Directive 2.401)
d.	All storage, transportation, inspections, training, and emergency procedures will be conducted according to WS Directive 2.401 Attachment 1. (WS Directive 2.401)

A6. Use of M-44s

WS- Arizona personnel will abide by WS Directive 2.415, and the EPA label when using M-44s.

A7. Translocation of Wildlife

WS Directive 2.501: Translocation of Wildlife

a.	*Translocation of wildlife from one geographic area to another may be conducted by WS personnel as a wildlife damage management activity when: a. Such activities are in accordance with the policies of regulating state and/or Federal wildlife management agencies. b. Such activities are in accordance with all applicable Federal, State, and local laws and regulations.*
b.	*Primary factors influencing translocation include availability of suitable habitat, impact (competition, predation, etc.), on the animals(s) to be moved as well as other species, the likelihood of animal returning, public attitudes, and potential for creating a damage/conflict situation at the new location.*

A8. Disposal of Carcasses

WS Directive 2.515: Disposal of Wildlife Carcasses and Furs
WS Directive 2.510: Animal Parts and Edible Meat

a.	All wildlife carcasses, whether in whole or part, will be disposed of consistent with Federal, State, county, and local regulations and WS Directive 2.210 "Compliance with Federal, State, and Local Laws and Regulations". Animals euthanized with drugs that may pose secondary hazards to scavengers must be disposed of according to Federal, State, county, and local regulations, drug label instructions, or lacking such guidelines, by incineration or at a landfill approved for such disposal. (WS Directive 2.515)
b.	Wildlife carcasses may be discarded on the property where they were killed or recovered, or deposited on another cooperator's property if approved by the respective property owner. Carcasses may be composted following Federal, state, and local laws. Wildlife carcasses or parts may be disposed of at approved public or private landfills where such facilities are approved for animal disposal. Carcasses shall not be deposited in roadside or commercial business dumpsters unless prior approval to do so has been obtained from the dumpster owner or lessee. Carcasses shall not be disposed of in household trash containers. Wildlife carcasses may be incinerated in approved facilities that comply with Federal, State, and local regulations. Open burning should be avoided due to potential fire hazards except when this method is required by regulations and can be conducted safely. All disposals will be made in a manner which demonstrates WS' recognition of public sensitivity to the viewing of wildlife carcasses. (WS Directive 2.515)
c.	*Furs, animal parts, or edible meat may be donated, salvaged, sold, or transferred when authorized by the State Director, in compliance with existing cooperative agreements, Memoranda of Understanding, and all applicable Federal, State, and local laws and regulations. Refer to WS Directive 2.510 "Fur, Other Animal Parts, and Edible Meat" for guidelines.* (WS Directive 2.515)
d.	*Feathers, claws, or other animal parts (except eagle parts and parts from the Federal*

	and State listed threatened or endangered species) may be donated or transferred to Native Americans for ceremonial or religious purposes, or to universities, museums, State wildlife agencies, or other reputable organizations for use in scientific or educational purposes. Donating, transferring or transporting protected species will be coordinated through the State Director and cleared with the State wildlife agency, and in cases involving Federally protected species, with the USFWS. WS personnel or family members, close relatives or acquaintances may not benefit from any animal(s), in whole or in part, taken by WS personnel while conducting official duties. This includes but is not limited to, edible meats, fur, or valuable animal parts. Animal parts commonly used for making scents, baits, lures, and attractants, are excluded. (WS Directive 2.510)

A9. Immobilization and Euthanasia

WS Directive 2.505: Lethal Control of Animals [Euthanasia]
WS Directive 2.430: Chemical Immobilization and Euthanizing Agents [I&E]

a.	*WS personnel will exhibit a high level of respect and professionalism when taking an animal's life, regardless of method. WS personnel will be familiar with the methods described in the current AVMA Guidelines for Euthanasia, and those methods will be used to euthanize captured or restrained animals, whenever practicable. In free-ranging wildlife, the AVMA recommends methods "be as age-, species-, or taxonomic/class-specific as possible." WS personnel will use methods appropriate for the species and conditions.* (WS Directive 2.505)
b.	*When euthanizing a captured or restrained animal, death of the animal must be confirmed; death should be confirmed in free-ranging wildlife when carcass recovery is possible. Confirmation can be achieved by the absence of a blinking response when the cornea is touched and by monitoring heart rate and respiration for a period of time long enough to confirm death.* (WS Directive 2.505)
c.	All WS-Arizona personnel requiring use of immobilization and euthanizing drugs must comply with WS Directive 2.430 "Controlled Chemical Immobilization and Euthanizing Agents", including full training and certification. *WS personnel using I&E drugs must receive training approved by the WS I&E Committee prior to independent use of possession of I&E drugs*. (WS Directive 2.430)
d.	*Only I&E drugs approved by the WS I&E Committee can be used by WS personnel, unless under emergency situations.* [Note: Attachment 2 of WS Directive 2.430 lists the approved I&E drugs.] *In emergency situations, unapproved I&E drugs can be used on a one-time or limited basis by WS personnel when approved by an attending/consulting veterinarian and the State director or designee, provided that such use is in compliance with all applicable laws.* (WS Directive 2.430)

A10. Wildlife Hazards to Aviation

WS Directive 2.305: Wildlife Hazards to Aviation

a.	*WS-Arizona personnel working at airports with WS agreements will notify the appropriate civil or military airport authorities as soon as practicable when imminent wildlife hazards to aviation are observed.*
b.	*WS-Arizona managers will ensure that WS personnel working at aviation facilities are provided with appropriate training and certifications commensurate with the responsibilities of their positions.*

A11. Training for Aerial Operations

WS Directive 2.620: Required Training for Aerial Operations

a.	*All WS' aerial operations and safety activities, including training and maintenance, will be conducted in strict compliance with the WS Aviation Operations and Safety Manual;,the Federal Aviation Regulations (FAR), the Fish and Wildlife Act of 1956 (Airborne Hunting), any applicable State and local laws and regulations, individual WS State and WS National Wildlife Research Center program Aviation Safety Plans, Aviation Communication Plan, and Aviation Emergency Response Plans. All pilots, crewmembers, ground crews, and aircraft maintenance personnel will adhere to the WS Aviation Operations and Safety Manual and its amendments, Title 14 Code of Federal Regulations (CFR) and FAR Part 43, 61, 91, 119, 133, 135, and 137. No aircraft shall be used in WS activities (either through contract, agreement, or volunteer) that have not been approved through the office of the WS national Aviation Coordinator (NAC), except for military transport and commercial travel purposes.*

A12. Personnel Safety

WS Directive 2.601: Safety [of WS personnel]
WS Directive 2.635: Zoonotic Diseases and Personal Protective Equipment

a.	*WS supervisors will promote a safe working attitude among employees. Supervisors will identify hazards, including wildlife-borne diseases, in advance of work assignments. Supervisors will also provide employees with adequate information, training, and personnel protective equipment to optimize employee safety.* (WS Directive 2.601)
b.	*WS personnel will adhere to safety requirements and use appropriate personal protective equipment provided for assigned work. Employees are required to immediately report unsafe working conditions to their supervisor and work cooperatively to minimize hazardous working conditions.* (WS Directive 2.601)
c.	*WS personnel are advised to alert their physician that they may be exposed to wildlife-borne diseases. Serious diseases including rabies, hantavirus, plague, Lyme disease, psittacosis, Clamydia psittaci, or histoplasmosis may be misdiagnosed unless the*

	physician is aware of the possibility of exposure. (WS Directive 2.601)
d.	*WS personnel will be provided with a Physicians Alert Card (APHIS Form 260 or APHIS Form 260A) which identifies a number of the more significant zoonotic diseases personnel are likely to encounter. Personnel will use the Physician's Alert Card when conferring with their physician about any illnesses or suspicious symptoms. Physical injury events such as animal scratches or bites (including embedded ticks) should be reported to the supervisor as soon as possible and documented within 30 days on a US Department of Labor Form CA-1…If an employee experiences signs or symptoms of a suspected work-related illness, zoonotic disease, or parasitic infection/infestation, the employee should notify their supervisor as soon as possible and seek medical attention for a diagnosis and confirmation from a physician that the condition is in fact work-related.* (WS Directive 2.635)
e.	*All WS personnel who handle or are exposed to wildlife, biological samples, or equipment used to handle or process animals or biological materials will be provided disease safety, biosecurity, and PPE training as prescribed in the WS Biological Risk Management Training Manual. Specific PPE requirements will vary among positions and the specific duties of personnel. All PPE supplies (e.g. gloves, safety glasses, DEET) will be routinely monitored and supplemented or replaced as necessary.* (WS Directive 2.635)

A13. Livestock Guarding Dogs

WS Directive 2.440: Livestock Guarding Dogs

a.	*All WS field personnel will be knowledgeable in the use and application of livestock guarding dogs. WS field personnel will assist producers who may be interested in using livestock guarding dogs by providing information and/or referring them to a WS guarding dog specialist for further assistance. Livestock guarding dogs are generally owned and managed by the livestock producer and are recognized by WS as useful for reducing predation.*
b.	*WS personnel must be cautious when working near or around guarding dogs to minimize potential hazards from applied management methods.*

A14. Use of Trained Dogs

WS Directive 2.445: Use of Trained Dogs in WS Activities

a.	*It is WS policy that trained dogs shall only be used by authorized personnel, including volunteers and contractors, to conduct specific WS functions. It is permissible for WS personnel to use employee-owned or government-owned trained dogs in accomplishing WS missions where it is safe and legal to do so. Government-owned and employee-owned trained dogs should accompany the WS employee/handler on official duty only when there is an operational need.*
b.	*Use of contract or volunteered dogs (e.g. dogs not directly owned by WS or its*

	employees) will be approved on a case-by-case basis by the applicable State Director. In such instances, the contracted or volunteer dog-handler must sign a form acknowledging that they will abide by WS Directive 2.445. In such instances the dog-handler must follow WS' guidelines and a WS employee must accompany the contract/volunteer dog handler throughout the operation.
c.	*Dogs will not be allowed to intentionally kill animals. When the objective is removal, animals will be euthanized as quickly as possible via mortal gunshot. Mortal gunshot is the only approved means of euthanasia.*
d.	Functions performed by trained dogs: wildlife hazing away from property or other resources; target animal detection to determine if further action is warranted; animal retrieval; decoying target wildlife into shooting range; trailing target animals to facilitate live capture or lethal removal.
e.	*WS personnel shall not allow trained dogs to have physical contact with or in any way attack, bite, or kill animals that are restrained in a trap or any other device. When trained dogs are used, handlers will be at the site of encounters between animals and dogs as soon as possible to minimize stress and reduce potential injury. If WS personnel are unable to prevent a trained dog from repeatedly making contact with a restrained animal, WS personnel must immediately intervene and discontinue use of that dog.*
f.	*WS personnel shall ensure a dog-in-training is muzzled and controlled on a leash when it is near a restrained animal. If the dog-in-training attacks or attempts to attack a restrained animals, WS personnel must immediately stop the interaction. WS personnel must discontinue use of dogs-in-training that repeatedly attempt to physically contact restrained animals.*
g.	*WS personnel shall ensure trained dogs used in wildlife damage management activities receive housing, food, water, medical care, and are properly licensed and vaccinated according to state and local laws. WS personnel shall ensure dogs are provided a safe transport box. The box shall provide enough shade and ventilation during warm months to keep dogs cool. During cool months, insulation and/or reduced ventilation shall be used to keep dogs comfortable.*
h.	*Dog handlers shall control or monitor their trained dogs at all times. A trained dog is considered under control when the dog responds to the command(s) of the dog handler by exhibiting the desired or intended behavior as directed. Dog handlers shall ensure trained dogs to not pose a threat to humans or domestic animals, or cause damage to property. Further, dog handlers (whether WS personnel or contractors) shall employ as needed various methods and equipment to monitor and/or control dogs, including but not limited to: muzzles, protective vests and collars, electronic training collars, harnesses, leashes, whistles, voice commands, global positioning system (GPS), telemetry collars, identification collar/contract information.*

A15. Feral, Free-Ranging, and Hybrid Dog Management

Directive 2.340: Feral, Free-Ranging and Hybrid Dog Damage Management WS

a.	*Where WS personnel determine that a captured dog is a pet, WS-Arizona personnel shall inform the land/resource owner as soon as is practicable.*
b.	*In urban areas where local animal control officers exist, WS personnel shall collaborate with them to determine if WS action is necessary to solve the property or human health and safety problem associated with feral, free-ranging, or hybrid dogs. If WS action is necessary and requested by the local authority, WS personnel must achieve/conduct the following: (1) Written approval of the WS Regional Director; (2) Notification to the WS Deputy Administrator; and (3) Written request from the State, local or tribal authority with jurisdiction over feral, free-ranging, or hybrid dogs, if such local authorities with jurisdiction exist. WS personnel shall ensure that written requests for assistance include: (1) a statement of the problem; (2) the location and time frame for WS activities; and (3) sufficient details regarding the scope of the assistance requested.*

A16. Tribal Government-to-Government Consultations

WS Directive 1040.3: Tribal Government-to-Government Consultations

a.	T*his Directive implements Executive Order (EO) 13175 ["Consultation and Coordination with Indian Tribal Governments."] regarding consultation, collaboration, and coordination with Tribes. APHIS will respect the rights of sovereign tribal governments and provide an opportunity for Tribes to participate in policy and program development. Each Tribe will be provided an opportunity for timely and meaningful government-to-government consultation regarding policy actions that may have tribal implications. This Directive does not preclude APHIS from consulting with a Tribe when the Tribe and the agency agree that consultation may be desirable, even if consultation is not specifically required. To enhance the evolution of working relationships and mutual partnerships between APHIS and Native American governments, the Agency will be flexible. APHIS should accept all requests for consultation; the emphasis must be on accepting opportunities rather than declining. Consultation does not require APHIS to do everything a tribal representative requests, but rather requires the agency to take the Tribes' views, information, rights, and interests into serious deliberative consideration. Consultation should be part of an effort to cooperate and collaborate in good faith with tribal partners.*

A17. Federally Threatened and Endangered Species

WS Directive 2.310: Endangered and Threatened Species

Please see previous sections of Part A for relevant APHIS-WS Directives related to capture, use of chemicals, carcass disposal, and firearm use and safety that could also minimize the risk of adversely affecting Federally-listed threatened and endangered species.

a.	*WS will conduct its activities to minimize impact on any federally listed endangered or threatened species or adversely modifying listed critical habitat.*

b.	*WS State Directors will assure that all of their WS personnel (Federal and non-Federal) are familiar with the requirements of Section 7 of the Endangered Species Act, as amended. WS personnel will also be familiar with Section 7 biological opinions on listed species potentially impacted by their wildlife damage management activities.*
c.	*WS State Directors will initiate consultation with the US Fish and Wildlife Service (FWS) if new damage management programs, new methods, or newly listed species result in the potential for adverse impacts.*
d.	*During routine work activities, incidents involving impacts on listed species will be reported by WS field personnel within 24 hours to the appropriate WS supervisor.*
e.	*Unless otherwise authorized, the location of dead or seriously injured listed species will be immediately reported to the appropriate FWS Law Enforcement Office and State wildlife representative.*
f.	*When endangered species are responsible for causing damage, the WS State Director will work with the FWS to determine if acceptable solutions for controlling damage can be agreed upon and implemented.*
g.	*When a managing agency (Federal, state, tribal) requests WS assistance in protecting listed species or controlling damages caused by listed species, the requesting agency will bear responsibility for funding the work. The WS State Director will coordinate with appropriate Federal, state, and local agencies to arrange funding and determine acceptable control procedures.*

3.3.2. Formal and Informal Consultations with the USFWS for Arizona

WS-Arizona conducts consultations with the USFWS per Section 7 of the Endangered Species Act for effects of all WS-Arizona activities on federally-listed threatened and endangered species. The effects analyses and findings pertinent to this EA on federally-listed species based on consultations completed on June 22, 1999 (1999 BO Jaguar), June 27, 2017 (2017 BO Ocelot) and July 25, 2011 (2011 BO Mexican wolf). On March 13, 2018, the USFWS issued a new Biological Opinion and completed the section 7 formal consultation on the Wildlife Service's WDM program for all of the other T&E species not not coveren in previously mentioned BO's occurring in Arizona. WS-Arizona will closely follow conservation measures outlined in its ESA consultation documents to minimize the risk of take of listed species. WS-Arizona will consult with the USFWS as required to maintain compliance with the ESA for WS-Arizona activities. The following list of measures from the informal and formal ESA consultation documentation addresses only those methods appropriate for terrestrial PDM activities for target species within the scope of this EA. Measures for the protection of other T&E species developed as part of the Section 7 Consultation process with USFWS is included in this EA.

B1. Reasonable and Prudent Measures from the 1999 Biological Opinion (BO) for WS-Arizona Effects on the Jaguar

The USFWS Biological Opinion for Jaguars, based on the WS-Arizona Biological Assessment dated June 22, 1999, requires use of the following reasonable and prudent measures, terms and conditions, and reporting or program activities within jaguar occupied range where Jaguars are federally listed as endangered. WS-Arizona has reinitiated consultation on jaguar with USFWS and received concurrence on February 24, 2005 from the USFWS, that recent sightings do not warrant reinitiation of consultation of the 1999 BO because the four reintiation criteria, as defined in 50 CFR 402.16, were not triggered.

Occupied Jaguar range is defined as: Occupied range of the jaguar shall be defined by the geographic boundaries of the Sierra Madrean archipelago within Arizona and New Mexico, and include all lands within the Arizona counties of Cochise and Santa Cruz, and Pima east of Organ Pipe Cactus National Monument, Pinal east of State highway 77 south of the Gila River, and Graham and Greenlee south of the Gila River, and in New Mexico, Hildago County. Occupied habitat of the jaguar shall be considered to include all areas as defined by the occupied range with the exception of urban areas, and agricultural/grassland habitats which are further than three miles from the base of major mountain ranges and one mile from major riparian corridors. WS-Arizona and USFWS will jointly develop maps to delineate these areas. If/when jaguar reports from other areas are substantiated, WS-Arizona will coordinate with USFWS to redefine this definition of occupied jaguar habitat. Any proposed action involving use of non-selective control devices not specifically allowed through the Terms and Conditions of this biological opinion which may occur within the areas defined as occupied habitat of the jaguar would require a site-specific consultation.

1.	All animal damage control activities of this program within the occupied range of the jaguar will be conducted in such a manner so as to minimize any risk to the jaguar.
2.	All WS-Arizona cooperators within the occupied range of the jaguar will be informed by WS-Arizona of the status of the jaguar and the specifics of its protection under the Act.
3.	All appropriate permits will be obtained prior to any predator control activities.
4.	WS-Arizona will investigate reports of any and all, observations of jaguars or signs of jaguar presence in the general vicinity (50 miles) of any active WS-Arizona animal control activities which may affect the jaguar, in cooperation with the appropriate State wildlife agency and Jaguar Conservation Team. WS-Arizona will provide USFWS with a report of such investigations as well as any animal control activities conducted by WS-Arizona within occupied habitat of the jaguar.
5.	All WS-Arizona employees that may be expected to conduct activities which may affect jaguars will receive adequate training.
TERMS AND CONDITIONS In order to be exempt from the prohibitions of section 9 of the Act, WS-Arizona must comply with the following terms and conditions in regards to the proposed action. These terms and conditions implement the reasonable and prudent measures described above. Terms and conditions nondiscretionary. The following terms and condition implements reasonable and prudent measure number one:	
1a.	Animal damage control activities which may possibly adversely affect the jaguar authorized by WS-Arizona within the occupied range of the jaguar shall require identification of the target animal to species before control activities are carried out. If the identified animal is a jaguar, that animal shall not be subjected to any control actions; and USFWS and appropriate State wildlife agency contacted immediately.
1b.	Within the occupied range of the jaguar, leghold traps shall be restricted to rubber-padded (or equivalent) traps with a jaw spread equivalent to a #3 Victor or smaller. Trapping

	within <u>occupied habitat</u> of the jaguar shall only be conducted on a limited, case-by-case basis. USFWS shall be notified by WS-Arizona prior to the use of traps within <u>occupied habitat</u> of the jaguar. All traps within <u>occupied habitat</u> are to be checked daily, and the WS-Arizona Specialist must have appropriate equipment on-hand to release a jaguar unharmed. The daily check requirement can be met by use of remote transmitters that signal whether a trap has been sprung.
1c.	The use of neck snares within the <u>occupied range</u> of the jaguar shall not include occupied habitat of the jaguar, and shall be limited to agricultural/grassland habitats only, avoiding riparian corridors.
1d.	If, within <u>occupied habitat</u> of the jaguar, a mountain lion or black bear is the offending animal, dogs will be a first choice if conditions are appropriate, to target the animal rather than less selective methods of control. If a jaguar is inadvertently chased and/or treed by the dogs, the dogs shall be called off immediately once it is realized the animal is a jaguar.
1e.	Foot snares shall only be used within <u>occupied habitat</u> of the jaguar on a limited, case-by-case basis. USFWS shall be contacted by WS-Arizona prior to the use of foot snares within <u>occupied habitat</u>. Foot snares shall only be used at confirmed lion or bear kills at fresh prey remains. When foot snares are used in <u>occupied habitat</u> they must be checked daily, and the WS-Arizona agent must have appropriate equipment on-hand to release a jaguar unharmed. The daily check requirement can be met by use of remote transmitters that signal whether a trap has been sprung.
1f.	The use of M-44s within the <u>occupied range</u> of the jaguar shall not include <u>occupied habitat</u> of the jaguar, shall be limited only to agricultural/grassland habitats avoiding riparian corridors, and shall be baited only with fetid meat attractants (which felids generally avoid).
1g.	If the presence of a jaguar is confirmed within the vicinity (50 miles) of on-going or planned animal control activities, WS-Arizona shall immediately contact USFWS to review what control activities are being implemented where, and if additional measures are necessary to protect the jaguar.
1h.	If any WS-Arizona activities results in the capture, injury, or death of a jaguar, USFWS and appropriate State wildlife agency must be contacted immediately, and all WS-Arizona activities using similar capture methods within the occupied range of the jaguar must be immediately curtailed while consultation with USFWS is reinitiated. If a jaguar is inadvertently captured, the WS-Arizona agent, using best professional judgment, should determine the condition of the animal (giving special attention to weather conditions, potential for heat stress, and any injuries) and if the jaguar is in eminent threat of further injury or mortality, it shall be immediately released. If the jaguar appears in satisfactory condition, the WS-Arizona agent shall immediately initiate communication to the Arizona Game and Fish Department, Service, and New Mexico Department of Game and Fish as appropriate, to ascertain expected response time for personnel permitted to tranquilize and radio-collar the jaguar (as provided for under the Jaguar Conservation Strategy). If this response time would require the animal to be confined for a period of more than 24 hours, result in additional injury, or threaten its life, the jaguar is to be released immediately.
The following term and condition implements reasonable and prudent measure number two:	

<table>
<tr><td>2a.</td><td>WS-Arizona cooperators within the occupied ramie of the jaguar shall be informed by WS-Arizona by letter that take of jaguar, including harm, injury, and harassment, is prohibited under the Act and could result in prosecution. Also, provide information, as available, on the identification of jaguar sign, and other information regarding the conservation of the species.</td></tr>
<tr><td colspan="2">The following term and condition implements reasonable and prudent measure number three:</td></tr>
<tr><td>3a.</td><td>Any animal damage control activities authorized or carried out by WS-Arizona shall be conducted only after all appropriate permits (e.g., Federal, State, or other) have been obtained.</td></tr>
<tr><td colspan="2">The following term and condition implements reasonable and prudent measure number four:</td></tr>
<tr><td>4a.</td><td>WS-Arizona, in coordination with USFWS and, if possible, the Jaguar Conservation Team and appropriate State wildlife agency, shall as soon as practical (but within three days) investigate all credible reports of jaguars within the vicinity (50 miles) of any active animal control activities which may affect the jaguar. The investigations shall include appropriate field collection of data. WS-Arizona is encouraged to coordinate these investigation with the appropriate State wildlife agency and Jaguar Conservation Team, and use the procedures for investigating observations and possible depredation by jaguar developed under the Jaguar Conservation Strategy. Any access to private land in order to complete an investigation shall require the permission of the land owner. The investigation and reporting to USFWS may be accomplished through the cooperative efforts of the Jaguar Conservation Team.</td></tr>
<tr><td>4b.</td><td>WS-Arizona will cooperate with USFWS and, if possible, the Jaguar Conservation Team and appropriate State wildlife agency, to investigate any reports of jaguars in occupied range. The investigation and reporting to USFWS may be accomplished through the cooperative efforts of the Jaguar Conservation Team.</td></tr>
<tr><td>4c.</td><td>A detailed report of each jaguar observation investigation conducted by WS-Arizona shall be provided to USFWS and the Jaguar Conservation Team within 30 days of the occurrence of each incident.</td></tr>
<tr><td>4d.</td><td>An annual monitoring report shall be submitted to USFWS by December 31 of each year, covering the previous fiscal year (October through September), detailing any and all animal damage control activities conducted within occupied habitat of the jaguar.</td></tr>
<tr><td colspan="2">The following term and condition implements reasonable and prudent measure number five:</td></tr>
<tr><td>5a.</td><td>All WS-Arizona employees who conduct PDM activities within occupied range of the jaguar shall be trained by experienced personnel to identify jaguars and jaguar sign, on procedures for recording and reporting jaguar observations, on appropriate release techniques for jaguars which may be caught in snares or traps, and on identification of livestock depredations that may be caused by jaguars. Training will be conducted in coordination, if possible, with the appropriate State wildlife agency and Jaguar Conservation Team. Updated training will be conducted as new information on the jaguar becomes available.</td></tr>
<tr><td colspan="2">USFWS believes that not more than one jaguar will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. With the implementation of the terms and conditions contained in this</td></tr>
</table>

biological opinion, USFWS does not expect that WS-Arizona activities will result in mortality of a jaguar. If, during the course of the action, the permitted level of incidental take is met or exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. WS-Arizona must immediately provide an explanation of the causes of the taking and review with USFWS the need for possible modification of the reasonable and prudent measures.

B2. Conservation Measures from the 2017 Biological Opinion (BO) for WS-Arizona Effects on the Ocelot

The USFWS Biological Opinion for Ocelots, based on the WS-Arizona Biological Assessment, dated June 27, 2017 requires use of the following reasonable and prudent measures, terms and conditions, and reporting or program activities within ocelot occupied habitat where ocelots are federally listed as threatened or endangered.

Occupied ocelot habitat in Arizona is defined as: Those portions of Game Management Units (GMUs) within the San Pedro Watershed (30B, 31, 32, 33, 34B, 35A, 35B) plus the following GMUs outside of the San Pedro Watershed (24A, 24B, and 37B).

The FWS believes the following conservation measures are necessary and appropriate to minimize impacts of incidental take of ocelot.	
1.	WS-Arizona will assist the USFWS and appropriate Federal and State agencies by maintaining interagency coordination and information exchange through reporting ocelot occurrences; having discussions about potential ocelot habitat; and reducing the potential for incidental take of ocelot. .
2.	WS-Arizona will implement specific measures and adjusting WDMP activities in identified areas likely to be occupied by ocelots in coordination with FWS.
"Potentially occupied ocelot areas" (a term used throughout these conservation measures), which includes ocelot habitat and travel corridors, is or will be identified on maps developed between the FWS and Wildlife Services.	
The following conservations will be implemented to minimize impacts to ocelots	
1. COORDINATION	
a.	Wildlife Services will maintain regular (at least annual or more frequent) coordination with the local FWS offices in Arizona and Texas, and other appropriate Federal and State agencies, to stay updated with information on new ocelot records, possible travel corridors, and revised maps of potentially occupied ocelot habitat/areas from FWS, to reduce the likelihood of impacts to ocelots as a result of the proposed action. Wildlife Services and FWS will review the maps of potentially occupied areas (Appendix A) during annual coordination meetings (or more frequently, if needed, based on ocelot detections in previously unoccupied areas) and update the maps, as needed. Updated contact information will be regularly exchanged between FWS and Wildlife Service.
b.	To further reduce risk to ocelots, Wildlife Services will notify and coordinate with the appropriate FWS office prior to conducting WDMP activities in areas where the likelihood of ocelot presence is highest based on the most recent records available at the time.
2. READINESS	

a.	Wildlife Services personnel who conduct WDMP activities in potentially occupied ocelot areas will be professionally knowledgeable in identification of ocelots, their preference and use of habitat, and their sign.
b.	When working in potentially occupied ocelot areas, Wildlife Services will always have equipment necessary to release ocelots properly to minimize harm to animals.
3. UNINTENDED OCELOT CAPTURE:	
a.	If unintended capture occurs, Wildlife Services will immediately contact the FWS Ocelot Species Recovery Biologist, and after coordination with FWS, remove the animal from the capture device and release the animal on-site as soon as it is deemed safe for the animal. If FWS cannot be reached, Wildlife Services will act in the best interest of the captured animal. In Arizona, Wildlife Services may use chemical and physical restraints to remove ocelots from foot-hold traps and snares, if needed for the safety of the ocelot. This will be done in accordance with the handling protocol established by Shindle and Tewes (2000) (attached to this biological opinion), or with a protocol developed cooperatively by FWS and Wildlife Services.
b.	In all instances of ocelot capture, Wildlife Services will obtain coordinates and photographs of both sides of the ocelot, if possible without risking human or ocelot safety, and provide them to the FWS. In the case of physical or chemical restraint in Arizona, Wildlife Services will, if possible, take hair samples and buccal swabs (only with chemical restraint) and provide them to the FWS.
4. REPORTING	
a.	Reporting observation or incidental take of ocelots. Wildlife Services will report any observation of ocelot or ocelot sign (tracks, scat, etc.) to the local FWS office within 24 hours, unless Wildlife Services sees or suspects the ocelot has sustained an injury that may be life-threatening without immediate veterinary attention. If an ocelot has sustained an injury, Wildlife Services will take immediate steps to report the incident to the local FWS office and proceed under its direction. If FWS cannot be reached immediately, a veterinarian will be contacted to treat the injured animal or provide guidance to Wildlife Services to treat the animal. Wildlife Services will report incidental take (e.g. capture, chase, treeing, etc.) of ocelots to the local FWS office as soon as possible. Wildlife Services will report the cause of incidental take, if known, and submit other relevant information (e.g. coordinates of the incident, photographs of both sides of the animal). Ocelot carcasses (including road mortalities) will be reported, and if it can be done so safely, should be collected and transported to the local FWS office (or properly stored until the animal can be transferred to FWS) for scientific and investigative purposes. Adequate photo documentation will be obtained and included as part of any reporting incident (of ocelot sign, observation, or incidental take).
b.	Annual reports. Wildlife Services will provide FWS (the appropriate Arizona and Texas FWS Offices) with an annual report summarizing information on relevant WDMP projects (specific information to be included in the report will be agreed upon by the respective Wildlife Services and FWS offices in each state during the annual meeting) that occurred within potentially occupied ocelot areas, as well as a summarization of any observation of ocelots or ocelot sign and incidental take of ocelots, if applicable.
5. THERMAL SAFETY: Wildlife Services will use techniques to reduce the risk of thermal impacts to ocelots in potentially occupied ocelot areas.	

a.	Traps will be set in the shade when needed to reduce the risk of heat stress to animals. Other techniques will be used as needed to reduce thermal stress as needed (for example, closing traps in high temperatures).
6. TRAP CHECK TIMES and METHODS	
a.	Wildlife Services will check all traps daily between sunrise and five hours after sunrise (or sooner if threat of exposure is of concern, based on best professional judgement of Wildlife Services) within potentially occupied ocelot areas.
b.	Wildlife Services primarily check traps in person, however, the daily check requirement can be met by use of remote transmitters that signal whether a trap has been sprung.
7. PROHIBITIONS and RESTRICTIONS: Within potentially occupied ocelot areas, Wildlife Services will:	
a.	Restrict use of neck snares. Neck snares, including collarums, can be used if the snare includes a stop (or other mechanical specification) that would prevent the capture of an ocelot.
b.	Restrict the use of foot-hold traps to padded-jaw foot-holds with pan tension devices. Pan tension will be set with an implementing force of greater than 6 pounds. Foot-hold traps will not be set with the intent to catch felids (cats) or with felid specific baits, lures or other attractants in potentially occupied ocelot areas.
c.	Restrict the use of foot snares to confirmed lion or bear kills at fresh prey remains from livestock depredations, or in cases of human health and safety.
d.	Not use M-44 devices.
e.	Not use live birds as bait.
8. EQUIPMENT STERILIZATION	
a.	Wildlife Services will sterilize all trapping and snaring equipment before reuse when any visibly sick (for example, if the animal has mange) target animal is caught.
9. USE OF DOGS	
a.	Within potentially occupied ocelot areas, if a mountain lion or black bear is the offending animal, dogs will be a first choice if conditions are appropriate, to target the animal rather than less selective methods of control. If an ocelot is inadvertently chased and/or treed by the dogs, the dogs shall be called off immediately once it is realized the animal is an ocelot. If possible and can be without risk to human and ocelot safety, the dog handler will photograph the ocelot quickly before calling off the dogs.

B3. Reasonable and Prudent Measures from the July 25, 2011, Mexican Wolf Biological Opinion (BO) for WS-Arizona Effects on the Mexican Wolf

The USFWS Biological Opinion for Mexican wolf, based on the WS-Arizona Biological Assessment dated July 25, 2011, requires use of the following reasonable and prudent measures, terms and conditions, and reporting or program activities within Mexican wolf occupied range where Mexican wolves are federally listed as endangered.

For purposes of the Biological Opinion occupied Mexican wolf range is defined as--
an area of confirmed presence of resident breeding packs or pairs of wolves or area consistently used by at least one resident wolf over a period of at least one month. The Service must confirm or corroborate wolf presence. Exact delineation of the area will be described by:

(1) 5-mile (8 km) radius around all locations of wolves and wolf sign confirmed as described above (nonradio-monitored); (2) 5-mile (8 km) radius around radio locations of resident wolves when fewer than 20 radio locations are available (for radio-monitored wolves only); or (3) 3-mile (4.8 km) radius around the convex polygon developed from more than 20 radio locations of a pack, pair, or single wolf acquired over a period of at least 6 months (for radio-monitored wolves).

Implementation Procedures	
1.	WS-Arizona shall coordinate WDM Program activities to reduce the likelihood of impact to the species by contacting the USFWS New Mexico Ecological Services Field Office (NMESFO), the USFWS Mexican wolf Recovery Program Coordinator, the Mexican Wolf Interagency Committee(s), the Mexican Wolf Interagency Field Team, and other appropriate Federal, State, and Tribal agencies prior to conducting WDM Program activities in Mexican wolf range.
2.	WS-Arizona personnel who conduct WDM Program activities in occupied wolf range shall be knowledgeable at a professional level in identification of Mexican wolf, their habitat and use of habitat, and their sign.
3.	WS-Arizona shall release any Mexican wolf inadvertently captured alive, and report the incident to the Interagency Field Team located in Alpine, Arizona and NMESFO within 24 hours, unless: (A) the animal has sustained an injury which appears to be life threatening without veterinary attention; or (B) protocol has been established and agreed to with the NMESFO for handling, marking, radio-collaring, or maintaining such animals in captivity. If an animal sustained a serious injury, WS-Arizona shall take immediate steps to report the incident to the NMESFO and proceed under their direction.
4.	WS-Arizona shall establish a 25-mile radius around the point of any incidental take of a naturally-occurring Mexican wolf. The area shall be treated as occupied Mexican wolf range or habitat until further investigation and surveys can be conducted. WS-Arizona shall cease the activity resulting in the take, as well as all other activities with the potential to incidentally take Mexican wolf in the occupied range, and shall immediately reinitiate consultation with the USFWS.
5.	When conducting PDM activities for species other than Mexican wolves in occupied Mexican wolf range, WS-Arizona shall conduct a daily trap check while using padded jaw traps with a jaw spread equivalent to #3 soft catch or larger or foot or leg snares. Traps shall be equipped with a drag in those cases where there is some question that the stake might not hold a wolf (i.e., loose soil) and connections shall be welded or otherwise securely fastened. All traps have the potential to capture juvenile wolves, and therefore, shall not be used in proximity to occupied dens and rendezvous sites from June 1 to October 1 unless Mexican wolf is targeted for a control action.
6.	WS-Arizona shall not use M-44 devices, LPCs, and neck snares without break away devices in occupied Mexican wolf range unless approved on a case-by-case basis by the USFWS or the USFWS's designated agent. Neck snares shall not be used near den or rendezvous sites unless they are being used to specifically target Mexican wolf. For the Mexican wolf, M-44 devices, LPCs, and neck snares shall not be used within a 5-mile buffer around pack home ranges or individual tracks or locations (see definition of occupied habitat).
Reasonable and Prudent Measures The USFWS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of Mexican wolf by WS-Arizona personnel	

<table>
<tr><td colspan="2">conducting WDM Program activities outside the boundaries of the Mexican Wolf Experimental Population Area and also within the boundaries of the National Wildlife Refuge System lands and National Park System/National Monument lands located inside the Mexican Wolf Experimental Population Area boundaries.</td></tr>
<tr><td>1.</td><td>WS-Arizona will assist the USFWS and appropriate Federal, State, and Tribal agencies by maintaining interagency coordination and information exchange; and by reporting occurrences, livestock depredations, and incidental take of Mexican wolf.</td></tr>
<tr><td>2.</td><td>WS-Arizona will implement measures and adjust its normal WDM Program activities in occupied Mexican wolf range to minimize incidental take of Mexican wolf in accordance with the terms and conditions below. WS-Arizona' measures and adjustments of WDM Program activities in the southwestern United States will minimize the potential for WDM Program activities to adversely impact the species.</td></tr>
<tr><td colspan="2">Terms and Conditions
In order to be exempt from the prohibitions of section 9 of the Act, WS-Arizona must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.</td></tr>
<tr><td colspan="2">The following terms and conditions implement Reasonable and Prudent Measure #1.</td></tr>
<tr><td>1.</td><td>WS-Arizona shall maintain regular (annual or more frequent) contact and coordination with the USFWS Mexican Wolf Recovery Program Coordinator, Interagency Committee(s), the Mexican Wolf Interagency Field Team, the NMESFO, and other appropriate Federal, State, and Tribal agencies to keep apprised of locations and information on the presence of Mexican wolf.</td></tr>
<tr><td>2.</td><td>WS-Arizona shall report the incidental take of Mexican wolf to the NMESFO, State, and Tribal wildlife agencies within 24 hours. Additional time shall be allowed for remote areas with limited access. Cause of death or injury shall be reported, if known.</td></tr>
<tr><td>3.</td><td>WS-Arizona shall notify the NMESFO and appropriate State and Tribal agencies of any Mexican wolf occurrence.</td></tr>
<tr><td>4.</td><td>WS-Arizona shall notify the appropriate officials, including but not limited to the USFWS Mexican Wolf Recovery Program Coordinator, Interagency Committee(s), the Mexican Wolf Interagency Field Team, and the NMESFO when WS-Arizona has evidence suspecting Mexican wolf predation on livestock or threat to public health and safety.</td></tr>
<tr><td>5.</td><td>WS-Arizona shall provide USFWS with an annual monitoring report of incidental take of Mexican wolf.</td></tr>
<tr><td colspan="2">The following condition implements Reasonable and Prudent Measure #2.</td></tr>
<tr><td>1.</td><td>WS-Arizona shall ensure that personnel implementing WS-Arizona WDM Program activities follow the Implementing Procedures above.</td></tr>
<tr><td colspan="2">The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of the incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. WS-Arizona must immediately provide an explanation of the causes of the taking and review with the USFWS the need for possible modification of the reasonable and prudent measures.</td></tr>
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B4. Conservation Measures from the March 13 2018, Programatic Biological Opinion relative to AZ PDM.

The March 13, 2018 USFWS Biological Opinion for the Programatic WS-Arizona Biological Assessment, requires WS-Arizona to implement conservation measures, terms and conditions, and reporting of program activities as it relates to the WS-Arizona WDM program. This BO covers all of WS-Arizona's program activities including beaver damage management, feral swine damage management, bird damage management, and predator damageme management. For the purpose of this PDM EA: Below is a table of the Conservation Measures taken from the USFWS March 13, 2018 Biological Opinion that are most relavant to the WS-Arizona PDM Program.

Implementation Procedures	
1. Mojave-Desert tortoise	Cross-country travel will be prohibited and driving of WS vehicles will be limited to existing improved roads, unimproved roads, or established (OHV/ORV) vehicle trails. Additionally, WS will set and adhere to a maximum speed limit of 25 miles per hour (mph) for all vehicles on unpaved secondary roads and 15 mph on unimproved roads. These conservation measures will ensure that potential effects to the tortoise from vehicle activities are discountable because the likelihood of crushing a tortoise on existing roads and trails is low. Furthermore, burrows are not located on existing roads or trails; therefore, burrows are not anticipated to be crushed as a result of WS vehicle activities.
2. Mojave-Desert tortoise	WS will use only leg-hold traps and foot snares equipped with under-pan tension devices set for more than four pounds of pressure in areas accessible by desert tortoises which will minimize the potential for tortoises to be trapped. Tortoises are typically not heavy enough to exert enough pressure to trigger a trap set for more than four foot pounds of pressure. Traps without under-pan tension devices will be set above ground a minimum of six inches which will prevent tortoises from being caught in those traps since they are too far off the ground for tortoises to reach. Neck snares will be placed six inches or more above ground level or a stop will be placed on the snare to keep from snaring a desert tortoise. These conservation measures will ensure that potential effects to the tortoise from trap placement are discountable.
3.Sonoran Pronghorn	IF WS conducts WDM activities in the range of the Sonoran pronghorn, WS will contact the Sonoran Pronghorn Recovery Coordinator at Cabeza Prieta National Wildlife Refuge and the Arizona Ecological Services Office (AESO) to coordinate prior to implementation of the proposed activities and ensure the proposed activities will not adversely affect Sonoran pronghorn. Any proposed activities that are likely to adversely affect the Sonoran pronghorn will undergo further section 7 consultation
4. Yuma Ridgway's (Clapper) Rail	Pan-Ttension devices will be used on traps and snares to reduce capture of non-target wildlife.
5. Yuma Ridgway's (Clapper) Rail	Projects involving habitat management where potential rails and/or its habitat could be affected will be discussed with the Service prior to implementation

6. Southwestern Willow Flycatcher and Yellow-billed Cuckoo	WS will contact the Service's southwestern willow flycatcher lead biologist if projects are planned within 0.25 mile of riparian habitat (native riparian trees or mix of native and tamarisk trees) or critical habitat during the April 15 to September 15 breeding season or if the project occurring (at any time of the season) is anticipated to alter habitat quality. WS will contact the Service lead biologist for the western yellow-billed cuckoo if projects are planned within 0.25 mile of riparian habitat (native riparian trees or mix of native and tamarisk trees, mesquite) or Madrean evergreen woodland (oak dominated but may contain riparian species) during the May 15 to September 30 breeding season or if the project occurring (at any time of the season) is anticipated to alter habitat quality.
7. Black-footed ferret	WS will consult with the Service in areas adjacent to the AVEPA, Espee and Double O ranches, and the Navajo Nation prior to conducting WDM activities that may affect ferrets. For the purpose of this consultation, we define "adjacent" as within 6.2 miles (10 kilometers). This distance may be adjusted based on new data, about which WS will be given advanced notice by the Service.
The Conservation Measures outlined in the March 13, 2018 USFWS BO, with their implementing terms and conditions, are designed to minimize the impact of the incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. WS-Arizona must immediately provide an explanation of the causes of the taking and review with the USFWS the need for possible modification of the reasonable and prudent measures.	

3.3.3. Additional Measures to Avoid Adverse Effects

C1. Protection of Human/Pet Health and Safety

a. Most PDM activities are conducted away from areas of high human activity except when directly applied on private landowner property to address a specific damage problem. If the risk of people being present exists, then activities are conducted during periods when human activity is low, such as at night or early morning whenever possible.

b. Although unlikely, in the event that WS-Arizona is requested to immobilize bears by AGFD and in which AGFD is involved either during a period of time when licensed harvest of bears is occurring or during a period of time where the drug withdrawal period could overlap with the start of a harvest season, WS-Arizona would euthanize the bear or mark the animal with ear tags labeled with a "*do not eat*" warning prior to release.

c. In most cases, live traps, culvert traps, and snares set for black bears are placed so that captured animals are not readily visible from any designated recreation road or trail or from federal, state or county roads. Sometimes culvert traps are used in and near campgrounds, developments, dumpsters, and other areas which attract bears. Trap warning signs are placed on each end of the trap.

d. Public safety zones can be delineated and defined by location or placed on maps at the Annual Work Plan meetings by BLM, and USFS, as necessary. These areas can be changed or updated as necessary. The public safety zone is one-quarter mile, or other appropriate distance, around any residence or community, county, state or federal highway, or developed recreation site. PDM conducted on federal lands within identified public safety zones will generally be limited to activity aimed at the protection of human health and safety. However, a land management agency or cooperator could request PDM activities in the public safety zone for an identified need. Depending of the situation and applicable laws and regulations, WS-Arizona could provide them service. However, the land management agencies would be notified of PDM activities that involve methods of concern such as firearms, dogs, and traps before these methods would be used in a public safety zone, unless specified otherwise in the AWP and as appropriate.

C2. Operating on Public Lands, Including in Wilderness Areas, Wilderness Study Areas (WSAs), and other Special Management Areas on Federal Lands

a. All WS-Arizona PDM actions conducted on BLM or US Forest Service lands are conducted per the interagency MOUs with associated annual work plans (see Section 1.6.4).

b. PDM conducted within BLM and Forest Service WSAs and Wilderness Areas is closely coordinated with the land management agency and performed in accordance with the BLM and APHIS-WS MOU, the Forest Service and APHIS-WS MOU, and the Wilderness Act (16 U.S.C. 1131-1136).

c. Outside of wilderness and wilderness study areas, any unanticipated work not included in the Annual Work Plan will be coordinated with the BLM Field Office Manager or USFS District Ranger or his/her representative.

C3. Miscellaneous Measures

a. **Use of Non-lead Ammunition.** WS-Arizona will use non-lead ammunition when required by land management policies and as required by Federal, state, and tribal laws and when and where required by ESA Section 7 consultations. WS-Arizona uses nonlead ammunition when shooting from aircraft, for work conducted north of I-40, and for Migratory bird damage management.

b. **Use of Existing Access.** Vehicle use is limited to existing roads and trails unless authorized by the land management agency or landowner for specific actions.

c. **Code of Ethics:** The APHIS-WS Code of Ethics requires that all WS personnel maintain high personal and professional standards in support of the WS mission to provide Federal leadership in wildlife damage management solutions that are safe, effective, selective, economically feasible, and environmentally responsible. (WS Directive 1.301**).**

3.3.4. Relevant State Laws and Regulations

Measures included in this section from relevant state laws and regulations are paraphrased.

D1. Categories of Wildlife and Legal Take

The following are Arizona State Statutes regarding legal take of wildlife:

ARS §17-101: Definition: predatory animals are foxes, skunks, coyotes and bobcats. Definition: fur-bearing animals are muskrats, raccoons, otters, weasels, bobcats, beavers, badgers and ringtail cats.

ARS §17-239: Wildlife depredations; investigations; corrective measures; disposal; reports; judicial review
A. Any person suffering property damage from wildlife may exercise all reasonable measures to alleviate the damage, except that reasonable measures shall not include injuring or killing game mammals, game birds or wildlife protected by federal law or regulation unless authorized under subsection D of this section. A person may not retain or sell any portion of an animal taken pursuant to this subsection except as provided in section 3-2403.

B. Any person suffering such property damage, after resorting to the relief as is provided in subsection A of this section, may file a written report with the director, advising the director of the damage suffered, and the species of animals causing the damage, and the director shall immediately order an investigation and report by an employee trained in the handling of wild animal depredation.

C. The department shall provide technical advice and assist in the necessary anti-depredation measures recommended in the report, including trapping, capturing and relocating animals.

D. If harvest of animals is found to be necessary to relieve damage, the commission may establish special seasons or special bag limits, and either set reduced fees or waive any or all license fees required by this title, to crop that wildlife. If the commission determines that this cropping by hunters is impractical, it may issue a special permit for taking that wildlife to the landowner, lessee, livestock operator or municipality suffering damage, provided that the edible portions, or other portions as prescribed by the commission, of all the wildlife taken by the person suffering damage are turned over to an agent of the department for delivery to a public institution or charitable organization.

E. Except as provided in section 41-1092.08, subsection H, in the event any person suffering property damage from wildlife is dissatisfied with the final decision of the commission, the person may seek judicial review pursuant to title 12, chapter 7, article 6.

ARS §17-301: Times when wildlife may be taken; exceptions; methods of taking

A. A person may take wildlife, except aquatic wildlife, only during daylight hours unless otherwise prescribed by the commission. A person shall not take any species of wildlife by the aid or with the use of a jacklight, other artificial light, or illegal device, except as provided by the commission.

B. A person shall not take wildlife, except aquatic wildlife, or discharge a firearm or shoot any other device from a motor vehicle, including an automobile, aircraft, train or powerboat, or from a sailboat, boat under sail, or a floating object towed by powerboat or sailboat except as expressly permitted by the commission. No person may knowingly discharge any firearm or shoot any other device upon, from, across or into a road or railway.

C. Fish may be taken only by angling unless otherwise provided by the commission. The line shall be constantly attended. In every case the hook, fly or lure shall be used in such manner that the fish voluntarily take or attempt to take it in their mouths.

D. It shall be unlawful to take wildlife with any leghold trap, any instant kill body gripping design trap, or by a poison or a snare on any public land, including state owned or state leased land, lands administered by the United States forest service, the federal bureau of land management, the national park service, the United States department of defense, the state parks board and any county or municipality. This subsection shall not prohibit:

1. The use of the devices prescribed in this subsection by federal, state, county, city, or other local departments of health which have jurisdiction in the geographic area of such use, for the purpose of protection from or surveillance for threats to human health or safety.
2. The taking of wildlife with firearms, with fishing equipment, with archery equipment, or other implements in hand as may be defined or regulated by the Arizona game and fish commission, including but not limited to the taking of wildlife pursuant to a hunting or fishing license issued by the Arizona game and fish department.
3. The use of snares, traps not designed to kill, or nets to take wildlife for scientific research projects, sport falconry, or for relocation of the wildlife as may be defined or regulated by the Arizona game and fish commission or the government of the United States or both.
4. The use of poisons or nets by the Arizona game and fish department to take or manage aquatic wildlife as determined and regulated by the Arizona game and fish commission.
5. The use of traps for rodent control or poisons for rodent control for the purpose of controlling wild and domestic rodents as otherwise allowed by the laws of the state of Arizona, excluding any fur-bearing animals as defined in section 17-101.

ARS §17-302: **Taking of bear or mountain lion for protection of property; report**

A. Other provisions of this title notwithstanding, a landowner or lessee, who is a livestock operator and who has recently had livestock attacked or killed by bear or mountain lion, may, if he complies with subsection B, lawfully exercise such measures as necessary to prevent further damage from the offending bear or lion, including the taking of such bear or mountain lion in the following manner:

1. All traps shall be inspected within seventy-two hours and nontarget animals released without further injury. The department shall provide technical advice and assistance in the release of nontarget bears and lions. Nontarget animals seriously injured and unable to leave the scene upon release shall be humanely dispatched. Target bears and lions shall be humanely dispatched immediately.

2. Bears and lions may be taken only by means of:
   (a) Leg hold traps without teeth and with an open jaw spread not exceeding eight and one-half inches.
   (b) Leg snares.
   (c) Firearms.
   (d) Other legal hunting weapons and devices.

3. All traps and snares shall be identified as to the person or agency setting the trap or snare.

4. A livestock operator taking a lion or bear pursuant to this section shall notify a department office within five days after setting traps or initiating pursuit in any manner. The notification for both bears and lions shall include information on the number and kind of livestock attacked or killed and the name and address of the livestock operator experiencing depredation. Such information shall not be public information.

5. A livestock operator taking a bear or lion pursuant to this section shall provide reasonable evidence of having livestock recently attacked or killed if a person authorized by the director requests such evidence within forty-eight hours of the department being notified pursuant to paragraph 4. Information shall include location description of sufficient detail to allow the site of depredation and traps set to be located. Such information shall not be public information.

6. Dogs may be used to facilitate the pursuit of depredating bears and lions.

B. A license or tag shall not be required for the taking of a bear or mountain lion under this section, but within ten days after the taking, the livestock operator shall file a written report with the department. The location of the take, identity of the livestock operator filing the report and location and date of livestock depredation are not public information. Such report shall also contain the following information:

1. Name and address of livestock operator experiencing depredation losses.
2. Number, ages and kinds of livestock lost.
3. Numbers and location of bears or lions taken.
4. Sex and estimated age of each bear or lion taken.
5. Location and date of livestock depredation.

C. No portion of an animal taken pursuant to this section shall be retained or sold by any person except as authorized by the commission.

D. No animal trapped or taken alive under this section shall be held in captivity.

E. In addition to other penalties provided by law, persons not in compliance with the provisions of this section may be ordered by the department to remove devices not in compliance with the requirements of this section and to cease and desist current pursuit activities intended to take the depredating bear or lion which the livestock operator has failed to comply with the provisions of this section.

F. A livestock operator entitled to take a bear or lion under the provisions of this section may contract with another person for the taking of the depredating bear or lion. The person under contract shall comply with all of the provisions of this section.

ARS §3-2401: Control of destructive animals and noxious rodents; agreements and cooperation with federal agencies; exception

A. The director shall cooperate with the animal and plant health inspection service of the United States department of agriculture in the control and destruction or relocation of predatory wildlife, reintroduced predatory wildlife, noxious rodents and related animals that are injurious to livestock, poultry, game, agriculture, other industries and the public health in accordance with organized and systematic plans of the animal and plant health inspection service. For such purposes, the director shall enter into written agreements with the animal and plant health inspection service regarding the methods and procedure to be followed, the extent of supervision to be exercised by the state and federal agencies, respectively, and the use and expenditure of state funds. The director, in cooperation with the animal and plant health inspection service, may also enter into cooperative agreements with other governmental agencies and counties of the state to promote the control and destruction of predatory wildlife, reintroduced predatory wildlife, noxious rodents and related animals.

B. The authority to destroy predatory wildlife, reintroduced predatory wildlife, noxious rodents and related animals does not include big game animals as defined in section 17-101, except:
1. Bear and mountain lion taken pursuant to section 17-302.
2. To protect public health and safety.

ARS §3-2405: Powers of boards of supervisors

The boards of supervisors of the several counties may within their respective counties:

1. Control and destroy predatory wildlife, reintroduced predatory wildlife, noxious rodents and related animals as provided in section 3-2401.
2. Enter into cooperative agreements with the department and the animal and plant health inspection service of the United States department of agriculture.
3. Make necessary expenditures from any special, contingent or general county fund available for the purposes specified in this section.

ARS §28-8281: Killing birds or animals; classification

A. Except as provided in subsection B, an aeronaut or passenger who intentionally kills birds or animals while in flight is guilty of a class 1 misdemeanor.

B. If authorized by the Arizona game and fish commission, the following persons may take coyotes by shooting from aircraft for wildlife and livestock management purposes:

1. An employee of the Arizona game and fish department.
2. An authorized employee of the United States government agency.

The Arizona Administrative Code, Title 12. Natural Resources, Chapter 4. Game and Fish Commisssion, R12-4-304. Lawful Methods for Taking Wild Mammals, Birds, and Reptiles

D. An individual may take predatory and furbearing animals by using the following methods, when authorized by Commission Order and subject to the restrictions under R12-4-303 and R12-4-318:

1. Firearms;
2. Pre-charged pneumatic weapons .22 caliber or larger;
3. Bow and arrow;
4. Crossbow;
5. Traps not prohibited under R12-4-307;
6. Artificial light while taking raccoon provided the light is not attached to or operated from a motor vehicle, motorized watercraft, watercraft under sail, or floating object towed by a motorized watercraft or a watercraft under sail;
7. Artificial light while taking coyote during seasons with day-long hours, provided the light is not attached to or operated from a motor vehicle, motorized watercraft, watercraft under sail, or floating object towed by a motorized watercraft or a watercraft under sail; and
8. Dogs

D2. Use of Pursuit Dogs and Artificial Light

ARS §17-302: Dogs may be used to facilitate the pursuit of depredating bears and lions.

ARS §17-301: A. A person may take wildlife, except aquatic wildlife, only during daylight hours unless otherwise prescribed by the commission. A person shall not take any species of wildlife by the aid or with the use of a jacklight, other artificial light, or illegal device, except as provided by the commission.

The Arizona Administrative Code, Title 12. Natural Resources, Chapter 4. Game and Fish Commisssion, R12-4-304. Lawful Methods for Taking Wild Mammals, Birds, and Reptiles

2. To take bear:
   j. Pursuit with dogs only between August 1 and December 31, provided the individual shall immediately kill or release the bear after it is treed, cornered, or held at bay. For the purpose of this subsection, "release" means the individual removes the dogs from the area so the bear can escape on its own after it is treed, cornered, or held at bay.

The Arizona Administrative Code, Title 12. Natural Resources, Chapter 4. Game and Fish Commisssion, R12-4-304. Lawful Methods for Taking Wild Mammals, Birds, and Reptiles

8. To take mountain lion:
   j. Artificial light, during seasons with day-long hours, provided the light is not attached to or operated from a motor vehicle, motorized watercraft, watercraft under sail, or floating object towed by a motorized watercraft or a watercraft under sail; and[14]
   k. Pursuit with dogs, provided the individual shall immediately kill or release the mountain lion after it is treed, cornered, or held at bay. For the purpose of this subsection, "release" means the individual removes the dogs from the area so the mountain lion can escape on its own after it is treed, cornered, or held at bay.

[14] Per personal communication with April Howard, AGFD no longer offers daylong hours for mountain lion hunting. However, the use of artificial light remains in Arizona Administrative Code despite the fact that AGFD no longer offers this type of hunting season.

D3. Use of Traps, Snares and Other Capture Devices

ARS § 17-361: Trappers; licensing; restrictions; duties; reports

A. The holder of a trapping license, may trap predatory, nongame, and fur-bearing mammals under such restrictions as the commission may specify.

B. All traps shall be plainly identified with the name, address, or registered number of the owner, and such markings of identification shall be filed with the department. All traps in use shall be inspected daily.

C. It shall be unlawful for a person to disturb the trap of another unless authorized to do so by the owner.

D. Pursuant to rules and regulations of the commission, each trapping licensee shall, on dates designated by the commission, submit on forms provided by the department, a legible report of the number of each kind of predatory, nongame and fur-bearing mammal taken and the names and addresses of the persons to whom they were shipped or sold or the wildlife management units where the animals were taken.

The Arizona Administrative Code, Title 12. Natural Resources, Chapter 4. Game and Fish Commisssion, R12-4-304. Lawful Methods for Taking Wild Mammals, Birds, and Reptiles

D. An individual may take predatory and furbearing animals by using the following methods, when authorized by Commission Order and subject to the restrictions under R12-4-303 and R12-4-318:

1. Firearms;
2. Pre-charged pneumatic weapons .22 caliber or larger;
3. Bow and arrow;
4. Crossbow;
5. Traps not prohibited under R12-4-307;
6. Artificial light while taking raccoon provided the light is not attached to or operated from a motor vehicle, motorized watercraft, watercraft under sail, or floating object towed by a motorized watercraft or a watercraft under sail;
7. Artificial light while taking coyote during seasons with day-long hours, provided the light is not attached to or operated from a motor vehicle, motorized watercraft, watercraft under sail, or floating object towed by a motorized watercraft or a watercraft under sail; and
8. Dogs

The Arizona Administrative Code, Title 12. Natural Resources, Chapter 4. Game and Fish Commisssion, R12-4-307. Trapping Regulations, Licensing; Methods; Tagging of Bobcat Pelts

G. A trapper shall:

1. Inspect traps daily;
2. Kill or release all predatory and fur-bearing animals;
3. Possess a choke restraint device that enables the trapper to release a javelina from a trap when trapping in a javelina hunt unit, as designated by Commission Order;
4. Possess a device that is designed or manufactured to restrain a trapped animal while it is being removed from a trap when its release is required by this Section; and
5. Release, without additional injury, all animals that cannot lawfully be taken by trap.
6. Subsections (G)(3) and (G)(4) do not apply when the trapper is using a confinement trap.

H. A trapper shall not:
1. Bait a confinement trap with:
a. A live animal;
b. Any edible parts of small game, big game, or game fish; or
c. Any part of any game bird or nongame bird.
2. Set any trap within:
a. One-half mile of any of the following areas developed for public use:
i. Boat launching area,
ii. Camping area,
iii. Picnic area, or
iv. Roadside rest area.
b. One-half mile of any occupied residence or building without permission of the owner or resident.
c. One-hundred yards of an interstate highway or any other highway maintained by the Arizona Department
of Transportation.
d. Fifty feet of any trail maintained for public use by a government agency.
e. Seventy-five feet of any other road as defined under A.R.S. § 17-101.
f. Subsections (H)(2)(b), (H)(2)(c), (H)(2)(d), and (H)(2)(e) do not apply when the trapper is using a confinement trap.
3. Set a foothold trap within 30 feet of sight-exposed bait.
4. Use any:
a. Body-gripping or other instant kill trap with an open jaw spread that exceeds 5 inches for any land set or10 inches for any water set;
b. Foothold trap with an open jaw spread that exceeds 7 ½ inches for any water set;
c. Snare, unless authorized under subsection (I);
d. Trap with an open jaw spread that exceeds 6 ½ inches for any land set; or
e. Trap with teeth.

I. A trapper who uses a foothold trap to take wildlife with a land set shall use commercially manufactured traps that meet the following specifications:
1. A padded or rubber-jawed trap or an unpadded trap with jaws permanently offset to a minimum of 3/16 inch and a device that allows for pan tension adjustment;
2. A foothold trap that captures wildlife by means of an enclosed bar or spring designed to prevent the capture of non-targeted wildlife or domestic animals; or
3. A powered cable device with an inside frame hinge width no wider than 6 inches, a cable loop stop size of at least 2 inches in diameter to prevent capture of small non-target species, and a device that allows for a pan tension adjustment.

J. A trapper who uses a foothold trap to take wildlife with a land set shall ensure that the trap has an anchor chain equipped with at least two swivels as follows:
1. An anchor chain 12 inches or less in length shall have a swivel attached at each end.
2. An anchor chain greater than 12 inches in length shall have one swivel attached at the trap and one swivel attached within 12 inches of the trap. The anchor chain shall be equipped with a shock-absorbing spring that requires less than 40 pounds of force to extend or open the spring.

D4. Protecting Human Safety

ARS §17-301-01: Protection from wildlife.

A. Notwithstanding any other provision of this title, any person may take wildlife in self-defense or in defense of another person if it is immediately necessary to protect oneself or to protect the other person.

B. A person shall notify the department within five days after taking wildlife under this section. No animal or part of an animal taken pursuant to this section may be retained, sold or removed from the site without authorization from the department.

D5. Aerial Take

ARS§28-8281: Killing birds or animals; classification

A. Except as provided in subsection B, an aeronaut or passenger who intentionally kills birds or animals while in flight is guilty of a class 1 misdemeanor.

B. If authorized by the Arizona game and fish commission, the following persons may take coyotes by shooting from aircraft for wildlife and livestock management purposes:

1. An employee of the Arizona game and fish department.
2. An authorized employee of the United States government agency

D6. Carcass Disposal and Report of Take

ARS §3-2403. Disposition of furs, skins and specimens

All furs, skins or specimens taken by animal damage control specialists whose salaries are paid from any state appropriation made for the purpose of carrying out the provisions of this article shall be disposed of as the department determines to be for the best interest of the state, but if such items are sold the net proceeds shall be credited to the general fund of the state.

CHAPTER 4: ENVIRONMENTAL ANALYSIS

Chapter 4 contains a discussion of the issues and affected environment, including issues that will receive detailed environmental impacts analysis, issues that were used to develop SOPs, and a brief discussion of issues that will not be considered in detail.

4.1. THE ENVIRONMENTAL BASELINE

To determine impacts of federal actions on the human environment, an environmental baseline needs to be established 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. Instead, it is one that is already heavily influenced by human actions related and unrelated to WS-Arizona PDM.

PDM has been conducted in Arizona for decades and, thus, the environmental baseline includes the effects of the current, ongoing WS-Arizona program PDM. Information used to determine the environmental baseline for this EA include data on species taken in PDM, wildlife population numbers and general trends, effects of PDM on recreation, and relative safety of PDM methods in use.

For wildlife populations, because definitive numbers are not often available, they are estimated from the best natural history information available regarding densities and occupied range or habitat types. Current and past harvest information (especially for those species which have current hunting/trapping seasons) can be used to compare impacts because wildlife populations are a renewable resource and a certain percentage can be taken from the population without adverse impacts. The analysis in Chapter 4 uses the best available information to determine the relative impacts of the Preferred Alternative and alternatives on the current environmental status quo (the human environment as it is today that includes ongoing WS-Arizona PDM actions). The Preferred Alternative (*i.e.*, a continuation of the status quo) is thus an appropriate baseline for analysis in this EA.

The wildlife population baselines are those that are in place under the current condition of the human environment. They incorporate and reflect the populations as they have been and are being affected by humans. Effects by humans are caused by hunting/trapping take, road kill mortality, and loss of habitat to development such as construction, logging, and mineral and energy extraction activities, and poaching. Little or no information is available to quantify the effects of these actions on the different wildlife species populations. Nevertheless, such effects are already part of the existing human environment, and thus part of the environmental baseline.

4.2. ANALYSIS OF ISSUES ANALYZED IN DETAIL

NEPA requires federal agencies to determine whether their actions have a *significant impact on the quality of the human environment.* The environmental consequences of the 5 alternatives are discussed below with emphasis on the issues presented in Chapter 2. The comparison of alternatives will be used to make a selection of the most appropriate alternative for WS-Arizona PDM actions. The alternatives selected for detailed analysis provide the best range of alternatives that could potentially meet the purpose and the need of PDM in Arizona as identified in Chapter 1.

Significance Criteria

The CEQ regulations on implementation of NEPA (40 CFR 1500-1508) describe the elements that determine whether or not an impact is "significant." Significance is dependent upon the context and intensity of the impact. The following factors will be used to evaluate the significance of impacts in this EA as they relate to the context and intensity of biological and other ecological effects. Social and economic impacts will be evaluated similarly to the extent applicable.

- **Magnitude of the Impact.** Magnitude relates to the size, number or relative amount of the impact. It is a measure of intensity. Magnitude as it relates to biological impacts is a measure of the number of individual animals or species removed in relation to their abundance. Quantitative analysis is used wherever possible because it is more precise, rigorous and based on the best available population estimates. Qualitative analysis is based on population trends and modeling. Magnitude may be determined either quantitatively or qualitatively.
- **Duration and Frequency of the Impact.** The duration and frequency may be temporary, seasonal, year round or ongoing. Duration and frequency is a measure of intensity.
- **Likelihood of the Impact.** The likelihood of an impact is a measure of its intensity by estimating the possibility that an activity or impact may occur.
- **Geographic Extent**. The consideration of the geographic extent of an effect may be site specific, within a given management area, at the State/territory/tribal land area, regional and/or national. The geographic extent of an effect is a contextual consideration.
- **Legal Status.** The legal status of an affected resource is a contextual consideration. Legal status may range from fully protected by federal law, such as an endangered species, to unprotected by law, as is the case for coyotes, fox, skunks and raccoons in Arizona.
- **Conformance with Statutes, Regulations and Policies.** Statutes, regulations and policies provide contextual information in the analysis. Compliance with applicable statutes, regulations and policies can also serve as mitigation to ensure that certain types of adverse impacts on the environment do not occur.

4.2.1. Effects on Target Predator Populations

As previously discussed in this EA, in Arizona, AGFD has the authority for management of resident wildlife species. AGFD is also the agency with responsibility for managing hunting and trapping of animals classified by state law as game or furbearers. AGFD provided statistics on take for many species. Since population estimates were not available for all species and may not have included all of the range for a species, WS-Arizona used the best available information to produce reasonable, but conservative population estimates to determine the relative impacts of WS-Arizona PDM and cumulative take on species populations. On Augutst 18, 2017, WS-Arizona met with AGFD to further develop the analysis on target predator populations. To adequately determine the magnitude of impacts in relation to predators and their populations, WS-Arizona data and known cumulative take was analyzed. WS-Arizona targets predators for a variety of its programs including rabies management, disease surveillance, managing wildlife hazards at airports, protection of property and HHS, and livestock protection. Although the actions taken for rabies management and disease surveillance are covered under separate EAs, WS-Arizona has included all the take of target and non-target species in the analysis for this EA to evaluate the cumulative impact to species through PDM.

One important aspect that is germane to the determination of significance under NEPA is the effect of a federal action on the status quo for the environment. States have the authority to manage populations of resident wildlife with the exception of migratory and T&E species as they see fit without oversight or control by federal agencies. Management direction for a given species can vary among states, and state management actions are not subject to NEPA compliance. Therefore, the status quo for the environment with respect to state-managed wildlife species is the management direction established by the states. Federal actions that are in accordance with state management have no effect on the status quo. Wildlife populations are typically dynamic and can fluctuate without harvest or control by humans. Therefore, the status quo for wildlife populations is fluctuation, both within and among years, which complicates determining the significance of human impact on such populations.

This chapter measures the number of individuals lethally removed in relation to that species abundance to determine the magnitude of impact to the populations of those species from the use of lethal methods. Magnitude may be determined either quantitatively or qualitatively. Determinations based on population estimates, allowable harvest levels and actual harvest data are quantitative, whereas, determinations based on population trends and harvest trend data, when available, are qualitative.

4.2.1.1. Alternative 1 - No Federal WS-Arizona PDM

Under this alternative, WS-Arizona would not provide assistance with PDM and, therefore would not have any effect on target predator populations in Arizona. However, Arizona state agencies (ADA and AGFD), and private entities or organizations conducting PDM could increase their efforts in proportion to the reduction of federal services. ADA's and AGFD's portion of the cooperative program with WS-Arizona would probably still provide some level of PDM, but without federal involvement. The primary concern with not having a federal program is that impacts on predator populations and the environment could increase due to non-professional, private individuals conducting PDM. Many of these individuals could be untrained and not licensed to use certain PDM methods that have the potential for significant negative impact when not properly used. Accountability, records maintenance, regulatory and policy compliance, and coordination with other agencies would not always be required or adhered to. Thus, the potential for impacting predator populations by non-WS entities could be higher. It is also likely that without WS-Arizona to respond to mountain lion and black bear damage complaints, take of those species by private citizens would increase under this alternative. Take by private citizens and efforts by other agencies and organizations to reduce or prevent depredations may produce results similar to those of the preferred alternative. However, the potential for use of illegal chemical toxicants caused by frustration as described could lead to unanticipated impacts on carnivore populations. Additionally, if no agency, groups, or individuals were able to respond to damage complaints, much of the public could become intolerant of wildlife as a whole (International Association of Fish and Wildlife Agencies 2004).

4.2.1.2. Alternative 2 - Technical Assistance Only

Under this alternative, WS-Arizona would only provide advice or guidance on PDM techniques and methods. WS-Arizona would not conduct any operational PDM to reduce damage complaints, and therefore, would not have any impact on predators in Arizona. As discussed under Alternative 1 (the No Federal Program Alternative), similar PDM would likely be conducted by private individuals, state agencies and organizations in proportion to federal services lost. Similar negative impacts to target predator populations as discussed under Alternative 1 would likely occur.

4.2.1.3. Alternative 3 - Nonlethal Required before Lethal Control

This alternative would require that resource owners or WS-Arizona Specialists use nonlethal techniques prior to WS-Arizona implementing lethal PDM methods to resolve a damage problem. For many damage situations, this would be no different than the preferred alternative because many resource owners have already been attempting to use nonlethal PDM methods. However, where nonlethal methods have not been previously attempted, this alternative would reduce WS-Arizona' ability to quickly address some predator damage problems.

Based on experience, a WS-Arizona Specialist may be able to predict whether the use of nonlethal PDM methods will successfully resolve a depredation problem. WS-Arizona policy specifies that WS-Arizona Specialists use nonlethal methods first, as appropriate. For example, using the WS Decision Model (Slate et al. 1992), a WS Specialist may determine that lethal PDM methods are necessary to abate a current problem. But they would also provide the landowner information on nonlethal techniques to reduce the likelihood of recurring damage. Since nonlethal PDM methods do not always prevent or reduce predator damage to acceptable levels, state or local agencies, and private organizations or individuals would likely assume responsibility for implementing the lethal PDM methods necessary to adequately deal with these problems.

Non-WS entities would likely initiate lethal PDM if they do not want to wait for WS-Arizona to implement lethal control, and take more predators than under Alternative 2. In fact, as discussed under Alternative 5, more black bears and mountain lions might be taken because private individuals would not be as apt to successfully harvest the target predator and might take several animals before actually removing the target individual. In addition, a private citizen may be less effective than a WS-Arizona Specialist at resolving a damage problem, and allow more damage to occur while attempting to take the target animal. Under this alternative, agricultural and property resource losses are expected to be greater than under the preferred alternative due to restrictions placed on WS-Arizona personnel. For the reasons discussed in the population impacts analysis in Section 4.2.1.5, it is highly unlikely that coyote or other predator populations would be impacted under this alternative.

4.2.1.4. Alternative 4 - Lethal PDM Methods are Used Only for Corrective PDM

Under this alternative, WS-Arizona take of target predator species would probably be somewhat less than that of the Preferred Alternative because lethal actions by WS-Arizona would be restricted to situations where damage had already occurred. Preventive PDM is used most often for coyotes in cattle and sheep production areas that have had historical damage. Most sheep and cattle producers already use one or more nonlethal PDM methods. Connolly and Wagner (1998) found that 55% of the United States sheep producers, who collectively own 70% of the nations' sheep, used one or more nonlethal PDM measures. Fencing, husbandry, guard animals, and frightening tactics were the most common nonlethal PDM methods used. Even with preventive nonlethal methods in use, it has been found that preventive aerial shooting reduced sheep and lamb losses later in the year compared to sites without (Gantz 1990, Wagner and Conover 1999). Decreased effectiveness is related to the logistics of getting to these areas and having to use less effective coyote removal methods during the summer months. The coyotes most likely to kill sheep are the ones raising pups (Till and Knowlton 1983) and late winter aerial shooting of coyotes on summer sheep grazing allotments removes coyotes that otherwise would likely have produced pups (Gantz 1990). By conducting preventive

PDM in late winter, the likelihood of transient coyotes re-occupying vacated territories and establishing new territories in time to produce pups is greatly reduced. Gantz (1990) concluded that late winter aerial shooting of coyotes on summer sheep range was an effective method to reduce coyote predation. Till (1992), found that depredating coyotes traveled an average of 2 miles and as far as 6 miles from their den site to the sheep flocks where they were killing lambs. By restricting corrective PDM to the immediate vicinity of predation losses, WS-Arizona would be unable to effectively resolve some depredation problems.

Under this alternative, where damage had not occurred, WS-Arizona could use only nonlethal PDM methods. For many individual damage situations, this alternative would be similar to the preferred alternative because many producers do not contact WS-Arizona until damage has already occurred. WS-Arizona does not routinely conduct proactive PDM for many of the predators discussed in this EA because of the relatively low occurrence and unpredictability of damage. Private individuals may implement their own non-lethal methods to prevent damage, then call WS-Arizona only after damage has occurred. WS-Arizona does conduct preventive PDM for species such as coyotes where a resource owner has had historic damage. Without WS-Arizona conducting lethal proactive PDM activities, it is likely that private efforts at proactive control would increase. These increased private PDM activities would lead to potentially similar impacts as those described under Alternative 3. Fewer predators would likely be taken by WS-Arizona than described in Alternative 5, but private efforts would likely increase, resulting in similar levels of take. For the reasons discussed in the population impacts analysis in Section 4.1.1.5, it is highly likely that coyote or other predator populations could be significantly impacted by implementation of this alternative. Impacts and hypothetical risks from the misuse of PDM methods or illegal chemical toxicant use under this alternative would probably fall somewhere between Alternatives 1 and 3.

4.2.1.5. Alternative 5 - Continue the Current Federal PDM Program (the Preferred Alternative)

Under the Preferred Alternative, take by WS-Arizona and others will be considered statewide providing a more comprehensive analysis of impacts to predators. The prior EAs (WS 1996, 1999a) determined that PDM had no significant impacts to predators on the different land classes in Arizona. This EA combines all land classes together to determine level of impacts statewide. A statewide EA is advantageous because data of take by hunters and others in Arizona is statistically more accurate on a statewide scale.

As previously discussed in this EA, the Arizona Wildlife Commission and AGFD have management authority over resident wildlife and their damage via the state's system of representative government. That system was established to represent the *collective desires* of the people of the State of Arizona with respect to the management of certain wildlife species. In this way, the state determines its desires for that component of the human environment which is comprised of wildlife.

A viable population can exist at many levels between one that is at carrying capacity (the maximum number of a species that a particular habitat can support) and one that is at only a fraction of carrying capacity. Because rates of increase may be density dependent (*i.e.*, the population grows at a faster rate as the population is reduced in relation to carrying capacity), predator populations have the ability to recover from declines. Density dependent rates of increase are a built-in defense mechanism of many wildlife populations to harvest, localized control, or non-man-induced mortality.

Therefore, even if a sustainable harvest rate is exceeded in the short term, this built-in defense mechanism can help maintain a viable population.

The methods used by WS-Arizona to take target predators under the current program are the same as those that have been used in recent years and were described in Chapter 3 of this EA. The methods that are used in each damage situation depend on the species causing the damage and other factors including, but not limited to, location (public versus private lands), weather, and time of year. Resource owners may use other methods in addition to the WS-Arizona methods that are used. Table 12 summarizes WS-Arizona's lethal take by PDM method for FY11 through FY15.

Table 12. WS-Arizona Average Annual Lethal Take of Predators by Method, FY11-FY15.

Common Name	Firearm	Traps/Snares	M-44[15]	Aerial Shooting	Tracking/Trailing Dogs	Hand Capture
Coyote	181	260	16	420	0	0.6
Feral Dog	37	25	0	0	0	0.8
Striped Skunk	6	28	0	0	0	4
Mountain Lion	35	0.8	0	0	0	0
Raccoon	2	17	0	0	0	0.2
Feral Cat	6	11	0	0	0	0
Hooded skunk	4	4	0	0	0	0.2
Black Bear	5	1.8	0	0	0	0
Badger	0.6	6	0	0	0	0
Gray Fox	3	2	0	0	0	0.2
Bobcat	2	3	0	0	0	0
Western Spotted Skunk	0	0.8	0	0	0	0.2
Hog-nosed Skunk	0.6	0.2	0	0	0	0
Kit Fox	0.2	0	0	0	0	0
White-nosed Coati	0.2	0	0	0	0	0
Red Fox	0	0	0	0	0	0
Ringtail	0	0	0	0	0	0
Virginia Opossum	0	0	0	0	0	0
River Otter	0	0	0	0	0	0
Total	**282.6**	**359.6**	**16.0**	**420.0**	**0.0**	**6.2**

WS-Arizona conducts PDM for seven primary target predator species in Arizona, but there is the potential for the need for PDM on other species. All target predators taken from FY11 to FY15 by

[15] WS-Arizona has not used M-44's in the state since 2012.

WS-Arizona are presented in Table 13 and Table 11 shows the average annual predator take by land class. (MIS 2016). The seven primary target species taken in Arizona are coyotes, feral dogs, striped skunks, mountain lions, raccoons, feral cats, and black bears. Most other target predators are taken by WS-Arizona only on an occasional basis, if at all. Some of these, especially skunks, have been taken for research and disease monitoring, and not as a result of typical property or livestock damage problems.

Table 13. Average Annual WS-Arizona Take of Predators by Land Class

Common Name	Private	Federal	State/Municipal	Tribal
Coyote	528	79	135	136
Feral Dog	23	0.4	11	27
Striped Skunk	3	15	19	0.2
Mountain Lion	5	20	9	2
Raccoon	16	1	0.6	1
Feral Cat	11	6	0	0
Hooded skunk	1	5	3	0
Black Bear	1	2	0.4	3
Badger	6	0	0.2	0.2
Gray Fox	3	0	0.4	0.2
Bobcat	4	0.4	0.4	0.2
Western Spotted Skunk	0.2	0.4	0.4	0
American Hog-Nosed Skunk	0	0.6	0.2	0
Kit Fox	0.2	0	0	0
White-nosed Coati	0.2	0	0	0
Red Fox	0	0	0	0
Ringtail	0	0	0	0
Virginia Opossum	0	0	0	0
River Otter	0	0	0	0

To provide a comprehensive view of all monitored predator take in Arizona, predators taken during the 2010-11 to 2014-15 hunting and trapping seasons are provided in Table 8 and used in the analysis. Furbearer harvest often reflects the value of the fur, the relative abundance of the species, and the number of hunters involved in harvesting. Harvest pressure during the late 1970s and early 1980s was much greater than recent years because fur was at a high value compared to the costs associated with trapping and, thus, a higher number of hunters were in the field.

<u>Specific Species Population Impact Analyses</u>

To assess the potential impacts to predators, each species is discussed in more detail below. Population information, take data, and applicable sustainable harvest information are analyzed to determine the likelihood and amount (where applicable) of potential impact to the seven predator species, as well as others that have been taken in past years.

Coyote Population Impact Analysis. Coyotes are the species most frequently targeted by WS-Arizona, primarily because WS-Arizona receives a significant number of requests for assistanct to address coyote-human conflicts. As a result, this species made up the largest percentage of the predator take from FY11 to FY15 (81%). In Chapter 3 of this EA, the coyote population in Arizona was conservatively estimated to be 125,000. This estimate is used to determine relative impacts shown in Table 14.

Table 14. WS-Arizona coyote take and cumulative coyote take by WS-Arizona and hunter harvest from FY11 to FY15.

COYOTE IMPACT ANALYSIS							
	FY11	FY12	FY13	FY14	FY15	Average	Proposed Take
Est. Population	125,000	125,000	125,000	125,000	125,000	125,000	125,000
WS-Arizona Take	993	1,325	823	628	623	878	2,000
Hunter Harvest	56,242	52,314	53,793	26,070	1,083	47,105	56,242
Total Take	57,235	53,639	54,616	26,698	1,706	47,983	58,242
WS-Arizona Take - % of Pop.	0.79%	1.06%	0.66%	0.05%	0.5%	0.7%	1.6%
Total Take - % of Pop.	45.8%	42.9%	43.7%	21.4%	0.5%	38.4%	46.5%
Maximum Sustainable Harvest Level	60%	60%	60%	60%	60%	60%	60

WS-Arizona took an average of 878 coyotes annually from FY11 to FY15 with a high of 1,325 in FY12, resulting from an increased number of requests for assistance. The take of 1,325 coyotes represents only 0.01% of the estimated coyote population in Arizona. The estimated hunter harvest averaged 47,105 from the 2010-11 to 2014-15 hunting seasons or about 38% of the projected coyote population. WS-Arizona' and hunter harvest take numbers are similar to historic levels. FY11 had the highest combined take for WS-Arizona and hunter harvest, approximately 57,235 coyotes, and about 46% of the projected coyote population. Harvest could increase by 17,765 additional coyotes per year or an additional 14% of the coyote population before a long-term sustainable harvest threshold would be met. Harvest levels would have to increase even higher before a decline in the population would be seen. It is likely that the average take from the past 5 years will continue. However, WS-Arizona has assessed for a maximum take level of 2,000 coyotes to account for fluctuations in requests for assistance.

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 <60% of the population was removed. The population recovered within 5 years when 60-90% of the population was removed. Pitt et al. (2001) stated that actual coyote populations would recover even more quickly than the model indicated, because the model assumed coyote territories were retained even at low densities, that animals would not move out of their territories to mate, and that animals would not move in from surrounding areas (no emigration) which all in reality would occur. The model also did not allow for a reduction in natural mortality rates at low population densities.

Pitt et al. (2001) 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. However, 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.

Because of the model limitations described above for pulse removal, natural populations are probably able to withstand greater levels of harvest than indicated by Pitt et al. (2001). These findings are consistent with an earlier model developed by Connolly and Longhurst (1975), and revisited by Connolly (1995) which indicated that coyote populations could withstand an annual removal of up to 70% of their numbers and still maintain a viable population. This conclusion is consistent with the U.S. General Accounting Office (1990) assessment that WS' impacts on coyote populations in the western United States can result in rapid occupancy of vacant territories (Windberg and Knowlton 1988). While removing animals from small areas at the appropriate time can protect vulnerable livestock, immigration of coyotes from the surrounding area quickly replaces the animals removed (Stoddart 1984). Connolly (1978) noted that coyotes have survived and even thrived in spite of early 20th century efforts to exterminate them.

Based on this information, WS-Arizona' impact on the coyote population in Arizona from the take of 2,000 coyotes, even with possible under-reporting of hunter harvest, would not affect the general coyote population because the total take of coyotes is currently less than 60% of the estimated population and a determination of low magnitude of impact. The analysis further suggests annual coyote take could conservatively be increased by about 30% of the estimated population (about 40,000 additional coyotes taken) before the short-term 70% allowable harvest level would be reached.

Based on the population data and available science, the take of 2,000 coyotes per year is not expected to have a negative impact on the species population or trend in Arizona. Cumulative impacts on coyote populations in general within Arizona are not substantial and would remain so even if WS-Arizona' lethal coyote damage management efforts were increased several-fold.

Feral Dog Impact Analysis. Feral and free-roaming dogs are somewhat common in Arizona. As regulated by Arizona state and local laws, requests for help with feral dogs are approved by the appropriate state or local agency. In response to a yearly average of 10,581 damage complaints involving dogs (Table 1), WS-Arizona lethally removed an average of 63 target feral dogs per year and turned an average of 97 feral dogs over to appropriate authorities during the period FY11 to FY15 (Table 11). From FY11 through FY15, WS-Arizona also took 1 feral dog which was released as non-target species incidental to PDM (Table 9). Take of feral or free-ranging dogs by WS-Arizona has little impact on the human environment since dogs are not an indigenous component of ecosystems in Arizona. In addition, the annual take of dogs by WS-Arizona is minor in comparison to the thousands killed by animal control and humane organizations in Arizona each year. It is likely that the average take from the past 5 years can be expected to continue. However, WS-Arizona will assess a maximum take level of 300 feral dogs per year to account for fluctuations in requests for assistance.

WS-Arizona personnel shall conduct feral or free-ranging dog management in coordination with State, Local, or tribal authorities with jurisdiction over dog control. WS-Arizona takes feral and free-roaming dogs at the request of the local authority for animal control and, thus, this action would almost assuredly occur in the absence of WS-Arizona intervention. In urban areas where local animal control offices or authorities exist, WS-Arizona personnel shall collaborate with them to determine if WS action is necessary to solve the property or human health and safety problem associated with the feral or free-ranging dogs. If WS-Arizona action is necessary and requested by the local authority, WS-Arizona personnel must achieve/conduct the following: (1) Written approval of the WS Regional Director; (2) Notification to the WS Deputy Administrator; and, (3) Written request from the State, Local, or tribal authority with jurisdiction over feral or free-ranging dogs, if such local authorities with jurisdiction exist. WS-Arizona personnel shall ensure that written requests for assistance include: (1) a statement of the problem; (2) the location and time frame for WS activities; and (3) sufficient details regarding the scope and assistance requested.

Skunk Populations Impact Analyses. The majority of requests for assistance with skunk-related damage involve striped skunks. WS-Arizona occasionally receives complaints for hooded skunks, hog-nosed skunks, or western spotted skunks. In Chapter 3 of this EA, the striped skunk population was conservatively estimated at 97,000. WS-Arizona killed an average of 46 and released 30 target striped skunks from FY11 through FY15 (Table 11). Additionally, WS-Arizona took an average of less than 1 striped skunks as non-targets annually during PDM from FY11-FY15 (Table 9). WS-Arizona is likely to take 25 to 60 skunks per year, and is unlikely to exceed 100 skunks per year. This level of take is not expected to have a negative impact on the species population or trend in Arizona.

Hunter harvest increased slightly over the past 5 years, averaging 359 skunks harvested annually for all four species of skunks compared to a lower harvest level from FY02 through FY06 when annual skunk harvest averaged about 71 (Table 7). The highest recent cumulative level of take occurred in FY12 with 418 (0.4% of the estimated population) skunks taken (Table 15). Skunk populations are reported to be able to sustain a 60% annual harvest level indefinitely (Boddicker 1980), which would equal 58,200 skunks based on the estimated Arizona population. Because the proposed cumulative take of WS-Arizona and non-WS entities is substantially less than the potential sustainable harvest level, cumulative impacts are likely of a very low magnitude.

Table 15. Cumulative striped skunk take by WS-Arizona (includes non-target) and hunter harvest from FY11 to FY15.

STRIPED SKUNK IMPACT ANALYSIS							
	FY11	FY12	FY13	FY14	FY15	Average	Proposed Take
Est. Population	97,000	97,000	97,000	97,000	97,000	97,000	97,000
WS-Arizona Take	52	61	20	26	31	38	60
Hunter Harvest	187	357	310	390	378	324	390
Total Take	239	418	330	416	409	362	450
WS-Arizona Take - % of Pop.	0.05%	0.06%	0.02%	0.03%	0.03%	0.04%	0.06%
Total Take - % of Pop. Population	0.25%	0.37%	0.34%	0.4%	0.4%	0.4%	0.46%
Maximum Sustainable Harvest Level	60%	60%	60%	60%	60%	60%	60%

WS-Arizona received an average of 45 complaints annually from FY11 to FY15 involving hooded skunks (Table 1). WS-Arizona took an average of 9 hooded skunks annually from FY11 through FY15 (Table 11). Hunter harvest of skunks is combined for all 4 species that inhabit Arizona. Hooded skunks, occupying a fifth of the area of striped skunks, were likely only a small proportion of the total hunter harvest reported to the state (likely much less than 20%). Using 20% as a likely over-estimate of hunter harvest, the average annual harvest from FY11 to FY15 by hunters would have been 389 skunks for a combined average annual take of 78 hooded skunks by hunters. Take would have to increase more than a hundred-fold before an impact would occur on the population, however WS-Arizona anticipates taking only up to 10 hooded skunks per year. Based on the available data it is unlikely that this level of take would have any adverse effect on the species' population or trend in Arizona.

Western spotted skunks are not often the target of PDM and WS-Arizona took an average of less than 1 western spotted skunk annually from FY11 through FY15 (Table 1). WS-Arizona also received an average of less than one request for assistance with spotted skinks per year for the same time period. Spotted skunk harvest by hunters is combined with all skunks species taken. A very minimal percentage of the skunk harvest in Arizona is spotted skunks, as they are not targeted thus they would probably be much less than 1% of the total skunk harvest. However, if 1% of the current hunter harvest were spotted skunks, then an average of two spotted skunks would be harvested by hunters annually, bringing average annual harvest of western spotted skunks from hunters and WS-Arizona to 4. This minor level of take would have a negligible impact to an estimated population of 57,000 (see Chapter 3). Compared to the take from FY12 through FY15 (Table 7) of over 359 skunks harvested annually, take of western spotted skunks is minimal. The magnitude of take is extremely low and could be increased substantially before an impact to the population would occur. WS-Arizona anticipates taking less than 10 spotted skunks per year. This level of take is not expected to have a negative impact on the species population or trend in Arizona.

WS-Arizona received an annual average of 2.3 damage complaints involving hog-nosed skunks from FY11 to FY15 (Table 1). WS-Arizona took an average of 0.8 hog-nosed skunks annually from FY11 to FY15 (Table 11). AGFD (2012) combines harvest from all four skunk species in Arizona and take of hog-nosed skunk is likely much less than 5%. However, using 5%, the total of WS-Arizona take and hunters harvest would be 2.5 which is <0.1% of the estimated population of 29,000 (see Chapter 3). Take would have to increase more than a hundred-fold before an impact would occur. Currently the magnitude of impact is negligible. WS-Arizona estimated take is less than 5 annually.

Mountain Lion Population Impact Analysis. Mountain lions generated the third greatest number of complaints in Arizona, 213 annually from FY11 to FY15 (Table 1). To resolve these complaints, WS-Arizona killed an average of 36 mountain lions per year and freed 3 from FY11 to FY15 (Table 11). During this same time period, hunters harvested an average of 283 lions annually (Table 16). WS-Arizona did not take any non-target mountain lions from FY11 through FY15. Table 16 gives the cumulative impact to mountain lions from all harvest including private depredation take and vehicular kills. Table 17 and 18 provides the cumulative impact for Graham County and Greenlee County wherein WS-Arizona conducts the majority of mountain lion work. The cumulative impact on the mountain lion population was highest in FY15 at 7.4% (Table 16).

Table 16. Statewide, cumulative mountain lion take in Arizona including WS-Arizona take, hunter harvest, and other known mortalities from FY11 to FY15.

MOUNTAIN LION IMPACT ANALYSIS							
	FY11	FY12	FY13	FY14	FY15	Average	Proposed Take
Est. Population	5,300	5,300	5,300	5,300	5,300	5,300	5,300
WS-Arizona Take*	42	47	34	28	29	36	75
Hunter Harvest	287	235	302	233	360	283	360
Other Take**	4	4	1	2	3	3	4
Total Take	333	286	337	263	392	322	439
WS-Arizona Take - % of Pop.	0.79%	0.88%	0.64%	0.52%	0.54%	0.68%	1.4%
Total Take - % of Pop.	6.2%	5.3%	5.6%	4.9%	7.4%	6.1%	8.28%
Allowable Harvest Level	30%	30%	30%	30%	30%	30%	30%

* WS-Arizona take by federal fiscal year does not match the mountain lion take for the calendar years as reported by AGFD (e.g., in CY11 AGFD (2016) reported 6 less lions taken, CY12 AGFD (2016) reported 10 less lions taken, CY13 AGFD (2016) reported 7 less lions taken, CY14 AGFD (2016) reported 5 more lions taken, and 4 more lions taken for CY15. Data does not match due to the mismatch between fiscal year and calendar year data sets.).
** Other take only includes road kills, poaching, etc.

Several studies of mountain lion population dynamics provide insights into sustainable harvest levels. The allowable annual harvest level for mountain lion populations is <30% (Lindzey et al 1992, Ross et al. 1996). Ashman et al. (1983) found for their study in Nevada that under "moderate to heavy exploitation of 30%-50% removal" the mountain lion population had the recruitment (reproduction and immigration) capability of rapidly replacing annual losses. Logan et al. (1996) determined the rate of population increase varied from 8-11% in an unhunted, uncontrolled population to 21-28% in a population where harvest and control was simulated by removing half of the lions from the study area (New Mexico). They concluded that rates of increase in mountain lion populations are density dependent; as a population declines in relation to carrying capacity, the rate of increase becomes greater. This is a natural mechanism of wildlife populations that serves to protect species by enhancing the ability of populations to recover from declines. Logan et al. (1996) suggested that, for a mountain lion population to remain at or near maximum carrying capacity, no more than 11% of the adults should be harvested annually. For a population managed for control, the harvest level might need to exceed 28% per year to cause the population to decline substantially. It appears that a viable population can be maintained up to 50% (Anderson and Lindzey 2005) of carrying capacity with harvest levels that range from 25% to 40% (Laundre et al. 2007, Stoner et al. 2006).

Concern may exist that increased mountain lion harvest may lead to decreased kitten survival. This suggests overall mountain lion harvest may be higher than direct harvest due to infanticide (Cooley et al. 2009, Ruth et al 2011). Increased male lion harvest has been suggested to lead to increased sub-adult males in the population and territorial instability (Logan and Sweanor 2010, Ruth et al. 2011). However, recent mountain lion research in Colorado have shown higher infanticide rates during a 5-year non-hunting period than the subsequent 5-year hunting phase of the study (Logan 2015). Infanticide mostly occurs in winter when mountain lion territories overlap and adult males, resident males and immigrating males practice infanticide on mountain lion cubs and possibly their mother (Ruth et al. 2011).

Arizona wildlife managers limit mountain lion harvest to between 10 and 25% of the estimated abundance (McKinney 2011). Recent mountain lion harvest in Arizona has been below 14%, which meets management goals. Logan et al. (1996) found that this level of harvest is less than a third of the level that could be sustainable by a population that is at half of carrying capacity. Data from Logan et al. (1996) also indicated that 89% of the adult plus subadult mountain lion in the San Andres Mountains in New Mexico were adults. Therefore, the percentage of adults in the hunter harvest is assumed to be no more than 89% but this may be an overestimate. The number of mountain lions harvested has fluctuated between 250 and 350 for the past 20 years with females averaging 40-50% of the harvest and adult females accounting for about 21% of the total harvest. These numbers are within the value that Anderson and Lindzey (2005) believed would not influence population abundance. This suggests harvests from hunted or controlled populations may have a higher proportion of subadults. Further evidence that the cumulative harvest levels of past years have not affected the mountain lion population can be seen in records of historic hunter harvest (Table 7) which has remained relatively stable from an average of 280 from 2002 to 2006 to an average of 299 from 2007 to 2011. The fact that there have been enough lions to maintain total harvest at increasing levels for so long a period is strong evidence that Arizona's mountain lion population has been near carrying capacity and able to withstand the levels of harvest and depredation take that have occurred. Therefore, from this evidence, it is assumed that WS-Arizona has not had a cumulative impact on the mountain lion population in Arizona.

AGFD monitors mountain lion take in game management units (GMUs). WS-Arizona take is included in the AGFD analyses. The majority of take by WS-Arizona is in Graham and Greenlee Counties where mountain lion habitat conditions are ideal and their density is probably the highest in Arizona. GMUs are not quite equal the counties but Graham County consists basically of GMUs 28, 31, and 32. Greenlee County consists of GMUs 1 and 27. The population of mountain lions in these counties is probably fairly high because the habitat conditions and prey base are ideal for healthy mountain lion populations. The Arizona density estimate is about 4 adult lions/100 mi^2 covering 80% of the state. This includes less desirable habitat such as Maricopa County where mountain lions are probably less dense. However, for the analysis at the local level in Graham and Greenlee Counties, the density estimate, 7/100 mi^2 (Cunningham et al. 1995) will be used. Tables 17 and 18 analyze impacts in the two counties by CY with data obtained from AGFD (2016) because they include WS-Arizona take.

Table 17. Cumulative mountain lion take only in Graham County, Arizona including WS-Arizona take, hunter harvest, and other know mortalities from Calendar Year 2011 to 2015.

MOUNTAIN LION IMPACT ANALYSIS FOR GRAHAM COUNTY (GMU 28, 31,32) BY CALENDAR YEAR						
	2011	2012	2013	2014	2015	Average 2011-2015
Est. Population	325	325	325	325	325	325
WS-Arizona Take*	22	26	24	16	14	20
Hunter Harvest	23	18	14	17	18	18
Other Take**	0	1	0	0	0	.25
Total Take	43	45	37	33	32	40
WS-Arizona Take - % of Pop.	6.8%	8.0%	7.4%	4.9%	4.3%	6.2%
Total Take - % of Pop. population	13.2%	13.8%	11.4%	10.2%	9.8%	12.3%
Allowable Harvest Level	30%	30%	30%	30%	30%	30%

* WS-Arizona take by calendar year does not match the lion take for the calendar years as reported by AGFD (e.g., in CY11 AGFD (2016) reported 7 more lions taken, CY12 AGFD (2016) reported 5 more lion taken, CY13 AGFD (2016) reported 14 more lions taken, CY14 AGFD (2016) reported 7 more lions taken, and in CY15 AGFD reported 12 more lions taken. Data does not match due to the mismatch between fiscal year and calendar year data sets.
** Other take only includes road kills, poaching, etc.

Table 18. Cumulative mountain lion take only in Greenlee County, Arizona including WS-Arizona take, hunter harvest, and other know mortalities from Calendar Year 2011 to 2015.

MOUNTAIN LION IMPACT ANALYSIS GREENLEE COUNTY (GMU 1,27) BY CALENDAR YEAR						
	2011	2012	2013	2014	2015	Average 2011-2015
Est. Population	129	129	129	129	129	129
WS-Arizona Take*	10	7	9	4	2	6
Hunter Harvest*	20	18	14	20	27	18
Other Take**	0	0	0	0	0	0
Total Take	30	25	23	26	29	24
WS-Arizona Take - % of Pop.	7.8%	5.4%	7.0%	3.1%	1.6%	4.7%
Total Take - % of Pop. population	23.3%	19.4%	17.8%	20.2%	22.5%	18.6%
Allowable Harvest Level	30%	30%	30%	30%	30%	30%

* WS-Arizona take by calendar year does not match the lion take for the calendar years as reported by AGFD (e.g., in CY11 AGFD (2016) reported 7 less lions taken, CY12 AGFD (2016) reported 1 less lions taken, CY13 AGFD (2016) reported 8 less lions taken, CY14 AGFD (2016) reported 2 less lions taken, and in CY15 AGFD reported1 less lion taken. Data does not match due to the mismatch between fiscal year and calendar year data sets.
** Other mortality does not include non-WS depredation take, only includes road kills, poaching, etc.

Graham County had a maximum take in CY 2012 with 45 taken and Greenlee County had a maximum take in CY 2011 with 30 being taken. This level of take represented 13.8% and 23.3% of the estimate populations in those counties. With the conservatively estimated population in those counties, WS-Arizona is not impacting the population in either county beyond the 30% harvest level. AGFD may adapt season length or harvest thresholds to address specific management objectives for mountain lions and prey species. However, this is expected to remain fairly stable over the long-term with AGFD monitoring take in these GMUs. Thus, WS-Arizona believes that it is not impacting these subpopulations of mountain lions. WS-Arizona anticipated that the average annual take from the past 5 years will continue. However, WS-Arizona assessed for a maximum take of 75 to account for fluctuations in requests. This level of take is not expected to have a negative impact on the species population or trend in Arizona.

Commentors provided additional publications for consideration during the first public comment period regarding the potential destabilizing effects of hunting and development on mountain lion populations (Peebles et al. (2013), Lambert et al. (2006), and Smith et al (2015)). These studies were reviewed and analyzed in section 2.3.11.4 of this EA, however the implications in the studies specific to mountain lion populations will be considered here. Factors addressed in the studies, such as hunting and development, are ongoing and not a novel situation and impacts of these factors are reflected in overall mountain lion population trends and status discussed in Section 4.2.1. Existing AGFD population monitoring and adaptive management of take, primarily regulated hunting, is sufficient to ensure that cumulative impacts on mountain lion populations do not have a significant adverse impact on the state mountain lion population. WS-Arizona take is very low (less than 1% of the estimated population per year), and consititutes only a small fraction of total known mountain lion mortality, and is unlikely to contribute substantively to existing population trends. Management of factors such as hunting and development are outside the scope of APHIS-WS authority and the scope of this analysis.

Feral Cat Impact Analysis. Feral cats are common in Arizona and WS-Arizona received an average of 44 requests for assistance from FY11 to FY15 (Table 1). WS-Arizona killed an average of 17 feral cats and released 15 to the appropriate Animal Control facility annually from FY11 to FY15 (Table 11). Cats have been cited as having an impact on multiple wildlife species (American Bird Conservation 1997, 2006), including sensitive mammals in Arizona (AGFD 2012). The effect of feral cat management on the natural environment would likely be positive, especially for the bird and small mammal species that feral cats prey upon. The take of cats by WS-Arizona (based upon requests) would be minor to the number killed by animal control and humane organizations in Arizona each year. The take of feral cats by the program is considered to be of no significant impact on the human environment since cats are not an indigenous component of ecosystems in Arizona. It is likely that the average take from the past 5 years will continue, however WS-Arizona expects a maximum take of 50 feral cats per year. This level of take is not expected to have a negative impact on the species population or trend in Arizona.

Raccoon Population Impact Analysis. WS-Arizona received an average of 40 requests for assistance with raccoons annually from FY11 to FY15 (Table 1). The raccoon population in Arizona has increased largely due to an increase in manmade habitat, habitat where raccoons thrive. As discussed in Chapter 3, a conservative population estimate for raccoons in Arizona is 148,000. In response to requests for assistance, WS-Arizona took an average of 19 raccoons each year (Table 11). Additionally, WS-Arizona released on average less than one non-target raccoons from FY11 to FY15 (Table 9). During the same general period (2010-2015), hunters took an average of 446 raccoons annually (Table 8). WS-Arizona's maximum take from FY10 through FY15 was 38 in FY11, less than 0.03% of the estimated population (Table 19). However, the highest combined take (hunter harvest combined with WS-Arizona's harvest) occurred in FY13 with 3,127 raccoons taken, or 2.1% of the estimated population. The allowable compensatory harvest level for raccoons is established at 20 to 40% of the fall population (Clark et al. 1989). WS-Arizona take and cumulative impact is of low magnitude to the statewide raccoon population. It is likely that the raccoon take trend of the past 5 years will continue, however WS-Arizona will assess a maximum of 45 raccoons per year in the future. This level of take is not expected to have a negative impact on the species population or trend in Arizona.

Table 19. Cumulative raccoon take in Arizona by WS-Arizona (includes non-target take) and hunter harvest from FY11 to FY15.

RACCOON IMPACT ANALYSIS							
	FY11	FY12	FY13	FY14	FY15	Average	Proposed Take
Est. Population	148,000	148,000	148,000	148,000	148,000	148,000	148,000
WS-Arizona Take	38	27	16	6	9	19	45
Hunter Harvest	595	1,391	3,111	327	127	1,356	3,111
Total Take	633	1,418	3,127	333	136	1,378	3,156
WS-Arizona Take - % of Pop.	0.03%	0.02%	0.01%	0.004%	0.006%	0.01%	0.03%
Total Take - % of Pop. Population	0.43%	0.96%	2.1%	0.23%	0.09%		2.13%
Allowable Harvest Level	40%	40%	40%	40%	40%	40%	40%

Black Bear Population Impact Analysis. WS-Arizona received an average of 40 complaints annually involving black bear damage in Arizona from FY11 through FY15 (Table 1). WS-Arizona killed an average of 7 bears per year from FY11 to FY15 (Table 11) with maximum of 14 in FY11. The increase in take during FY11 corresponded to 95 damage complaints during that year. However, the highest cumulative take which includes all known mortality occurred in FY12 with 352 or 6.9% of the estimated population, about 25% of the allowable harvest (Table 20). The AGFD establishes female harvest limits for each individual hunt unit and when the limit is reached the unit is closed. The AGFD does not set a total harvest limit or threshold. With a population estimate of 5,100, a cumulative take of 1,000 black bears would have to be killed to reach 20% of the population level, which is the maximum sustainable harvest level.

Table 20. Cumulative black bear take in Arizona including WS-Arizona take, hunter harvest, and other know mortalities from FY11 to FY15.

BLACK BEAR IMPACT ANALYSIS							
	FY11	FY12	FY13	FY14	FY15	Average	Proposed Take
Est. Population	5,100	5,100	5,100	5,100	5,100	5,100	5,100
WS-Arizona Take*	14	12	3	4	1	7	25
Hunter Harvest	291	303	239	220	242	262	262
Other Take/Mortality *	27	37	4	25	13	21	21
Total Take	331	352	246	249	256	286	308
WS-Arizona Take - % of Pop.	0.27%	0.24%	0.06%	0.08%	0.02%	0.1%	0.49%
Total Take - % of Pop. Population	6.5%	6.9%	4.8%	4.9%	5.0%	5.6%	6.0%
Allowable Harvest Level	20%	20%	20%	20%	20%	20%	20%

* Other mortality includes road kills, poaching, etc.

AGFD has responsibility for black bear damage management and has decision authority over the take in Arizona. WS-Arizona has an agreement with AGFD to respond to black bear complaints involving livestock and HHS. AGFD monitors the black bear population and includes take from WS-Arizona in their analyses. WS-Arizona notifies AGFD where and when black bears are taken to be considered in their analysis at the GMU level. Therefore, WS-Arizona is not additively impacting the population since AGFD uses WS-Arizona take information to determine the allowable recreational harvest for each GMU. AGFD adjusts seasons, permit levels, and female harvest limits to address population objectives and ensure a sustainable population. In addition to lethal take, WS-Arizona captured and relocated an average of 10 bears annually from FY11 to FY15 (Table 11) and this action did not impact the population. It is likely that the average take trend for the past 5 years can be expected to continue, however WS-Arizona has assessed a maximum take level of 25 black bears per year in the future. Based on the analysis, this level of take is not expected to have a negative impact on the species population or trend in Arizona.

Fox Populations Impact Analyses. WS-Arizona received an annual average of 19.4 requests for assistance with all fox species from FY11 through FY15 (Table 1). WS-Arizona took an average of 5 target gray fox in Arizona from FY11 to FY15 (Table 11). WS-Arizona took an average of less than 1 kit fox in Arizona from FY11 to FY15 and no red fox (Table 11). AGFD reported an average of 910 fox taken by hunters (Table 8) for all three species in Arizona (AGFD 2016).

As discussed in Chapter 3 of this EA, the gray fox population in Arizona is estimated to be 114,000. This estimate is used to determine relative impacts as shown in Table 21. An acceptable harvest rate for gray fox is 15% (Apker 2015) or 17,100, based on the estimated AZ population. During the same period, as stated above, hunters took an average of about 8,935 annually (Table 8) which further illustrates the current low rate of take by WS-Arizona (about 0.01% of the total take). However, the impact analysis on gray fox (Table 21) assumes that all fox taken by hunters (Table 8) in Arizona were gray fox for the sake of being conservative. Annual take averages about 8% of the population or about 50% of the allowable harvest. It is likely that the average take trend for the past 5 years can be expected to continue, however WS-Arizona has analyzed a maximum take of 30 grey fox per year to account for fluctuations in requests for assistance.

Table 21. Cumulative gray fox Take in Arizona by WS-Arizona (target and non-target) and hunter harvest from FY11 to FY15.

GRAY FOX IMPACT ANALYSIS							
	FY11	FY12	FY13	FY14	FY15	Average	Proposed Take
Est. Population	114,000	114,000	114,000	114,000	114,000	114,000	114,000
WS-Arizona Take	13	7	1	3	1	5	30
Hunter Harvest*	10,258	9,848	9,309	6,324	1,497	8,935	10,258
Total Take	10,271	9,855	9,310	6,327	1,498	8,941	10,288
WS-Arizona Take - % of Pop.	0.01%	0.006%	0.001%	0.003%	0.001%	0.004%	0.03
Total Take - % of Pop. population	9.0%	8.6%	8.2%	5.6%	1.3%	7.8%	9.02
Allowable Harvest Level	15%	15%	15%	15%	15%	15%	15%

* Assumes all fox harvested by hunters were gray fox to be conservative

WS-Arizona takes very few kit foxes as targets in PDM activities because they generate few complaints and are rarely a significant problem. WS-Arizona took an average of one kit fox for PDM in Arizona annually from FY11 to FY15 (Table 11). Hunter harvest for foxes in Arizona is combined for all species and, thus, an accurate number taken is not available. AGFD (2016) believes that the kit fox take is less than 5% of the fox harvest. Assuming conservatively that 10% of the fox harvest is kit fox (Table 8), then an average of about 894 were taken annually. With an estimated 17,000 kit fox in Arizona (see Chapter 3), take is about 5% of the estimated population. A sustainable harvest has not been determined for kit fox but if 10% of the population could be taken without an adverse impact, a relatively conservative assumption, it is possible that 1,700 kit fox could be harvested. Cumulative take could be doubled before a moderate magnitude of impact would be reached. WS-Arizona PDM has had virtually no impact on this species because there has been little take. WS-Arizona does not anticipate taking more than 5 kit fox per year, but WS-Arizona could take several hundred without impacting the population, and this is only likely in an abnormal situation such as widespread rabies outbreak.

WS-Arizona did not take any red fox during PDM activities in Arizona. Red fox are only found on the Navajo Nation in Arizona (Mikesic and Larue 2003), thus, hunter harvest was probably few, if any. If 1% of the fox harvest (Table 8) recorded by AGFD (2016) were red fox, then an average of 41 would have been harvested. The red fox population was estimated at 1,100 in Arizona in Chapter 3 of this EA. An allowable harvest for red fox is 50% of the total population (Harding et al. 2002) or 550 per year. Thus, the cumulative take would clearly be a low magnitude, less than 10% of the allowable harvest. WS-Arizona had no impact on the red fox and could increase PDM activity for this species, if necessary. WS-Arizona anticipates taking less than 5 red fox per year, which would have no effect on the population.

Bobcat Population Impact Analysis. WS-Arizona received an average of 14 requests for assistance with bobcat damage from FY11 to FY15 (Table 1). In response to requests for assistance, WS-

Arizona took an average of 5 target bobcats annually during FY11 to FY15 (Table 11). WS-Arizona did not kill any non-target bobcat incidental to PDM (Table 9) from FY11 to FY15, but did free 27 bobcats. Hunters harvested an average of 4,514 annually during the same time (Table 8). Apker (2015) reported an allowable harvest level for bobcat populations of 17%, or 4,590 bobcats from the estimated population of 27,000. The average take of bobcats, by WS-Arizona (7) and hunters (2,177) from FY07 to FY11, was about 47% of the allowable harvest. Therefore, total harvest could increase about two-fold during low harvest years and by a few hundred during high harvest years without having an effect on the population. Historic harvest of bobcats (1987-2011) by hunters and trappers was at its high in FY87-FY91 with an average of 4,293, and averaged 4,328 from FY12-FY15 (Table 7). This represented 16% of the estimated population of 27,000, lower than a sustainable harvest (4,590 for the estimated population). This population estimate is considered very conservative and a much higher level of harvest could likely be supported. Even so, WS-Arizona take has been less than 0.1% of the population and a minor component of overall bobcat mortality. WS-Arizona will not take more than 20 bobcats per year without further analysis, and this level of take is not expected to have an adverse effect on the bobcat population.

Badger Population Impact Analysis. WS-Arizona received an average of 4 requests for assistance with badger damage annually from FY11 through FY15 (Table 1) and took on average 6 target (Table 11) and less than 1 non-target (Table 9) annually, from FY11 to FY15. Few badgers are harvested by hunters in Arizona; badgers have primarily been trapped in the state. An average of 56 badgers per year have been taken over the last 5 years (Table 7). The estimated population of badgers in Arizona is 114,000, as discussed in Chapter 3 of this EA. Badger populations can safely sustain an annual harvest rate of 30-40% annually (Boddicker 1980). The cumulative impact is negligible at much less than 0.0001% of the estimated population. Cumulative take would have to be in the tens of thousands before an impact would occur. Take and cumulative impacts from WS-Arizona PDM are a minor component of badger mortality. WS-Arizona will not take more than 10 badger per year, without further analysis, which is not anticipated to adversely affect the badger population.

River Otter Population Impact Analysis. WS-Arizona did not receive any requests for PDM assistance for river otter damage management assistance and none were killed from FY11 to FY15. Arizona does not have a hunting or trapping seasons for otters. WS-Arizona take and known cumulative harvest have been zero from FY11 to FY15 and, therefore, inconsequential to the Arizona otter population. AGFD has documented increasing nuisance otter issues and anticpates a need for WS-Arizona to assist with managing the increasing number of river otter complaints (A. Howard, AGFD, Pers. comm. 9/6/2017.). WS-Arizona will work closely with AGFD to provide wildlife damage assitance when dealing with nuisance river otters complaints. If necessary the take would be very few and targeted. WS-Arizona does not anticipate taking more than 6 river otters annually under this analysis. This level of take is not expected to have a negative impact on the species population in Arizona.

Ringtail Population Impact Analysis. WS-Arizona received an average of 3 requests for ringtail damage management annually from FY11 through FY15 (Table 1). WS-Arizona did not take any as target species (Table 11) and one was freed as a non-target (Table 9), from FY11 to FY15. The estimated population of ringtail is 23,000 as discussed in Chapter 3 of this EA. The ringtail population has experienced almost no impact from PDM from FY11 to FY15 while hunters harvested an average of 39 ringtails per year (Table 7). The highest estimated harvest in prior years (1976 to present) was 4,475 (AGFD 2016) in the 1987-88 season representing 19% of the estimated population. Current take is less than 1% of prior harvest. WS-Arizona take and cumulative harvest are inconsequential to the ringtail population and would have to be in the thousands before a moderate level of impact would be reached. WS-Arizona anticipates taking less than 5 per year. This level of take is not expected to have a negative impact on the species population or trend in Arizona.

Opossum Population Impact Analysis. WS-Arizona received an average of 1 request for opossum damage management assistance annually from FY11 to FY15 (Table 1). WS-Arizona did not take any opossums during that time period. No other take is known for opossum in Arizona. The estimated population of opossums in Arizona is 3,000, as discussed in Chapter 3 of this EA. A sustainable harvest rate has not been determined, though it is likely high (Seidensticker et al. 1999). WS-Arizona PDM take and cumulative impacts have been nonexistent. WS-Arizona will not take more than 2 opossum per year under this analysis, which will not negatively impact the population.

White-Nosed Coati Population Impact Analysis. WS-Arizona received an average of 2 requests for assistance with white-nosed coati damage management annually from FY11 through FY15 (Table 1). WS-Arizona did not take any white-nosed coati from FY11 to FY15. Take of white-nosed coatis by hunters is not known as white-nosed coatis are classified as a nongame mammal by AGFD. However, AGFD allows a bag limit of one coati per calendar year per licensed hunter. The estimated population of white-nosed coatis is difficult to determine as little is known about their densities. However, if data is based off of the densities of 0.6/ mi2 in Central America (Kaufmann 1999) this would provide an estimate of 7,000 in Arizona, as discussed in Chapter 3 of this EA, WS-Arizona does not anticipate that the level of take would increase in the foreseeable future. WS-Arizona does not anticipate taking more than 5 white-nosed coati per year, which would not negatively impact the population.

Other Target Predator Species Impacts. WS-Arizona received one request in FY11 for feral domestic ferret damage management assistance. No other take is known for feral domestic ferret in Arizona.

Other predator species that may cause occasional problems in Arizona such as the long-tailed weasels, did not elicit any requests for assistance, nor have any been killed as target or non-target species from FY11 to FY15. WS-Arizona receives periodic complaints involving these species, so it is possible that WS-Arizona could conduct operational PDM in the future to take offending animals. Long-tailed weasels were not reported in harvest records (AGFD 2016), thus hunter and trapper harvest is not available. Population estimates are given for these species in Chapter 3 and, as noted, maybe somewhat rare in the state because of limited distribution. Even with minimal take by WS-Arizona, these populations are highly unlikely to be cumulatively impacted by WS-Arizona PDM efforts. Therefore, unless a major project takes place that involves the take of a large number (more than 25) of long-tailed weasels (not to include feral domestic ferrets as they are not part of the natural environment), WS-Arizona would not analyze population impacts in a new EA.

4.2.2. Effects on Non-target Species Populations, Including T&E Species

Non-target species can be impacted by PDM whether implemented by WS-Arizona, other agencies, or the public. Impacts can range from direct take while implementing PDM methods to indirect impacts resulting from the reduction of predators in a given area. Measures are often incorporated into PDM to reduce impacts to non-target species. Various factors may, at times, preclude use of certain methods, so it is important to maintain the widest possible selection of PDM tools for resolving predator damage problems. PDM methods used to resolve predator damage must also be legal and biologically sound. Often, but not always, impacts to non-target species can be minimized. WS-Arizona targets predators for a variety of its programs including rabies management, disease surveillance, managing wildlife hazards at airports and PDM. Although the actions taken for rabies management and disease surveillance are covered under separate EAs, WS-Arizona has included all the take of target and non-target species in the analysis for this EA to evaluate the cumulative impact to species through PDM.

- **Impact on Trophic Cascades Including Prey Populations and Potential for Mesopredator Release**

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. Depending on the nature of the impact and the prey species, changes in vegetation and prey behavior can have impacts on abiotic factors such as soil compaction, soil nutrients, and river morphology (Beschta and Ripple 2006, Naiman and Rogers 1977). In the Midwest, changes in coyote activity were documented to impact white-tailed deer activity and 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.

The issue of trophic cascades also refers to the impact of the presence or absence of a larger apex predator (e.g., wolves or coyotes) on another predator (fox, raccoons, feral cats) that may have different effects on prey populations (aka. mesopredator release; Prugh et al. 2009, Brashares et al. 2010, Miller et al. 2012). The presence of coyotes in an area has been shown to limit the density of smaller predators which may prey more heavily than coyotes on songbirds, ground nesting birds such as ducks and game birds, and some rodents (Levi and Wilmers 2012, Miller et al. 2012). Recovery of wolf populations and associated long-term declines in coyote populations have been documented to result in an increase in survivorship of pronghorn deer fawns (Berger and Conner 2008). Carnivores such as badgers, bobcats, and fox also increase in number when coyote populations are reduced (Robinson 1961, Nunley 1977b, Crooks and Soulé 1999).

Data on the impacts of coyotes and coyote removal on prey populations are mixed. In two studies conducted in south Texas (Beasom 1974c, Guthery and Beasom 1977), intensive short-term predator removal was employed to test the response of game species to reduced coyote abundance. At the same time, rodent and lagomorph species were monitored. A marked reduction in coyote numbers apparently had no notable effect on the populations of rabbits or rodents in either study. Similarly, Neff et al. (1985) noted that reducing coyote populations on their study area in Arizona to protect pronghorn fawns had no apparent effect on the rodent or rabbit population.

Wagner and Stoddart (1972) noted that coyote predation is a significant source of mortality in jackrabbit populations and may have played an important part in jackrabbit population trends, but they make no connections between PDM and jackrabbit mortality or coyote populations. In fact, the coyote population in Wagner and Stoddart (1972) was subject to more sustained and intensive control (coyotes were taken through use of aerial shooting, trapping for bounties and pelts, and the use of 1080 poison bait stations that were placed in fall and recovered in spring) than is expected to occur under the current WS-Arizona PDM program. Any moderating effects of coyotes on jackrabbit populations occurred even though the population was subject to intensive removals.

Wagner (1988) reviewed literature on PDM impacts on prey populations and concluded that such impacts vary with the locale. In some ecosystems, prey species, such as snowshoe hares, increased to the point that vegetative food sources were depleted, despite predation. In others, coyotes may limit jackrabbit density, while food shortages do not limit jackrabbit abundance (Wagner 1988, Stoddart et al. 2001). Wagner and Stoddart (1972) reported that coyote predation was a major source of jackrabbit mortality in the Curlew Valley of Utah that may have caused a decline in the local jackrabbit population.

Henke (1995) reviewed literature concerning coyote-prey interactions and concluded that short-term coyote removal efforts (<6 months per year) typically did not result in increases of small mammal prey species populations. This finding is supported by Gese (2005) in which local coyote removal of up to 60 to 70% of the population for two consecutive years in a 131 mi2 study area did not appear to have an impact on local lagomorph abundance. Some of the reason for the lack of impact noted by Gese (2005) may have been attributable to the fact that coyote pack size and density in the project area returned to pre-removal levels within 8 months of removal. Henke (1995) also concluded that long-term intensive coyote removal (nine months or longer per year) could, in some circumstances, result in changes to the rodent and rabbit species composition in the area where removals occurred, which could lead to changes in plant species composition and forage abundance. Henke (1995) based the conclusion that long-term intensive coyote removal could result in changes to prey populations on a previous study (Henke 1992) that was conducted in the rolling plains area of Texas that involved one year of pretreatment and two years of treatment. Removals occurred year round and resulted in a sustained reduction in the coyote population of approximately 48%. After the initiation of coyote removal, species richness and rodent diversity declined in treatment areas and relative abundance of badgers, bobcats, and gray foxes increased. However, the sustained reduction in coyote populations (and presumably other mesopredators) resulting from restoration of wolf populations resulted in increases in the number of voles within 3 km of wolf dens (Miller et al. 2012).

Another recent meta-analysis conducted by Ripple et al. (2013) suggested that any MPR effects due to wolves could be dependent on the context, and may be influenced by bottom-up factors, such as the productivity of a system without wolves. Factors such as human-provided food subsidies, scavenging opportunities on livestock and large ungulates, and existence of alternative prey may confound results. The authors suggest that a link exists between wolf population declines and expansion in the ecological influence of coyotes. The strength of any trophic cascade created by wolf recolonization may be dependent on whether wolf populations may reach ecologically-effective densities (also suggested by Letnic et al. (2007)), the amount of unfragmented habitat available, levels of wolf harvests and removals, and presence of refugia and food subsidies available to coyotes.

In Australia, researchers have suggested that widespread and intensive control of dingoes using aerial distribution of 1080-poisoned baits has resulted in releases of mesopredators, especially introduced foxes and cats (Letnic et al. 2007, Wallach et al. 2008, Brook et al. 2012), although

Allen et al. (2014) argues that other plausible explanations may exist. Letnic et al. (2007) suggested factors that may also limit the control of dingoes on foxes include the abundance of prey (particularly introduced rabbits), seasonal activity patterns, levels of site and vegetation productivity, predator control regimes used, human food subsidies, and reproductive rates. Importantly, the authors argue that it is possible that top predators can ecologically express control over mesopredator populations only when apex predator population densities reach a certain threshold (also suggested by Ripple et al. 2013), which is likely to be above that at which apex predators pose a threat to livestock of human safety. Lack of human tolerance to predators may not allow that ecological threshold of abundance to be reached.

Similarly, Newsome et al. (2017) found that top predators suppressed mesopredators in areas where top predator densities were highest (core area), supporting the notion that removal of top predators can cause MPR. At areas outside the top predators core area, mesopredators and top predators have been shown to coexist, indicating that MPR may not occur when top predators are removed in those areas since mesopredators already had a realized ecological role. However, there is uncertainty with their results, since mesopredators could coexist in the high density core of a top predator's territory, but those individual animals are thought to be difficult to detect. The authors note that abiotic factors, such as human disturbance and agriculture, caused both top predators and mesopredators to be absent from the area, dampening the strength of top-down forces enough to create a bottom-up driven system.

Wallach et al. (2008) suggest that dingoes originally coexisted with two endangered species (a ground-nesting bird and a rock-wallaby), and extensive dingo baiting may be the unintended cause of Australia's extinction crisis due to MPR of introduced foxes and cats. Intensively baited dingoes may have managed to preserve pack cohesiveness due to learned behavior in response to human persecution, including becoming difficult to sample and highly secretive in areas of human presence and where they were expected to be exterminated. After intensive baiting of dingoes, endangered species may either crash (which is improperly attributed to the baiting program) or exhibit an exponential increase followed by a crash after a lag period (mesopredator populations increase during the lag period before adversely affecting the population of the endangered species). Brook et al. (2012) found evidence that controlled dingo populations hunted less at dusk (dusk being their common hunting period concurrent with prey activity), and therefore feral cats hunted more at dusk with higher efficiency. Cats may also have the additional behavioral advantage of climbing trees both to access prey and avoid predation by dingoes. Dingo densities may actually increase for a time following intense baiting due to dispersal of young dingoes.

Allen et al. (2013) demonstrated that the removal of dingoes did not result in increased mesopredator abundance. Further, Allen et al. (2014) argues that three often-cited studies purporting to provide evidence of MPR in Australia are actually plagued by imprecise sampling of predator populations. Additionally, none of the studies provide reliable evidence of MPR because there was no verification of reduced dingo populations due to baiting. The authors assert that, despite broad patterns of MPR demonstrations in some contexts, MPR cannot be reliably separated from other equally plausible explanations for the suggested interrelationships among dingoes, foxes, and cats. Additional research by Allen et al. (2018) has indicated that bottom-up effects (habitat and food availability) have a greater influence on hopping-mice (prey item of mesopredators) than the abundance of dingoes.

Some individuals have expressed concerns that activities such as WS-Arizona's PDM would cause disruptions to trophic cascades or irruptions in prey populations, such as rodents or rabbits, by eliminating or substantially reducing top predators (Prugh et al. 2009, Crooks and Soule´ 1999, Ritchie and Johnson 2009, Estes et al. 2011, Bergstrom et al. 2014). WS-Arizona has reviewed these studies but, for the most part, they are not applicable to the types of PDM proposed for Arizona because they involve reviews of the complete absence of apex consumers from the system (e.g., Berger et al. 2001, Bechta and Ripple 2006, Frank 2008, Gill et al. 2009, Ripple et al. 2013; Estes 2011) and WS-Arizona is not removing entire populations.

In some instances impacts have also been observed in cases where the predators were substantially reduced over an extended period of time (e.g., Henke 1992, 1999 and Wallach et al. 2010 discussed above). Ripple and Beschta (2006) documented a site in Zion National Park largely avoided by mountain lions because of high human activity, an impact sustained over a period of decades. Reduction in mountain lions resulted in increases in mule deer and associated increases in herbivory on riparian cottonwoods. Ultimately, this resulted in decreased cottonwood regeneration in the riparian area, increases in bank erosion, and reduction in both terrestrial and aquatic species abundance.

Given the patchy and limited scope of WS-Arizona PDM actions, repopulation of areas where PDM is conducted occurs relatively quickly, often within a year of the removals. As noted above in the section on biodiversity and ecosystem resilience, removals are not expected to result in long-term reductions in pack density or the number of coyotes despite reductions in the age structure of the population (Gese 2005).

The removal of larger predators (e.g., coyote) resulting in an increase in populations of smaller predators (e.g., fox or skunk) is a theory termed mesopredator release and has been documented in the absence of larger predators. Mammal damage management including that conducted by WS-Arizona would not result in an elimination of larger predators. Lethal removals, when necessary, are highly specific to individual site locations and damage situations. For example, APHIS-WS removes only a minor portion of a coyote population in a given area with a history of depredations during specific times when livestock are most vulnerable to predation, or APHIS-WS removes individual animals in response to damage that is occurring to property or other resources. Studies show that coyotes are highly prolific and capable of rapid repopulation from areas following localized damage management and from hunter harvest (Gese 1998, Blejwas et al. 2002, Williams et al. 2003). While removing animals from small areas at the appropriate time can protect vulnerable resources (such as birthing and young livestock), immigration of coyotes from the surrounding area quickly replaces the animals removed and maintains biodiversity (Stoddart 1984). Section 4.2.1.5 discusses how predator populations are not adversely affected, and how cumulative mortality would have to far exceed the greatest expected levels before sustainability would be affected. Therefore, there is no evidence that coyote damage management actions would lead to indirect increases in mesopredators (e.g., skunk, raccoon, fox), or result in other indirect effects on biodiversity.

As discussed in this EA, WS-Arizona only conducts PDM following a request for assistance. When direct management of a depredating animal(s) is needed, efforts focus on management of the specific depredating animal or local group of animals. WS-Arizona does not strive to eliminate or remove predators from any area on a long term basis, no predators or prey would be extirpated, and none would be introduced into an ecosystem. As discussed in detail in Section 4.2.1.5, impacts are generally temporary and in relatively small or isolated geographic areas compared to overall population distributions. Therefore, we conclude that the impacts of WS-Arizona actions are not of sufficient magnitude or scope to result in ecosystem-level shifts in trophic cascades. Most removal of predators for PDM by WS-Arizona involves removal of a small percentage of individuals of the total population from relatively isolated locations (see Section 4.2.1.5). This level of removal is not of sufficient magnitude to result in substantive reductions in predator species abundance.

- **WS-Arizona Impact on Biodiversity and Ecosystem Resilience.**

Biodiversity refers to the variety of species within an ecosystem. Ecosystem resilience refers to the magnitude of disturbance that can be absorbed before the system redefines its structure by changing the variables and processes that control behavior (Gunderson 2000). Predators, particularly apex predators, can have a pronounced impact on biodiversity and ecosystem resilience, (Estes et al. 2011). In diverse ecosystems, there is a degree of redundancy in the roles species play within the different ecological levels (e.g., apex predators, mesopredators, herbivores, plants, decomposers). In general, ecosystems that are less complex in terms of biodiversity and trophic levels, are more susceptible to adverse impacts and stressors such as climate change; disease outbreaks, introduction of invasive species, disease, etc. (e.g., reduced ecosystem resilience; Beschta et al. 2013, Crooks and Soulé 1999, Ritchie and Johnson 2009, Estes et al. 2011, Bergstrom et al. 2014).

Predators impact ecosystems directly through predation and exclusion/reduction in populations of other predators/mesopredators, and indirectly through alteration of prey behavior and habitat use, limiting the abundance of prey species and alteration of impacts these species have on other levels of the food web (see discussion of trophic cascades below; Prugh et al. 2009, Ritchie and Johnson 2009, Estes et al. 2011, Wallach et al 2010, Miller et al. 2012). The loss of apex predators from an ecosystem reduces biodiversity and shortens the food web length in the system which may alter the presence and abundance of mesopredators, increase the intensity of herbivory and ultimately impact the abundance and composition of plant communities, soil structure, nutrients and even physical characteristics of the environment (Diamond 1992, Berger et al. 2001, Beschta and Ripple 2006, Ripple and Beschta 2006, Prugh et al. 2009, Estes et al. 2011). Some authors and members of the public have raised concerns that PDM actions by WS-Arizona may result in unintentional adverse impacts on biodiversity and ecosystem resilience by eliminating or reducing predator populations (Bergstrom et al. 2014). Presence of native predators in a healthy ecosystem may also improve the ability of the system to resist adverse impacts of invasive species. Wallach et al. (2010) found that increases in dingo populations that occurred in the absence of exclusion fencing and poison baiting result in decreases in mesopredators and generalist herbivores and an increase in small and intermediate-weight mammals. Allowing predator populations to achieve a degree of social stability (the presence of packs and associated territoriality) was also identified as important because it established natural population control at levels below the maximum that could potentially be sustained by the prey base.

WS-Arizona PDM would occur in localized areas of Arizona and would not be conducted throughout the year, but would occur for short periods after damage had occurred (i.e., reactive damage management). Activities conducted to reduce threats of damage (i.e., proactive damage management) would likely occur for short periods (90 to 180 days) during the time of year when addressing predators would be the most beneficial to reducing threats of damage (e.g., the period of time immediately preceding and during calving and lambing in the spring). On average, WS-Arizona conducted activities on properties comprising nearly 10.9 million acres during FY 2016, which would represent about 15% of the land area per year in Arizona. WS-Arizona generally only conducts activities on a small portion of the land acres allowed under an MOU, AWP, cooperative service agreement or other comparable document. For example, a landowner may allow WS-Arizona to conduct activities on the 1,000 acres they own but WS-Arizona personnel might only conduct activities on 5 acres of the property. In addition, the number of predators addressed annually by WS-Arizona and other entities is likely a small percentage of the actual populations of those species in the State. Therefore, the effects on biodiversity would be of low magnitude.

Most evaluations of the impacts of predator removal or loss on biodiversity involve systems wherein the predator species has been completely removed from the environment for years (e.g., Berger et al. 2001, Beschta and Ripple 2006, Frank 2008, Gill et al. 2009). WS-Arizona's actions will not result in long-term extirpation or eradication of any wildlife species, so findings of most of these studies are not particularly relevant to the current analysis. WS-Arizona operates in accordance with federal and State laws and regulations enacted to ensure species viability. WS-Arizona operates on a relatively small percentage of the land area of Arizona and take is only a small proportion of the total population of any species as analyzed in Chapter 4. Analysis of impacts on target species in Section 4.2.1.5 and elsewhere in this section indicates the current WS-Arizona PDM program will not result in the direct or indirect loss of any wildlife species population or sustained reduction in predator population densities. Any reduction of a local population or groups would be temporary because natural immigration from adjacent areas or reproduction from remaining animals would replace the animals removed unless actions are taken by the landowner/manager to make the site unattractive to the target species. The limited nature of WS-Arizona take of most predator species listed in this EA is so low that substantive shifts in population age structure are not anticipated (Section 4.2.1.5) and further discussions of this issue will focus on removal of coyotes, which are the species most commonly taken by WS-Arizona.

Henke (1992, 1995) documented a decline in species richness and rodent diversity and increases in relative abundance of badgers, bobcats and gray foxes in areas of Texas where year-round coyote removals resulted in a sustained 48% reduction in the local coyote population. Cottontail rabbit density and raptor richness, species diversity and density did not differ between control and treatment areas. However, the year-round level of coyote removals, which occurred in Henke (1992) does not occur during normal PDM operations which would occur in Arizona under Alternative 5. Similarly, the degree of predator control (exclusion or sustained year-round intensive population reduction efforts via the use of toxicants), was far greater in the study by Wallach et al. (2010) than occurs as a result of PDM that would be conducted by WS-Arizona. Based on findings of Gese (2005), both the number of coyotes and the number of packs in areas with PDM patterns similar to that of WS-Arizona had returned to pre-control levels within 8 months. Although there was evidence of a reduction in the average age of the population, there was no evidence that this resulted in an increase in coyote densities above pre-control levels. Based on this information, we conclude that the impacts of the current WS-Arizona operations (Alternative 5) are not of sufficient magnitude or scope at the local or state level to adversely impact biodiversity or ecosystem resilience.

The impacts of the current APHIS-WS program on biodiversity are not significant nationwide, statewide or Districtwide (GAO 1990); many of the methods and species reviewed in GAO (1990) are the same as the current Arizona APHIS-WS program. WS-Arizona operates on a relatively small percentage of the land area. APHIS-WS' take is only a small proportion of the total population of any species as analyzed in Chapter 4. The AGFD is leading the way in developing guidelines for the elimination of invasive species and re-establishment of native assemblages (AGFD 2012). The AGFD manages wildlife resources in the state in a manner consistent with the North American Model for Wildlife Management, regulated, traditionally consumptive (hunting trapping, fishing) uses have not had a negative influence on those species (AGFD 2012).

- **Effects from the Use of Lead in Ammunition**

Effects to the environment include important factors such as lead used in ammunition as part of PDM activities. WS-Arizona uses nontoxic shot in aerial shooting state wide and a limited amount lead bullets for ground-based shooting. WS-Arizona also uses non-toxic bullets for ground-based shooting in most areas north of Interstate-40. To address even the most remote concerns raised regarding this issue, detailed scientific facts and data related to any potential exposure of lead resulting from the lead used by WS-Arizona in WDM activities are presented here.

In general, hunting using rifles or shotguns, which would be similar in nature to aerial shooting with regard to dispersal of lead shot, tends to spread lead over wide areas, and at low concentrations (Craig et al. 1999). The primary concerns raised thus far, regarding hunting and lead shot contamination, have been focused on aquatic areas where waterfowl hunting occurs, and the feeding habits of many species of waterfowl that result in them picking up and ingesting shot from the bottoms of ponds, lakes, and marshes. Use of lead shot in dry land upland areas has not raised similar levels of concern except where such activities are more intensively concentrated such as those which can occur with dove hunting at harvested crop fields and with game bird hunting at shooting preserves (Kendall et al. 1996). In an ecological risk assessment of lead shot exposure in non-waterfowl bird species, ingestion of lead shot was identified as the exposure mode of concern rather than just contact with lead shot or lead leaching from lead shot distributed in the environment (Kendall et al. 1996). Shots fired during PDM activities are scattered in distribution over relatively wide areas, mostly in remote uninhabited locations, where contact with humans or ingestion by birds picking up grit to aid in digestion of food are highly unlikely.

The amount of lead deposited on the landscape from the firing of shotguns and rifles during PDM is very small since the amount of land area involved is huge: for example, 2.4 million acres on average are managed annually for coyote damage (FY11 to FY15). WS-Arizona uses firearms for many WDM activities in Arizona, including, ground-based shooting, harassment shooting, and shooting to euthanize animals caught in traps, but excluding aerial shooting. WS-Arizona tracks ground-based shooting activities, harassment shooting, and animals killed in traps.

If we assume for ground-based shooting that three shots are fired for every animal taken and that one shot is fired to euthanize animals in traps and for harassment shooting for every animal taken, then an average of just over 4,340 shots were fired annually from FY11 to FY15. Many of these shots, including the majority of shots fired to take and harass birds at airports, are made using nontoxic shot, but this information is not tracked in the WS-Arizona MIS. Therefore, to err on the side of being conservative, we will assume that all shots are with lead shot. Even so, the number of shots are relatively minimal and scattered over considerable portions of the landscape.

WS-Arizona shooting for all species taken (including birds) or hazed (harassment shooting) in PDM occurs on small proportion of the land area in Arizona, about 8%, average of 6 million acres from FY11 to FY15. However, as discussed in Chapter 1, WS conducts PDM on a small proportion of the lands under agreement, probably a tenth to a fifth of the lands in Arizona. Thus at most, <1%, of the lands in Arizona could have bullets scattered on them as WS-Arizona only uses nonlead products for aerial shooting operations, operations north of I40, and when conducting migratory bird work. Rifle bullets are about 0.3 oz. and about 0.1 oz. for small caliber firearms and pellets for air rifles). WS-Arizona uses shotguns for about 90% of the shooting in Arizona. About 5% of the shooting is with rifles and the other 5% is to euthanize animals in traps with small caliber pistols (.22) or shoot birds with air rifles (~0.1 oz. each at most – nonlead only). It should be noted that the majority of animals shot by WS-Arizona are retrieved and disposed of so they are not available to scavengers, reducing the chance of non-target animals getting lead poisoning. However, assuming that the carcasses do not retain the shot or bullets, we can determine the amount of lead deposited over the landscape by WS-Arizona. WS-Arizona potentially deposits almost no lead from shotshells and 20 lbs. from bullet fragments (this assumes that 150 grain bullets are used for large caliber rifles and 50 grain bullets are used for small caliber rifles and pistols) over about 6 million acres in Arizona. This amounts to an average of only about 0.00005 oz. lead/acre. If WS-Arizona's WDM activities distribute approximately a single ounce of lead shot per each hundred acres of land area, such an amount is an incredibly small amount of lead to result in any potential effects at all to the human environment from WS-Arizona' WDM activities.

The hazard standard set by EPA for lead concentrations in residential soils is 400 ppm (1 ppm is equivalent to 1 mg/kg or 0.0064 oz./lb.) in children's play areas, and 1,200 ppm on average for the rest of a residential yard[16]. We are unaware of any established standards for lead contamination of soil in remote rural areas of the kind where WS-Arizona conducts most WDM activities, but it is reasonable to assume the guideline for residential areas would be more stringent than any such standard that might ever be established for remote rural areas. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). A representative average weight of soil is in the range of 110 lbs. (49.9 kg) per cubic foot (Environmental Working Group [*undated*]). The number of cubic feet of soil in the top 8 inches of soil in one acre is about 29,000. Therefore, a reasonable estimate of the total weight of the top layer of soil per acre where spent lead shot should remain would be 3.2 million lbs. (110 X 29,000) or 1.5 million kg. If considered over the amount of land area involved in WDM in the state during a typical year, the amount of lead distributed from WS-Arizona WDM activities would constitute an average of about 0.0002 mg/kg of soil (at 0.01 oz./acre). This is an infinitesimally small fraction, about one-2 millionth of the concentration in the EPA hazard standards for residential area soils shown above.

Viewed another way, we can estimate the amount of lead in each of the spots on the ground where the soil is impacted by lead shot, and then put into perspective the risk of a person encountering one of those spots and becoming exposed to toxic levels of lead. The amount of lead in the soil impact zones of each shot taken would be calculated as follows: Each shot potentially distributes 1.2 to 1.5 ounces, or 34.0 to 42.5 grams of lead into an approximate 30" circle, which is about 5 ft^2. Under the same assumptions of weight per cubic foot of soil and depth of soil in which the lead shot would

[16] The EPA soil-lead hazard is bare soil on residential real property or on the property of a child occupied facility that contains total lead equal to or exceeding 400 parts per million (ppm = mg/g) in a play area or average of 1,200 ppm for bare soil in the rest of the yard based on soil samples (40 CFR 745.65(c)).

remain shown above, the amount of lead per unit weight of soil in the 5 ft^2 circle would be about 200 to 260 mg/kg (ppm). Therefore, even if a person were to come into contact with the entire area of one of the impact spots on the ground, the amount of lead in the soil would average less than the EPA hazard standard for children's play areas. The chances of someone stumbling across one of the impact spots could be calculated as follows: there are 13,500 5-square-foot impact spots (shots per year) distributed over 1.8 million acres, or more than 78 billion square feet, of landscape – this means that the total area of impact spots for any one year are only one millionth of the area of the affected landscape. After 100 years, the number of impact spots would accumulate to only one-ten thousandth of the area of the affected landscape. It would be highly unlikely for a person to stumble across one of the affected impact spots, but, even if someone did, there would be no health risk unless the person ingested some of the soil (which people, obviously do not normally do) and the portion ingested contained some lead eroded from the spent shot. Solid lead exposed to the environment tends to form an oxidizing layer that slows down its ability to be dissolved in water (Craig et al. 1999), which means the lead from spent shot in the soil would tend to remain in place and not distribute throughout the soil. This would further lessen the chance that someone contacting an impact spot would become exposed to a lead hazard.

A reasonable estimate of the amount of lead deposited by small game hunters would be in the range of about 650,000 lbs. distributed over the entire state[17]. Considering the land area of the state is about 114,000 mi^2 or about 73 million acres, the average amount of shot distributed is about 0.14 oz./acre or 4 g/acre per year. Assuming this lead shot deposition rate by private small game harvesters occurs on the same areas where WS conducts WDM, the total cumulative amount of lead deposited on average on the areas where WS conducts WDM is about 4.3 g/acre per year. Using the same calculations and assumptions shown above for estimating WS' lead shot deposition per kg of soil, we find that this cumulative amount of lead deposited still would average only about 0.003 mg/kg (equivalent to ppm) of soil. That amount is still far below the EPA hazard standard of 400 ppm to 1200 ppm of soil established for residential soils. Soil uncontaminated by human activities generally contains lead levels up to about 50 ppm (or 50 mg/kg) (Agency for Toxic Substances and Disease Registry 2005). Assuming that the soils in the areas where WS conducts WDM have the upper limit of this baseline level, it would take an additional 350 mg/kg to reach the EPA hazard standard for children's playgrounds, and 1,150 mg/kg to reach the standard for other residential yard areas. It would take over 100,000 years for enough lead to accumulate from shooting by WS and hunters to reach the EPA hazard standard for children's playgrounds.

A remaining question is whether lead shot deposited in remote areas by WS might lead to contamination of water, either ground water or surface water via runoff that occurs during or following rainfall or melting snow cover. Stansley et al. (1992) found that lead did not appear to transport readily in surface water when soils are neutral or slightly alkaline in pH *(i.e.*, not acidic), but that it will transport more readily under slightly acidic conditions. In their study, they looked at lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Although they detected elevated

[17] Total number of small upland game animals that were most likely harvested by use of shotguns, averaged over the last several years, was about 1.3 million doves and 900,000 other small upland game (quail, pheasants, chukar, grouse, crows, rabbits,) (AGFD 2006). It has been estimated 5-8 shots are fired per dove taken in the field (Lewis and Legler 1968). At an average of 3 shots fired per animal harvested for all species except doves for which it is estimated that 6 rounds are fired per dove on average for this analysis, the total number of shots fired to harvest the 2.2 million animals would be about 10.5 million. At 1 ounce of shot per shell fired, the amount of lead distributed into the environment would be about 650,000 lbs.

lead levels in water in a stream and a marsh that were in the shot fall-zones, they did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot where it was believed the lead contamination was due to water runoff from the parking lot, and not from the shooting range areas. Their study indicated that even when lead shot is highly accumulated in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water further downstream. They also reported that muscle samples from two species of fish collected in the water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992). Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil of the impact areas were far below the EPA's action level (*i.e.*, requiring action to treat the water to remove lead) of 15 ppb. They reported that the dissolution (*i.e.*, capability of dissolving in water) of lead declines when lead oxides form on the surface areas of the spent bullets and fragments in the impact areas. This means transport of lead from bullets or shot distributed across the landscape is reduced once the bullets and shot form these crusty lead oxide deposits on their surfaces, which serves to naturally further reduce the potential for ground or surface water contamination. These studies suggest that, given the very low and highly scattered shot concentrations that occur from WS' aerial shooting activities, as well as most other forms of dry land small game hunting in general, lead contamination of water from such sources would be minimal to nonexistent. Based on the above analysis, we conclude that the amounts of lead deposited by WS WDM operations, even when considered cumulatively with the amounts deposited by hunters, are far below any level that would pose any risk to public health or of significant contamination of water supplies.

In a review of lead toxicity threats to the California condor, Center for Biological Diversity et al. (2004) concluded that lead deposits in soils, including those caused by target shooting by the military at shooting ranges on military reservations used by condors, did not pose significant threats to the condor. The concern was that lead might bio-accumulate in herbivores that fed on plants that might uptake the lead from the soil where the target ranges were located. However, Center for Biological Diversity et al. (2004) reported blood samples from condors that foraged at the military reservation where the target shooting occurred did not show elevated lead levels, and, in fact showed lower lead levels than samples from condors using other areas. Because lead deposited by WS's WDM activities is widely scattered in comparison to military shooting ranges, it is clear that, despite valid concerns about other sources of lead toxicity in the environment, lead deposited onto the landscape by WS should not cause any significant impacts on wildlife, nor should it contribute in any significant way to cumulative impacts from other sources of lead shot deposited by hunting. However, there appears to be a growing body of evidence that lead bullets and shot remaining in carcasses of animals that are shot but not removed from the landscape can pose lead toxicity problems for scavenging California condors (Center for Biological Diversity et al. 2004). WS has voluntarily restricted aerial shooting to use of non-lead shot, non-lead ammunition for migratory bird work, and non-lead ammunition north of Interstate 40, and to remove and dispose of coyote carcasses shot from the ground with lead ammunition in areas occupied by condors, and relies on the USFWS and the Peregrine Fund (which is under an agreement with the USFWS to monitor condors) to determine occupied areas.

Concerns have been raised regarding lead poisoning from Bald Eagles scavenging predators that have been shot. The WS Program has tried various nontoxic (non-lead) shot loads to reduce the concern of lead poisoning, and continues to move in this direction as new nontoxic ammunition is developed that is effective for predators. However, some evidence has shown that the threat of lead toxicity to eagles is not as severe as previously thought. Hayes (1993) reviewed literature and analyzed the hazard of lead shot to raptors, in particular eagles. Key findings of that review were:

- Eagles are known to scavenge on coyote carcasses, particularly when other food sources are scarce or when food demands are increased.

- In studies that documented lead shot consumption by eagles (based on examining the contents of regurgitated pellets), the shot was associated with waterfowl, upland game bird, or rabbit remains, and was smaller than BB or #4 buckshot used in aerial shooting. Lead levels have been detected in eagle blood samples, but the source of the exposure was unknown. Lead residues have been documented in jackrabbits, voles (*Microtus sp.*), and ground squirrels which can explain how eagles could ingest lead from sources other than lead shot. In one study (Pattee et al. 1981), four of five captive bald eagles force fed uncoated lead shot died and the fifth went blind. Frenzel and Anthony (1989) suggested, however, that eagles usually reduce the amount of time that lead shot stays in their digestive systems by casting most of the shot along with other indigestible material. It appears that healthy eagles usually regurgitate lead shot in pellet castings which reduces the potential for lead to be absorbed into the blood stream (Pattee et al. 1981, Frenzel and Anthony 1989).

- WS personnel examined nine coyotes shot with copper plated BB shot to determine the numbers of shot retained by the carcasses. A total of 59 shot pellets were recovered, averaging 6.5 pellets per coyote. Of the 59 recovered pellets, 84% were amassed just under the surface of the hide opposite the side of the coyote that the shot entered, many exhibited minute cracks of the copper plating, and two shot pellets were split. The fired shot were weighed and compared with unfired shot and were found to have retained 96% of their original weight. Eagles generally peel back the hide from carcasses to consume muscle tissue. Because most shot retained by coyotes tends to end up just under the hide, it would most likely be discarded with the hide. Any shot consumed would most likely still have the nontoxic copper plating largely intact, reducing the exposure of the lead to the digestive system. These factors, combined with the usual behavior of regurgitation of ingested lead shot indicate a low potential for toxic absorption of lead from feeding on coyotes killed by aerial shooting.

The above analysis indicates adverse effects on eagles from scavenging on coyotes killed by aerial shooting are unlikely. The USFWS and the AGFD did not identify this as a concern in the Conservation assessment and strategy for the bald eagle in Arizona (Driscoll et al. 2006) which covered potential adverse effects on Bald Eagles from all sources. Bald eagle populations appear to be increasing in the contiguous 48 states and have met or exceeded recovery goals in several states. Golden eagle populations appear to be healthy, but show non-significant trends in the BBS. BBS data indicate a general increasing trend in breeding populations of both Golden Eagles (non-significant +1.0, P=0.54) and Bald Eagles (significant +6.1, P=0.01) in North America since 1966 (Sauer et al. 2006). Thus, eagle populations do not appear to be significantly adversely affected by lead toxicity problems. Arizona WS retrieves coyote carcasses where practical and disposes of them in an area where eagles and other scavengers such as condors would not be able to scavenge on them. WS-Arizona only uses nonlead products when shooting from aircraft and nonlead in rifles north of I-40 and in bird management.

No evidence has been brought forth to indicate that any animals killed during PDM by WS-Arizona have resulted in any indirect lead poisoning of condors or other scavenging animals. However, since WS-Arizona is aware that condors have died from lead poisoning, we will then determine if we expect to conduct any shooting activities involving the use of lead bullets or shot in the areas where condors occur or are expected to occur in the state and will consult with USFWS on a regular basis to determine appropriate measures to reduce or eliminate the risk of indirect lead poisoning from WS-Arizona activities. Measures that have been implemented includes switching to non-toxic shot or bullets as practical, retrieval and disposal of animal carcasses shot with lead ammunition, or, if practical, retrieval of any lead bullets from such carcasses. We believe this adaptive management approach should be sufficient to avoid lead toxicity effects on reintroduced condors.

- **The Relationship between Predators and Rodent and Rabbit (Microherbivore) Populations**

Rabbit and rodent populations normally fluctuate substantially in several-year cycles. Two hypotheses attempt to explain these cyclic fluctuations: 1) rodent and rabbit populations are self-regulated through behavior, changes in reproductive capacity due to stress, or genetic changes (Chitty 1967, Myers and Krebs 1971), or 2) populations are regulated by environmental factors such as food and predation (Pitelka 1957, Fuller 1969). Keith (1974) concluded that: 1) during cyclic declines in prey populations, predation has a depressive effect and as a result, the prey populations may decline further and be held for some time at relatively low densities, 2) prey populations may escape this low point when predator populations decrease in response to low prey populations, and 3) since rabbit and rodent populations increase at a faster rate than predator populations, factors other than predation must initiate the decline in populations.

Wagner and Stoddart (1972) and Clark (1972) independently studied the relationship between coyote and black-tailed jackrabbit populations in northern Utah and southern Idaho. Both concluded that coyote populations seemed to respond to an abundance of jackrabbits. When a broad range of prey species is available, coyotes will generally feed on all species available; therefore coyote populations may not vary with changes in the availability of a single prey species (Knowlton 1964, Clark 1972).

Wagner (1988) reviewed literature on predator impacts on prey populations and concluded that such impacts vary with the locale. In some ecosystems, prey species such as snowshoe hares increase to the point that vegetative food sources are depleted despite predation. In others, e.g., jackrabbits in the Great Basin, coyotes may limit jackrabbit density and evidence indicates food shortages do not occur to limit jackrabbit abundance. Wagner and Stoddart (1972) reported that coyote predation was a major source of jackrabbit mortality and may have caused a decline in jackrabbit numbers in the Curlew Valley in Utah.

In general, it appears that predators prolong the low points in rodent and rabbit population cycles and spread the duration of the peaks. Predators generally do not control rodent populations (Keith 1974, Clark 1972, Wagner and Stoddart 1972). Predator impact cannot be generalized across all predator-prey systems. Systems that are strongly driven by pulses of resources, bottom-up population limitation by food can be more important than predators in changing rodent abundance (Previtali et al. 2009). Generalist predators are not likely to control prey while specialist predators may have an impact on prey populations when the populations are at low levels and they are in combination with other predators (Maron et al 2010). It is more likely that prey abundance controls predator populations.

Henke (1995) reviewed literature concerning coyote-prey interactions and concluded that short term (≤6 months per year) coyote removal efforts typically do not result in increases in small mammal prey species populations, but that longer term intensive coyote removal (9 months or longer per year) can in some circumstances result in changes in rodent and rabbit species composition which may lead to changes in plant species composition and forage abundance. The latter conclusion was based on one study (Henke 1992) which was conducted in the rolling plains area of Texas that involved one year of pretreatment and two years of treatment. Whether such changes would occur in all ecosystems in general remains to be proven. Assuming that such changes do nevertheless occur in general, the following mitigating factors should serve to minimize these types of environmental impacts:

1. Most PDM actions in localized areas of the state would not be conducted year round but would occur for short periods after damage occurs (Corrective PDM situations) or for short periods (90-120 days) at the time of year when benefits are most likely such as the period of time immediately preceding and during calving and lambing in the spring.

2. WS-Arizona conducts PDM on properties that comprise less than 5% of the land area of the state and kill a low percentage (< 5%) of the population of coyotes in any one year (Section 4.1.1.1) means ecosystem impacts from WS-Arizona actions should be low in magnitude.

3. Take of other carnivores that prey on rodents and rabbits is too low to indicate any potential for a significant effect. Evidence also exists to suggest other carnivores such as badgers, bobcats, and foxes increase in number when coyote populations are reduced (Robinson 1961, Nunley 1977a). Therefore, even if coyote numbers were reduced substantially in a localized area, other species that prey on rodents and rabbits would probably increase in number to naturally mitigate some reduction in coyote predation on those prey species that might occur.

Other prey species of coyotes include mule deer and pronghorn. Information presented in Chapter 1 indicates that local short term predator population reductions may enhance deer and antelope populations. This could be either a beneficial or detrimental effect depending upon whether local deer populations were at or below the capacity of the habitat to support them. However, as stated above, since WS-Arizona generally conducts PDM on less than 5% of the land area of the state and would take less than 5% of the coyote population in any one year, it is unlikely that positive effects on deer or antelope populations would be significant, except in isolated instances. If AGFD or a tribe request coyote removal for the purpose of enhancing antelope or deer herds, an increase in local populations would be desired and considered a beneficial impact on the human environment. In those situations, it is likely that coyote control would be ended when herd management goals have been met. In any event, it is unlikely that impacts would be significant in large portions of the state under the current program.

E. Impacts on Wildlife Species Populations Caused by Low-level Flights during Aerial Shooting

Concern is sometimes expressed that aerial shooting might disturb other wildlife species populations to the point that their survival and reproduction are adversely affected and thus lead or contribute in some significant way to population declines. Issues relating to aerial shooting, including information on WS-Arizona aerial shooting areas and equipment, are discussed below.

A number of studies have looked at responses of various wildlife species to aircraft overflights. The National Park Service (1995) reviewed many such studies and revealed that a number of them have documented responses by certain wildlife species that suggest adverse impacts could occur. Few, if any studies, have proven that aircraft overflights cause significant adverse impacts on wildlife populations, although the report stated it is possible to draw the conclusion that impacts to populations are occurring. The Colorado Air National Guard (ANG) came to the conclusion that military training flights were not expected to cause adverse effects on wildlife after extensive review of numerous studies of this issue (ANG 1997a, 1997b).

Table 22 provides data on aerial shooting hours and acreage flown for the counties in which aerial shooting occurred for the past 5 years. The majority of aerial shooting time occurred in 3 counties: Cochise (28%), Mohave (25%), Coconino (21%), Apache (10%) and Navajo (6%). counties make up much of the remainder of aerial shooting time. Even in the counties of Arizona with the majority of WS-Arizona aerial shooting activities, 90% to more than 90% of the land area of those counties is not exposed to any WS-Arizona aerial shooting in a typical year. Thus, WS-Arizona conducts aerial shooting on small areas within the counties.

From FY11 to FY15, WS-Arizona flew an average of 166 hours annually in fixed-wing airplanes over about 5,071.01 mi2 of properties that were under WS-Arizona agreements in Arizona (Table 22). Thus, WS-Arizona aerial shooting activity is minor in terms of geographic scope because 95% of the land area in the state is not exposed to any such activity. Of the hours flown from FY11 to FY15, 72.6 hours occurred over BLM lands, 61.1 hours over private land, 3.12 hours over USFS lands, 51.9 hours over state lands and 1.6 hours over tribal lands (Table 23). The average amount of time spent flying over all lands in Arizona that were aerially hunted amounted to an average of almost 3.3 minute/ mi2 of all properties in a year. Therefore, on the small proportion of the landscape exposed to aerial shooting only a tiny fraction of the time in an entire year is generally exposed to aerial shooting overflights.

Table 22. WS-Arizona cumulative aerial shooting hours and acreage flown for FY11 to FY15 in Arizona counties where aerial shooting occurred.

County	WS-Arizona Aerial Shooting Hours					
	FY11	FY12	FY13	FY14	FY15	Ave.
Apache	9.5	13.5	5.7	32.5	25.2	17.28
Cochise	26.4	50.8	28.6	62	60.4	45.64
Coconino	58.5	52.4	59.4	0	4.5	34.96
Graham	0	0	3.8	9	5.2	3.6
Mohave	43.1	44.9	18.6	29.3	76.4	42.46
Navajo	12.5	13.3	26.6	0	0	10.48
Pima	0	1.1	0	0	0	0.22
Pinal	0	0	0	0	0	0
Yavapai	1	0	0	0	58.4	11.88
Total	151	176	142.7	132.8	230.1	166.52
Acreage Under Agreement Flown						
Apache	189,140	204,820	117,000	255,040	143,000	181,800
Cochise	145,710	237,884	167,056	407,056	454,245	282,390
Coconino	1,457,826	1,321,976	449,986	0	871,990	820,356
Graham	0	0	83,873	266,473	150,873	100,244
Mohave	1,248,204	1,281,484	530,770	597,120	496,212	830,758
Navajo	1,653,646	53,137	81,981	0	0	357,753
Pima	0	4480	0	0	0	896
Pinal	0	0	0	0	0	0
Yavapai	64,000	30,000	0	0	60,003	30,801
Total	4,758,526	3,133,781	1,430,666	1,525,689	2,176,323	2,604,997

Table 23. The number of hours spent aerial shooting different land classes in Arizona from FY11 to FY15.

Fiscal Year	BLM		USFS		State		Private		Tribal	
	Acres	Hours[1]	Acres	Hours[1]	Acres	Hours[1]	Acres	Hours[1]	Acres	Hours[1]
FY11	1,437,993	43.1	688,672	5.6	1,032,366	37.0	1,379,114	59.9	3,694,473	6.4
FY12	1,603,413	65.5	614,140	0	1,038,503	26.1	1,668,622	107.5	3,162,593	1.5
FY13	755,548	34.0	698,363	4.4	1,053,677	83.3	417,743	39.6	2,986,320	0.0
FY14	990,380	64.6	717,812	0.5	828,223	60.7	732,909	36.3	1,688,402	0.0
FY15	819,443	155.7	619,637	5.1	1,093,090	52.4	1,352,511	62.2	2,278,043	0.0
Ave.	1,121,355	362.9	667,725	3.12	1,009,160	51.9	1,110,180	61.1	2.761,966	1.6
min/mi2	12.4		0.18		2.0		2.1		0.02	
All lands ave. min/mi2	3.3									

[1]Hours listed as Hobbs Hours which indicates hours and tenths of an hour.

E1. Low-level Flight Impacts on Wildlife

We reviewed a number of studies and analyses of the effects of low-level flights on a number of animal species.This section only considered the effects of flight, not noise or other disturbance from aerial shooting activities.

Waterbirds and Waterfowl. Low level overflights of 2-3 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). 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 flying military aircraft in North Carolina 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 budgets of the species. Other reviews have suggested there may be adverse effects on waterfowl (National Park Service 1995). WS-Arizona aerial shooting activities are not conducted over wetland habitats, and a majority of such flights occur in winter when waterfowl and waterbirds have migrated further south. Thus, there is little to no potential for any adverse effects on these types of species.

Raptors. Mexican spotted owls (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 predisturbance behavior 10-15 minutes following the event and researchers observed no differences in nest or nestling success (Delaney et al. 1999) which indicates that helicopter 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 such 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*) are 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 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.

Regarding potential effects of WS aircraft overflights on bald eagles, ANG (1997a) analyzed and summarized the effects of overflight studies conducted by numerous federal and state government agencies and private organizations. These studies determined that military aircraft noise initially startled raptors, but negative responses were brief and did not have an observed effect on productivity (Ellis 1981, USFS 1992, Fraser et al. 1985, Lamp 1989 cited in ANG 1997a). 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 over 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 (Awbrey and Bowles 1990 *cited in* ANG 1997a). Therefore, there is considerable evidence that eagles would not be adversely affected by WS-Arizona aerial shooting overflights.

The above studies indicate raptors are relatively unaffected by aircraft overflights, including those by military aircraft which produce much higher noise levels than the small aircraft used in aerial shooting. WS-Arizona PDM operations, especially aerial shooting are generally conducted over a very short period of time "often only a matter of minutes" for a given property or agreement area. Any potential negative effects to raptor species are expected to be minimal and temporary. Therefore, we conclude that WS-Arizona PMD operation including aerial shooting flights will not result in long term or significant negative effects on raptors.

Passerines. Reproductive losses have been reported in one study of small territorial passerines (*perching birds,* includes sparrows, blackbirds, and many other mostly small-bird families) after exposure to low altitude overflights (Manci et al. 1988 cited in ANG 1997a), but natural mortality rates of both adults and young are high and variable for most passerines. The research reviewed 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 indicates the much quieter noise of WS small planes 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, USFS 1992). These studies and reviews indicate there is little or no potential for WS-Arizona overflights to cause adverse effects on passerine bird species.

Sage-Grouse. We could find no studies of the effects of overflights on sage-grouse. However, impacts are probably minor when overflights only occur on an infrequent basis and care is taken to avoid leks (strutting grounds used by males during the breeding season) because wildlife agencies routinely use aircraft to locate sage-grouse leks (Connelly et al. 1981). The USFWS reviewed available scientific and other information on threats to sage-grouse and did not identify aerial overflights as a concern, although they did identify other types of activities such as off-road vehicles and recreation as potentially having disturbance effects on breeding (USFWS 2005). PDM activities that remove coyotes and other potential predators may actually benefit sage-grouse and other grouse species. Although Autenrieth (1981) suggested that nest predation was likely the most important population constraint on sage-grouse, predation on adult birds does occur and may be significant in some cases. Presnall and Wood (1953) reported tracking a coyote approximately 5 miles to its den in northern Colorado, and finding evidence along the way that the coyote had killed 3 adult sage-grouse and destroyed a sage-grouse nest. Examination of the stomach contents from an adult female coyote removed the next day showed parts of an adult sage hen, plus 6 newly-hatched sage hen chicks. The area around the den site was littered with sage hen bones and feathers. No other prey animal remains were found around the den, and it appeared that the pups had been raised largely upon sage-grouse. Till (1992) documented sage-grouse remains at 4 of the 30 coyote den sites examined during his study in south central Wyoming, but provided no indication of the relative abundance or distribution of sage-grouse in his study area. In northern Utah, researchers from Brigham Young University confirmed predation, primarily by red fox and coyote, as the cause of death for 13 of 21 radio-instrumented sage-grouse in the first year in their study area (Bunnell and Flinders 1999). Two additional instrumented birds could not be found but were suspected to have been killed by predators, suggesting a 71% predation loss of instrumented birds. Additionally, 11 other sage-grouse were found dead in their study area, and all but 1 of these birds was killed by mammalian predators. We are not aware of any studies conducted to determine if coyote and red fox control would actually result in significant benefits to grouse populations. However, the above studies indicate there may be some benefit to the removal of these predators in some situations.

A potential indirect effect on sage-grouse of coyote removal that has been identified is meso-predator release, which is the increase in smaller mammalian carnivore species after larger carnivores have been reduced or eliminated. Concerns have been expressed that red fox populations might increase in areas of sage-grouse habitat where coyote removal is conducted and that red fox would be worse predators of sage-grouse than coyotes (Gunnison Sage-Grouse Rangewide Steering Committee 2005). The meso-predator release theory allows that smaller predators are allowed to increase due to either a lack of predation or release from competition or both. Gehrt and Clark (2003) present an opposing view of meso-predator release and point out several weaknesses in the circumstantial evidence that has been used to suggest that meso-predator release occurs.

Gunnison Sage-Grouse Rangewide Steering Committee (2005) cited studies of red fox and coyote home ranges in duck breeding areas of North Dakota as evidence that red fox numbers may increase if coyote numbers are reduced. Sargeant et al. (1984) reported on the effects of red fox predation on breeding ducks. Their data were collected when coyote populations were presumably suppressed by widespread use of predacides, and he notes that at the time (1968-73), *"Coyote populations in most of the midcontinent area appear to be suppressed by man."* The authors noted an inverse relationship between red fox and coyote populations and speculated that *". . . protection of coyotes will result in expansion of local or regional populations that in turn will cause reductions in fox populations."* They inferred that this will reduce predation on upland nesting ducks. Sargeant et al. (1984) reported on spatial relationships between coyotes and red foxes and showed that home ranges of fox families did not overlap the core centers of coyote home ranges on a North Dakota study site. Although none of their radio collared foxes were killed by coyotes in their study, they hypothesized that red foxes tended to avoid coyote territories, presumably because of the fear of being killed by coyotes. Thus, they inferred that a red fox population would increase if the coyote population is reduced, because the removal of territorial coyotes would create vacant coyote territories that could then become occupied by red foxes.

However, the presence of coyotes does not completely displace red foxes. Voigt and Earle (1983) verified that red fox travel through coyote areas during dispersal, but did not establish there. They also reported that *". . . individual foxes and coyotes can occur in close proximity to each other along territory borders and when coyotes travel into fox areas."* They also noted that *" . . . fox-coyote range overlap near borders was similar to fox-fox range overlap near borders"* and that *". . . coyotes do not completely displace foxes over areas."* Gese et al. (1996) reported that coyotes tolerated red foxes when encountered about half of the time in Yellowstone National Park, although they also at times were aggressive toward and would sometimes kill foxes.

Also, there are other studies that suggest coyote territories would not remain vacant for very long after the coyotes are removed. Gese (1998) noted that adjacent coyote packs adjusted territorial boundaries following social disruption in a neighboring pack, thus allowing for complete occupancy of the area despite removal of breeding coyotes. Blejwas et al. (2002) noted that a replacement pair of coyotes occupied a territory in approximately 43 days following the removal of the territorial pair. Williams et al. (2003) noted that temporal genetic variation in coyote populations experiencing high turnover (due to control) indicated that *". . .localized removal did not negatively impact population size . . ."* When we consider the level of coyote removals that WS PDM activities achieve during PDM actions (only 2-4% of the estimated population - see Section 4.1.1.1), it is most likely that coyote populations are probably not impacted enough, even at the individual territorial level, to create the vacant territories that would theoretically allow red fox populations to increase substantially at the local level based on the North Dakota studies discussed above. Therefore, we believe it would be unlikely for WS-Arizona' coyote removal actions to lead to indirect increases in predation effects on grouse populations.

Mammals

Deer. Krausman et al. (1986) reported that fixed-wing overflights by Cessna 172 and 182 model small aircraft ≥ 100 feet above ground level (AGL) did not generally disturb desert mule deer in Arizona (Krausman et al. 1986). They observed that only 3 of 70 observed responses of mule deer to the overflights at 150 to 500 feet AGL resulted in the deer changing habitats. The few that did change habitats did so on the first overflight experience, but then did not change habitats on subsequent overflight exposure. They believed that the deer may have been accustomed to overflights because the study area was near an interstate highway that was frequently followed by aircraft. The aircraft they evaluated are larger and noisier than the J3 Supercub and Huskey airplanes used in most WS aerial shooting. For example, at level flight 500 feet directly overhead the 182 Cessna generates noise levels of 73.8 cdBA while the J3 Supercub (Piper PA-18) has a comparable noise level of 65 cdBA6 7. Therefore, we would assume the airplanes used in aerial

6 Data obtained at http://www.faa.gov/about/office_org/headquarters_offices/aep/noise_levels/; "*A-weighted decibels*" are a standard measure used to compare noise levels of aircraft; the Federal Aviation Administration (FAA) has published data on noise levels of various aircraft measured directly beneath the aircraft flying overhead at 500 feet AGL for small propeller driven airplanes; cdBA is "corrected" Noise Level "A-weighted" decibels. (Tom Connor, FAA, pers. comm. 2005).

7 A noise level of 65 dBA is described by the FAA as "*comparable to normal conversation at 5' in a commercial area*." Info. obtained @ http://www.awp.faa.gov/atenviro/CRITERIA.htm.

shooting would be even less disturbing to mule deer than the aircraft used in the above study that concluded minimal disturbance. VerCauteren and Hygnstrom (2002) noted in a study that included aerial censuses of deer that deer typically just stood up from their beds, but did not flush, when the aircraft passed overhead. In addition, WS-Arizona aerial shooting personnel frequently observe deer and antelope standing apparently undisturbed beneath or just off to one side of WS-Arizona aircraft.

One particular concern with overflights is the potential to affect mule deer on their winter range during winter months in years when conditions such as heavy snow and poor forage availability have already stressed the deer to the point that heavy *winter kill* losses are likely. WS-Arizona has conducted aerial shooting to protect sheep in several known areas of deer winter range. WS-Colorado looked at this very issue in detail and found no significant impacts to deer in their winter range including areas where aerial shooting was concentrated (WS 2005). The EA found no evidence to suggest aerial shooting overflights contributed in some way to declining deer numbers. In areas where herds have declined or remained substantially below the Colorado Division of Wildlife's herd objectives, drought, which results in poor forage availability for pregnant does and subsequent poor survival of fawns, was believed to be the major factor responsible (WS 2005). WS-Arizona aerial operations occur on only a small percentage of that analyzed in the Colorado EA (WS 2005) and, thus, likely to have even less of an effect.

Elk. Espmark and Langvatn (1985) found that elk become habituated to noise. We could find no studies of the impacts of aerial overflights on elk.

Bighorn sheep. Krausman and Hervert (1983) reported that, in 32 observations of the response of bighorn sheep to low-level flights by small fixed-wing aircraft, 60% resulted in no disturbance, 21% in "slight" disturbance, and 19% in "great" disturbance. 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. Weisenberger et al. (1996) found that desert bighorn sheep and mule deer had elevated heart rates for 1 to 3 minutes and changed to alert behavior for up to 6 minutes following exposure to jet aircraft. Areas of bighorn sheep habitat are generally too rugged to be suitable for aerial shooting. Also, as stated previously, WS pilots are instructed during training to watch for and avoid readily visible non-target wildlife, including bighorn sheep. Therefore, WS-Arizona aerial overflights present little or no potential to cause any effects on bighorn sheep.

Bison. Fancy (1982) reported that only 2 of 59 bison (*Bison bison*) groups showed any visible reaction to small fixed-wing aircraft flying at 200-500 feet AGL. Therefore, available evidence indicates bison herds would not be adversely affected by aerial overflights that happen to occur in areas they inhabit.

Pronghorn (Antelope). Krausman et al. (2004) found that Sonoran pronghorn (a T&E species in Arizona) 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. They also reported that pronghorn and desert mule deer do not hear noise from military aircraft as well as humans do, which indicates a reason why they appear not to be disturbed as much as previously thought. Therefore, available scientific evidence indicates overflights do not cause any adverse effects on pronghorn populations. Thus, there does not appear to be any serious concern about overflights effects on pronghorn populations. We are unaware of any studies that indicate coyotes can cause serious winter mortality of pronghorns, but removal of coyotes in winter might theoretically reduce fawn predation later on in the spring similar to the way it reduces lamb losses on lambing ranges (Wagner and Conover 1999). If so, then aerial shooting of coyotes may have a net benefit to maintaining pronghorn populations.

Wild Horses. BLM in Arizona manages six burro Herd Management Areas (HMA) of approximately 5,000 head in mostly far western Arizona and two small wild horse herds; one in Cerbat Mountains approximately 80 horses, and Cibola-Trigo approximately 190 horses (Figure 3 - *taken from* BLM 2006c). Concern is sometimes expressed that aircraft overflights could impact horses and burros. We could not find studies conducted specifically on wild horse response to aircraft overflights. However, while wild horses have been reported to become alarmed at the sight and sound of helicopter activity, especially in areas where helicopters are predominately used by BLM during round-ups, the small fixed-wing aircraft that are primarily used by WS-Arizona have little noticeable effect on wild horses. Frequently, wild horses in the proximity of a hunt area are seen to totally ignore fixed-wing aerial shooting activities, even to the point of not getting up from a reclining position (WS 1999b). WS in Arizona has conducted minimal PDM near these areas and does not anticipate a drastic increase in such activity. We conclude that WS-Arizona' aerial shooting activities likely have little effect on wild horses and burros.

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 (ANG 1997a). Small mammals habituate, albeit with difficulty, to sound levels greater than 100 dbA (*i.e.* A-weighted decibels) (USFS 1992). As discussed in Section 2.4.2.2, the noise levels of the aircraft used by WS-Arizona are low in comparison to other aircraft. Small mammals such as field rodents and rabbits have small home ranges and are generally widely distributed. The fact that WS-Arizona only conducts aerial shooting on less than 5% of the land area of the state indicates that about 95% of small mammal populations are not even exposed to WS-Arizona aerial overflights. Further lessening the potential for any significant adverse impacts is that such flights occur only a few days per year. Regarding potential effects on livestock, the only persons likely to have concerns are livestock owners or managers. However, they are the ones requesting PDM assistance in most cases and are therefore more concerned about stopping or preventing predation on their livestock. WS-Arizona stays at least 500 feet from livestock when aerial shooting which is

Figure 3. Burro Herd Areas managed by BLM in Arizona (BLM 2006c).

effective in avoiding livestock disturbance for the most part based on personal observations of WS-Arizona aerial crews.

Relative Noise Levels of WS Airplanes Used in Aerial Shooting

WS uses small fixed-wing aircraft and, on occasion, small helicopters for aerial shooting. Helicopters have not been used from FY01 to FY16 in recent years due to their increasing costs and much greater cost of operation than fixed-wing aircraft - 0% of WS aerial shooting hours in Arizona have been with helicopters over the past 5 years. The fixed-wing aircraft used by WS are relatively quiet whereas helicopters are somewhat noisier. As stated previously herein, the noise level of the J3 Supercub (Piper PA-18), which is not as quiet in operation as the Husky airplane model also used by WS (L. Burraston, WS National Aviation Manager, pers. comm. 2006), is reported by the Federal Aviation Administration (FAA) to be 65 dBA when measured directly underneath the airplane flying at 500 feet AGL8. Put in perspective, that noise level is similar to normal conversation at 5 feet (in a commercial area) [9]. In comparison, most military jet aircraft noise levels at 500 feet AGL range from 97 to 125 dB at various power settings and speeds (U.S. Coast Guard 1999). To experience the same level of noise by common military aircraft as one would experience directly beneath a flying J3 Supercub, a listener would have to be nearly 2 miles away from an F-16 and more than 3.7 miles away from the B-1B flying at 200 to 1000 feet AGL (from data presented in ANG 1997a). The effects on wildlife from these and other similar types of military aircraft have been studied extensively as shown in the information presented in this section and in ANG (1997a, 1997b) incorporated by reference herein, and were found to have no expected adverse effects on wildlife. Therefore, it is logical to conclude that the aircraft used in aerial shooting should have far less potential to cause any adverse disturbance effects on wildlife than military aircraft because the military aircraft produce much louder noise and are flown over certain training areas as many as 2,500 times per year, and yet were found to have no expected adverse effects on wildlife (ANG 1997a, 1997b). Further lessening the potential for effect from WS aerial shooting flights is that they occur on a small percentage of the land area of the state and of federal public land grazing allotments (about 4% of BLM and <1% USFS lands), and individual grazing allotments that have aerial shooting operations are exposed to relatively small numbers of overflights in any one year with an average of 2 min/mi^2 of exposure over the year.

Conclusion of Low-level Flight Impcats on Wildlife

The above studies indicate that most bird and mammal species are relatively tolerant of aircraft overflights, even those that involve noise at high decibels such as from military aircraft. It appears that some species will frequently or, at least occasionally, show what appear to be adverse responses to even minor overflight occurrences. In general, the greatest potential for impacts to occur would be expected to exist when overflights are frequent such as hourly and over many days which 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 frequent overflights appears to naturally mitigate for adverse effects on their populations in local areas where such flights occur on a regular basis, as discussed above. WS aerial operations occur in relatively remote rangeland areas and not near commercial airports or military flight training facilities. In addition, WS conducts very few flights over any one area in any one year. This issue

8 Information obtained from FAA website @ http://www.faa.gov/about/office_org/headquarters_offices/AEP/noise_levels/media/uscert_appendix_07.xls.

was analyzed in great detail and found to have no significant impact on any wildlife species in Colorado and WS-Colorado averages more than four times more aerial shooting than Arizona (WS 2005). Therefore, WS-Arizona aerial overflights have little potential to reach a level that could be viewed as *chronic* in any local area. We conclude that aerial shooting activities will have minimal impact on any domestic animals or wildlife species in Arizona.

E2. Land Classes Exposed to WS Aerial Shooting

From FY11 to FY15, WS-Arizona flew an average of 166 hours annually in fixed-wing airplanes over about 5,071 mi^2 of properties that were under WS-Arizona agreements in Arizona or 3% of the lands in Arizona. However, as discussed in Section 1.1.2, agreements on tribal property often entail the entire reservation and, thus, acreage may be much higher than the acreage where WS-Arizona conducts aerial shooting. Omitting tribal lands in Arizona, WS-Arizona conducts aerial shooting 4,070 mi^2 of properties that were under WS-Arizona agreements about 1% of the land area of the state less tribal lands. Thus, WS-Arizona aerial shooting activity is minor in terms of geographic scope because 99% of the non-tribal land area in the state is not exposed to any such activity. Of the hours flown from FY11 to FY15, 75% occurred over BLM, 13% over State lands, and 12% over private lands. Less than 1% occurred on USFS lands and Tribal lands. The average amount of time spent flying over the properties that were aerially hunted amounted to an average of almost <1 minute/mi^2 of all properties in a year. Most aerial shooting occurred on BLM lands at an annual average of 12 min./mi^2. Therefore, on the small proportion of the landscape exposed to aerial shooting only a tiny fraction of the time in an entire year is generally exposed to aerial shooting overflights.

Table 24 shows data on aerial shooting hours acreage flown for the counties in which aerial shooting occurred for the past 5 years. The majority of aerial shooting time occurred in the 4 counties of Arizona, Cochise (27%), Coconino (21%), Mohave (25%), and Apache (10%) counties. WS-Arizona conduct more aerial operations in Cochise and Mojave Counties, Arizona than in any other portion of the state. Cochise County aerial activities are to protect a variety of resources including livestock and wildlife. Mohave County activities are for the need to protect pronghorn. Even in the counties of Arizona with the majority of WS-Arizona aerial shooting activities, 80% to more than 90% of the land area of those counties is not exposed to any WS-Arizona aerial shooting in a typical year. It should be noted that in FY11 to FY15 in Cochise County an average of 7% of the acreage of the County was flown. In all other counties with aerial shooting, the land area of the county flown is usually 5% or less. Thus, WS-Arizona conducts aerial shooting on small areas within the counties.

Table 24. WS-Arizona cumulative aerial shooting hours and acreage flown for FY11 to FY15 in Arizona counties where aerial shooting occurred.

County	WS-Arizona Aerial Shooting Hrs.					
	FY11	FY12	FY13	FY14	FY15	Avg.
Apache	9.5	13.5	5.7	32.5	25.2	17.28
Cochise	26.4	50.8	28.6	62	60.4	45.64
Coconino	58.5	52.4	59.4	0	4.5	34.96
Graham	0	0	3.8	9	5.2	3.6
Mohave	43.1	44.9	18.6	29.3	76.4	42.46
Navajo	12.5	13.3	26.6	0	0	10.48
Pima	0	1.1	0	0	0	0.22
Pinal	0	0	0	0	0	0
Yavapai	1	0	0	0	58.4	11.88
Total	151	176	142.7	132.8	230.1	166.52
Acreage Under Agreement Flown						
Apache	189,140	204,820	117,000	255,040	143,000	181,800
Cochise	145,710	237,884	167,056	407,056	454,245	282,390
Coconino	1,457,826	1,321,976	449,986	0	871,990	820,356
Graham	0	0	83,873	266,473	150,873	100,244
Mohave	1,248,204	1,281,484	530,770	597,120	496,212	830,758
Navajo	1,653,646	53,137	81,981	0	0	357,753
Pima	0	4480	0	0	0	896
Pinal	0	0	0	0	0	0
Yavapai	64,000	30,000	0	0	60,003	30,801
Total	4,758,526	3,133,781	1,430,666	1,525,689	2,176,323	2,604,997

Aerial Shooting Flights on Federal Lands

As discussed above, WS-Arizona does conduct a portion of the total amount of aerial shooting on federal public lands. WS-Arizona conducted aerial shooting PDM on an average of 17 of the more than 800 BLM and USFS grazing allotments and 1,230 state land leases in the state per year for the past 5 years (FY11-FY15) with a maximum of 21 in FY14 (Table A-3), about 1% of the grazing allotments. The BLM land area of grazing allotments where WS-Arizona aerial shooting conducted totaled 1,752 mi^2 during FY11-FY15, which is 9% of the total area of BLM lands in the state. Overflights on the BLM areas flown were only a tiny fraction of the time in a year and minimal impact. Additionally, WS-Arizona did not aerial gun in any of the BLM special management areas such as WAs or WSAs from FY11 to FY15.

The information below shows that WS-Arizona aerial overflights on specific areas of BLM/USFS lands in Arizona have occurred on an infrequent basis and on a relatively small proportion of the total BLM/USFS land area of the state. A majority of the land area is not exposed to aerial shooting flights, and the duration of WS-Arizona overflights are relatively low, occurring on only a small portion of the time in a year. Clearly, aerial overflights by WS-Arizona on BLM/USFS lands in the state are minor in time and geographic scope and in no way could be considered to approach a level that could be interpreted as presenting chronic overflights exposures to wildlife on substantial areas of federal public land.

Considering the evidence presented here that wildlife generally are not adversely affected by overflights, and the further evidence discussed below in (ANG 1997a, 1997b) indicating that even frequent overflights totaling more than several hundred per year by the military in specific areas do not cause adverse effects on wildlife populations, it is logical to conclude that the much more infrequent aerial overflights by WS have little or no potential to result in adverse impacts on non-target wildlife on BLM or USFS, lands in the state. Further site-specific analysis of the effects of WS aerial overflights on wildlife is not necessary to make a reasoned choice among alternatives in this EA process. Regardless of where such overflights occur, the best available information on this issue indicates adverse effects are not serious. Existing procedures in place to further lessen the potential for concern about impacts on wildlife populations or other resources and interests on federal public lands include work planning coordination with the BLM and USFS. It is during such coordination that the federal land managers and AGFD personnel are provided the opportunity to let WS personnel know about specific locations where mitigation or restrictions on WS PDM activities might be necessary to reduce or eliminate the potential for adverse effects on specific resources. That process is where new information and knowledge can be brought to our attention that might change our conclusions about the seriousness of actual or potential effects on wildlife resources from aerial overflights. We rely on that process to assist in avoiding substantive adverse effects on relevant components of the human environment.

The above information shows that WS aerial shooting overflights on specific areas of BLM lands in Arizona have occurred on an infrequent basis and on a relatively small proportion of the total BLM land area of the state. Even within the specific BLM districts where WS conducted the aerial shooting activities, a majority of the land area is not exposed to aerial shooting flights, and the duration of WS-Arizona overflights are relatively low, occurring on only a small portion of the time in a year (0.3% of the time/year in the Arizona Strip District). Clearly, aerial shooting flights by WS-Arizona on BLM lands in the state are minor in time and geographic scope and in no way could be considered to approach a level that could be interpreted as presenting chronic overflights exposures to wildlife on substantial areas of federal public land.

Again, considering the evidence presented earlier in Section 2.4.2.1 that wildlife generally are not adversely affected by overflights, and the further evidence discussed in this section (ANG 1997a, 1997b) indicating that even frequent overflights totaling more than several hundred per year by the military in specific areas do not cause adverse effects on wildlife populations, it is logical to conclude that the much more infrequent aerial shooting overflights by WS-Arizona have little or no potential to result in adverse impacts on non-target wildlife on BLM, nor USFS, lands in the state. It is apparent that further site-specific analysis of the effects of WS-Arizona aerial shooting overflights on wildlife is not necessary to a reasoned choice among alternatives in this EA process. This is because regardless of where such overflights occur, the best available information on this issue indicates adverse effects are not serious. Existing procedures in place to further lessen the potential for concern about impacts on wildlife populations or other resources and interests on federal public lands include work planning coordination with the BLM and USFS. It is during such coordination that the federal land managers and AGFD personnel are provided the opportunity to let WS-Arizona personnel know about specific locations where mitigation or restrictions on WS-Arizona PDM activities might be necessary to reduce or eliminate the potential for adverse effects on specific resources. That process is where new information and knowledge can be brought to our attention that might change our conclusions about the seriousness of actual or potential effects on wildlife resources from aerial shooting overflights. We rely on that process to assist in avoiding substantive adverse effects on relevant components of the human environment.

E3. Potential for Effects on Wildlife from Gunshot Noise

Some commenters have expressed concern that gunfire noise during WS aerial shooting might result in significant disturbance impacts on wildlife species. The time spent shooting at coyotes from aircraft is actually an exceedingly small proportion of overflight times. WS-Arizona aerial shooting data show an average of 2 coyotes killed per hour of aerial shooting. A typical *pass* in which shots are taken at a coyote takes only a few seconds and usually involves 2 to 3 shots with a 12 gauge shotgun. It generally takes an average of just more than 1 pass to successfully shoot and kill a coyote (because most are killed on the first pass). It is estimated that on average no more than about 30-45 seconds of every hour spent flying are involved in making passes and shooting (L. Burraston, National Aviation Manager, WS, pers. comm. 2006) which means that only about 1-2% of the time spent aerial shooting is actually spent in shooting at target animals and generating gunshot noises.

A few studies have indicated gunshot noise can alter behavior of some wildlife species, including waterfowl (Meltofte 1982) and eagles (Stalmaster and Newman 1978). It has been suggested that firearms noise affects species that are hunted due to their association of such noise with being pursued and shot at by humans (Larkin 1996). As part of the existing human environment (i.e., *environmental status quo*), an average of over 50,000 persons participated in hunting each Gambel's quail (*Callipepla gambelii*) and mourning dove (*Zenaida macroura*) annually over the last 10 years in Arizona and killed about 1 million of each species (AGFD 2012). WS-Arizona aerial shooting accounts for an average of 166 animals shot per year in Arizona from FY11 to FY15. At an average of 4 shots per animal killed, the number of shots fired in a year during aerial shooting is less than 664. In all WS-Arizona programs conducted in Arizona, WS-Arizona cumulatively fired just about an annual average of 10,000 shots per year (average of 4 shots fired every time a firearm was used to shoot a target animal or for harassment shooting, and 1 shot for all mammals taken in traps or with dogs); most shots fired were harassment shooting at airports. The number of shots fired by private hunters each year for just Gambel's Quail and Mourning Doves would, at a highly conservative estimate of 2 shots fired per animal killed, would be nearly 4 million shots fired. Considering all additional small and big game taken in the state, WS-Arizona shooting is just a fraction of the shots fired by hunters. WS-Arizona's contribution to overall gunshot noise in areas of wildlife habitat is less than 1% of the number of shots fired at wild animals in the state each year. Therefore, WS-Arizona adds only exceedingly small amounts of gunshot noise to that which occurs annually as part of the existing human environment in wildlife habitat areas of Arizona.

Gunshot noise from WS aerial shooting activities probably has no discernable or at most only minor potential to adversely affect wildlife populations because of the small frequency and duration of WS-Arizona aerial shooting flights and the small proportion of geographic area involved (9% of the total lands in the State of which 11% of the State lands, 9% of BLM land area, 8% private lands, and <1% of USFS land area) which means only small proportions of non-target wildlife populations would ever hear any noise from WS-Arizona gunshots. Also, shooting from aircraft is virtually always at an extreme downward angle towards the ground. Pater (1981 cited in Larkin 1996) reported that muzzle blast is louder in the direction toward which the weapon is pointed by up to 14 decibels. Thus shooting downward toward the ground would serve to lessen the noise in lateral directions from the aircraft. WS-Arizona personnel on the ground observing aerial shooting training passes in which shots are taken report that the gunshot noise heard at a distance of 150 yards or more is more like a pop-noise rather than the sound of an explosion (L. Burraston, National Aviation Manager, WS, pers. comm. 2006). This indicates shotgun noise from the airplane is not loud enough to cause much of a startling or disturbance effect at a distance. Animals that happen to be directly beneath or in close proximity to the airplane when shooting passes are made will undoubtedly hear the firearm noise as much louder, but the low frequency of occurrence of flights and small fraction of aerial shooting time actually spent firing the shotgun, along with the very small proportion of the geographic area over which shooting passes are made suggests only very small proportions of wildlife populations would be exposed to any close-proximity shotgun firing noise.

If gunshot noise caused serious adverse effects on wildlife populations, we believe the Tribes, USFS, BLM, and AGFD would have addressed and mitigated such effects from the hundreds of thousands of private and tribal hunters that are allowed to hunt and shoot at game and certain nongame animals on federal public lands and elsewhere. The fact that big game populations have been fairly stable and continue to be hunted in Arizona indicates there have been no consequential cumulative disturbance effects on big game species from aerial shooting activities.

E4. Cumulative Impacts of Both WS and Other Aircraft Overflights

Some public comments have raised the concern that WS aerial shooting overflights, when added to other types of low level overflights, might result in cumulative adverse effects on certain wildlife species populations.

Military Overflights

Arizona has three military air bases: Luke Air Force Base in Glendale, Davis-Monthan in Tucson, and the Marine Corp Air Station in Yuma. All conduct training flights in the vicinity of the base and at locations in southern Arizona (*e.g.*, Gila Bend Air Force Auxiliary Field, Goldwater Range). The Air National Guard in Colorado finalized an EIS (ANG 1997a) on a proposal to expand military training flights. That EIS contains considerable analysis on the potential for military training overflights by jet aircraft to adversely affect numerous wildlife species, and we refer readers to that document for a more thorough coverage of the detailed analysis. The primary counties in Arizona where military flies are Maricopa, Pima, and Yuma counties wherein WS-Arizona does not fly in Maricopa or Yuma and has not flown in Pima since FY12 (Table 24). In summary, the analysis in that EIS established the following:

Many studies exist that have documented behavioral responses in wildlife, but those studies have not provided evidence that wildlife species populations have been adversely affected to any substantial degree. ANG (1997a) concluded that their Preferred Alternative (the Colorado Airspace Initiative), which involved from 62 to 2,461 sorties (military training flights) on 14 separately identified airspace components per year, was not expected to result in any significant environmental impacts. In particular regarding effects on wildlife, ANG concluded that no adverse impacts were expected on any wildlife species in any of the airspace components where the training flights would occur.

Aircraft overflights within 650 to 1640 feet have been shown to increase the heart rates and cortisol levels of large herbivores (USFS 1992). However, even when animals flee temporarily from approaching aircraft, available evidence suggests risks of damage are low as animals take care not to injure themselves when startled or frightened.

Studies of wildlife subjected to aircraft overflights have not shown evidence of compromised reproduction, either directly or indirectly (USFS 1992).

A majority of the literature reviewed led to the conclusion that numerous wildlife species have the ability to adapt to the presence of man and various man-made sound sources, including jet aircraft noise. Although initially startling, habituation to jet aircraft noise occurs with most wildlife species. No published scientific evidence was identified that indicated harm may occur to wildlife as a result of exposure to the levels of noise generated by military aircraft that would utilize the airspace associated with military training flight areas.

USFWS and state wildlife agencies expressed some concerns about the potential for adverse effects from military overflights on waterfowl in waterfowl habitat areas and on bighorn sheep in their lambing areas. (see analysis in Section 2.4.2.1 – WS-Arizona does not conduct aerial shooting actions in those types of areas unless requested by responsible wildlife management agencies; conversely, in other states, APHIS-WS has been requested to protect waterfowl nesting areas from coyote predation impacts, and aerial shooting has been used to meet those objectives to enhance waterfowl populations). It can be concluded that aircraft overflights will not adversely affect wildlife species within the region of influence.

The ANG (1997a) EIS analysis thus shows that military overflights, even where they occur on a regular basis up to many hundreds of times a year over specific areas, are not likely to result in adverse effects on wildlife. ANG (1997a) described the locations of areas in and routes on which military training flights occur in Colorado. The areas, military operations areas and training flight routes occur in several counties in south-central Colorado (Alamosa, Costilla, Saguache, Fremont, and Custer). None of the military operating areas or training routes occurs in the western half of Colorado, which is where 88% of WS-Arizona aerial shooting time occurs in the state (WS 2005). Similarly, most military flights are in southwestern Arizona, where WS-Arizona has done little, if any, aerial shooting. Therefore, virtually no potential exists for military training flights to add to the cumulative impacts analysis of WS-Arizona aerial shooting activities in Arizona.

Aerial Shooting by Other Agencies and Individuals and Other Types of Aircraft Flights

The only aerial shooting that occurs in Arizona is by WS-Arizona. No permits are issued to private individuals.

There has been some concern expressed about the possibility that commercial aircraft flights could present concerns about cumulative impacts on wildlife when considered together with WS aerial shooting overflights. However, most such flights occur at such high altitudes (generally more than 30,000 feet), that they present virtually no potential to disturb wildlife and we are unaware of any scientific evidence to the contrary. The highest number of low-level flights that occurs in the Counties where WS-Arizona conducts most aerial shooting is in Grand Canyon National Park where aircraft tours are commonly given. WS-Arizona does not fly in the Park and, thus, does not contribute to aircraft noise in that area. Therefore, we conclude such flights have no potential to contribute to cumulative impacts on wildlife that are affected by or exposed to WS-Arizona aerial shooting overflights.

Conclusions about Cumulative Impacts from Overflights

There is no obvious threshold of significance when it comes to the cumulative effects of overflights on wildlife. This is because our analysis and the considerable analysis of ANG (1997a, 1997b) show that, despite considerable research on numerous wildlife species, no scientific evidence exists that indicates any substantive adverse effects on wildlife populations will occur as a result of any of the types of low level or other overflights that do or may occur. It is apparent that WS-Arizona' aerial shooting has occurred in Arizona, or may occur in the future, even with the potential of other commercial or military training flights in the same area, are inconsequential to what has already been found by analysis in an EIS to have little to no potential for causing adverse impacts on any wildlife species populations, despite the fact that the military training flights are far more numerous and produce far greater noise levels than the small aircraft used by WS.

The geographic scope of WS-Arizona's aerial shooting in Arizona is limited - on a land area basis, less than 9% of Arizona, <1% USFS lands, and about 9% of BLM lands are exposed to some level of aerial shooting in a typical year. Frequency of WS-Arizona's aerial shooting flights on areas of federal public land are also low - only about 0.1% of BLM grazing allotments in the state are exposed to more than a few aerial shooting flights in a year. Even if such overflights increased ten-fold, available scientific evidence as discussed in Sections 2.4.2 indicates wildlife species would not be adversely affected because most species are tolerant or habituate to overflights. WS-Arizona's standard practice of avoiding concentrations of big game animals while conducting aerial activities further lessens the already low to nonexistent potential for such flights to adversely affect their populations.

Our analysis indicates that the scientific evidence does not support the conclusion that aerial overflights by WS-Arizona, or cumulatively when added to other types of overflights, have significant impacts on wildlife. There is considerable scientific evidence presented herein that overflights do not adversely affect wildlife. That fact by itself goes a long way toward providing qualitative support for a finding that there is no potential for significant adverse effects on the quality of the human environment, either on a state-wide basis or at the local level, from WS-Arizona overflights. In conclusion, we have found no evidence to suggest that overflights' effects on wildlife, even cumulatively, would result in significant impacts on wildlife species populations, let alone result in effects on such populations that would rise to the level of causing a significant impact on the quality of the human environment.

4.2.2.1. Alternative 1 - No Federal WS-Arizona PDM

Under this alternative, WS-Arizona would not provide assistance with PDM and, therefore, would not have an effect on non-target or T&E species. AGFD and ADA would likely provide some level of professional PDM assistance and would continue to take minimal numbers of non-target species. Private efforts to reduce or prevent depredations would increase the most under this alternative. This could result in less experienced persons implementing PDM methods leading to a greater take of non-target wildlife (potentially including T&E species) than under the Preferred Alternative (Alternative 5) or any of the other alternatives.

Similar to WS-Arizona PDM, private individuals could take coyotes and other predators year-round. Private landowners could increase their efforts and public land grazers could also increase their efforts, but their efforts would be restricted (no use of snares, leghold traps and toxicants on public land with exceptions) according to Proposition 201, and they could potentially take more non-target species because the PDM methods used could be used by persons with less experience and less target specific. Private individuals could use PDM methods where WS-Arizona personnel may not because WS-Arizona personnel follow WS-Arizona SOPs that include self-imposed restrictions for the protection of many aspects of the human environment (*i.e.*, not setting traps closer than 30 feet to livestock carcasses to avoid capturing scavenging birds or using pan-tension devices to exclude smaller animals). Hazards to raptors, including bald eagles, and other non-target species could be greater under this alternative.

WS-Arizona implements SOPs to minimize or eliminate any impacts on T&E species (Chapter 3). WS-Arizona would adhere to these measures, but private citizens would not be required to act in accordance with them. This could lead to take of T&E species, or adverse effects on other sensitive species. Private efforts to take target predators could result in potential adverse impacts for over 1,200 T&E and sensitive species (Tables 9 and 10) in the state. This potential is much higher under this alternative than under the Preferred Alternative. The potential use of illegal PDM methods such as chemical toxicants could impact non-target species populations, including T&E species. Therefore, it is likely that more impacts to non-target species would occur under this alternative than under the Preferred Alternative.

4.2.2.2. Alternative 2 - Technical Assistance Only

Alternative 2 would not allow WS-Arizona to conduct operational PDM. Therefore, WS-Arizona would not have any direct impact on non-target or T&E species. Under this alternative, AGFD and ADA would likely provide some level of professional assistance with PDM. Private PDM efforts would likely increase in proportion to any reduction in effort by WS-Arizona. Although technical support from WS-Arizona might lead to more selective use of PDM methods by private parties than that which would occur under Alternative 1, private efforts to reduce or prevent depredations could result in less experienced persons implementing PDM methods leading to greater take of non-target and T&E species as discussed under Alternative 1. This alternative would have the potential for increased adverse impacts resulting from WS-Arizona not providing quality PDM and the compensatory actions of private individuals. Presumably, many service recipients would become frustrated with WS-Arizona' failure to resolve their wildlife damage, and would go elsewhere for assistance. Higher variability in the level and scope of PDM activities could occur without a full

IWDM program, and this could have a greater negative effect on some local wildlife species (including T&E species).

4.2.2.3. Alternative 3 - Nonlethal Required before Lethal Control

This alternative would require that resource owners or WS-Arizona Specialists use nonlethal techniques prior to WS-Arizona implementing lethal PDM methods to resolve a damage problem. For many damage situations, this would be no different than the Preferred Alternative because many resource owners would have already attempted the use of nonlethal methods prior to contacting WS-Arizona for assistance. However, where nonlethal methods had not been attempted, this alternative would reduce WS-Arizona' ability to quickly address certain predator damage problems. Based on experience, a WS-Arizona Specialist may already be able to predict whether the use of nonlethal PDM methods will successfully resolve a particular depredation problem. WS policy already requires the use of nonlethal methods first, as appropriate. Using the WS Decision Model (Slate et al. 1992), a WS Specialist may determine that lethal PDM methods are necessary to abate a current problem. But the WS Specialist would also provide the landowner information on nonlethal techniques to reduce the likelihood of recurring damage. Since nonlethal PDM methods do not always prevent or reduce predator damage to acceptable levels, state or local agencies, private organizations, and individuals would likely assume responsibility for implementing the lethal PDM methods necessary to adequately deal with these problems. WS-Arizona would have a lesser impact on non-target and T&E species populations under this alternative than compared to Alternative 5, but the potential exists for private citizens to initiate lethal control prior to WS-Arizona involvement. If this occurs, the non-target take could likely increase, including T&E species risks, to a level greater than under Alternative 5, but would be expected to be less than the likelihood under Alternative 1. Measures to avoid T&E impacts were described in Chapter 3 of this EA. WS-Arizona would adhere to these measures, but private citizens might or might not be required to act in accordance with them. This could lead to greater impact on T&E species than under Alternative 5.

4.2.2.4. Alternative 4 - Corrective PDM Only When Lethal PDM Methods are Used

Alternative 4 would not allow WS-Arizona to conduct preventive operational PDM. For many individual damage situations, this alternative would be similar to the current program because producers often do not contact WS-Arizona until damage has already occurred. WS-Arizona conducts proactive PDM for a few predators because most predators cause only sporadic damage. WS-Arizona conducts preventive PDM primarily for coyotes where the area has had historic damage and the population level is such that damage is expected to reoccur, except where wildlife resources are being protected where damage may not have occurred (*e.g.*, prior to the reintroduction of a species such as the black-footed ferret), but is anticipated. Preventive damage management for coyotes is often conducted with aerial shooting. Wagner and Conover (1999) concluded that the need of traps, snares, and M-44's for corrective PDM was lower at sites with preventive aerial shooting than sites without preventive aerial shooting. Leg-hold traps, snares, and M-44s have a higher risk of capturing a non-target species than aerial shooting. Therefore, WS-Arizona is likely to have more impacts on non-target species using these methods, than under the Preferred Alternative. Therefore, risks to non-target species by WS-Arizona PDM activities would probably be somewhat greater under this alternative.

This alternative would also have the potential for increased adverse impacts resulting from private individuals. Presumably, WS-Arizona PDM recipients that are anticipating damage in historic loss areas and become frustrated with WS-Arizona' failure to prevent predator damage from occurring would turn elsewhere for assistance. These increased private PDM activities could lead to similar impacts as those described under the No Program Alternative. However, technical support on damage prevention might lead to more selective use of PDM methods by private parties than that which are likely to occur under Alternative 1. Impacts and potential risks from illegal chemical toxicant use under this alternative would probably be the same as those under Alternatives 1 and 2. More non-target species, and potentially T&E species, could be taken under this alternative than under Alternative 5.

4.2.2.5. Alternative 5 - Continue the Current Federal PDM Program (the Preferred Alternative)

WS-Arizona has taken few non-target species while conducting PDM compared to the number of target animals taken. Non-target lethal take averaged less than 0.0005% of the total take of all animals killed by WS-Arizona conducting PDM over the last five FYs. The highest take of non-target species was from the use of foot-hold traps and snares. As PDM methods have improved in the last few decades, the incidence of non-target species take has decreased. WS-Arizona took 106 non-target animals from FY11 to FY15 (Table 9) which represented 16 species (10 were predators analyzed in this EA). Of the 106 individuals, only 4 individuals (3 species) were killed while the remaining 102 animals were live captured and released. These low levels of take of these species was found to be of low magnitude. Thus, lethal take of the 3 species had minimal impacts on their population. The minimal lethal take of non-target species also gives a good indication of the selectiveness of the PDM methods used. Measures to minimize non-target impacts were described in Appendix 2. These SOPs have insured that non-target take in Arizona remains relatively low. Non-target species taken in Arizona were recorded as unintentional targets and non-targets. Unintentional targets are listed on the agreement as a target species, but are taken unintentionally during efforts to take other target species. Non-targets are not listed as target species on the agreement and are taken unintentionally during efforts to take target species. The only difference under this EA from the past Current Program Alternatives in WS-Arizona (1996, 1999a) is that all non-target species taken are considered in this document whereas non-target take in previous EAs were considered for different land classes. The take of non-targets in the previous EAs (WS 1996, 1999a) was found not to have a significant impact on the quality of the human environment and similar to the levels of take analyzed together in this statewide EA.

Unintentional target and non-target animals killed by WS-Arizona during PDM activities from FY11 to FY15 annually averaged less than one gray fox, less than one javelina, and less than one badger. Very few of these species were taken and impacts to these species would be considered minimal. Non-target take was included in the population impacts analysis in this EA for predator species killed as non-targets. Cumulative impacts to these populations, including the take of non-targets, were minimal. In fact, evidence suggests that small carnivore abundance typically increases in areas where coyote populations have been reduced (Robinson 1961, Nunley 1977a). Thus, current PDM activities in Arizona may benefit the smaller predators. Other potential non-target species that could be taken are considered abundant enough that PDM is unlikely to have an adverse effect on the population. However, this would not be true for T&E species in Arizona and WS-Arizona has measures to minimize their take (discussed below). WS-Arizona does not anticipate any substantial increase in non-target take under the Preferred Alternative.

Consideration of Impacts to T&E and Sensitive Species in Arizona. The USFWS, BLM, USFS, AGFD, and tribes all have some responsibility for managing threatened, endangered, or sensitive (Tables 8, A-1, and A-2) species that potentially could be impacted by PDM. These agencies monitor these species' populations to determine if different activities, singly or combined, are impacting them (a cumulative impact analysis). Mortality for T&E and sensitive species is also monitored where feasible. Much of the activity that results in mortality or population limiting factors is difficult to determine. Mortalities due to road kills, loss of habitat (*i.e*., land development, construction, housing, industrial complexes, road, mining, and oil and gas development), and natural disasters (*i.e*., fires, floods, lightning, heavy winters, and drought) would be the same under all alternatives because they are part of the environmental status quo. These factors are not likely to be determined sufficiently, even with unlimited funding, and, thus, can only be estimated based on how well a population is doing (increasing, decreasing, stable). The availability of habitat is often the most critical concern because the available habitat determines the number that an area can support.

Measures to avoid T&E and sensitive species impacts were described in the SOPs in Chapter 3. Those measures should ensure that the Preferred Alternative will minimize PDM impacts on T&E species. Of the federal and state listed T&E or sensitive species occurring in Arizona, WS-Arizona PDM could adversely affect only terrestrial vertebrate species (mammals, birds, reptiles, and amphibians). Because PDM methods will not affect water or wetlands, Arizona's T&E fish species thus no effect. Since WS-Arizona PDM will not modify or impact habitat to any extent, consequently there will be no effect on T&E invertebrates and plants.

Table 10 identified the federally listed species that could potentially be impacted by PDM. However, as discussed below, WS-Arizona PDM will have no effect on Sonoran pronghorn, Mount Graham red squirrel, and masked bobwhite because WS-Arizona does not conduct PDM in their range but could have a positive effect if we would conduct predator management within their range. WS-Arizona PDM will have no effect on the Sonora tiger salamander because WS-Arizona does not use the PDM method (large gas cartridge) that has the potential to adversely impact this species in its range. However, the use of PDM methods by WS-Arizona is not likely to place any of the species in jeopardy following RPA or RPM initiated to minimize impacts. These measures were discussed in BOs issued by USFWS for the black-footed ferret, California condor, and Bald Eagle, 2010 for the ocelot, 2011 for the gray wolf (including a Conference Opinion), 1999 for the jaguar, and 2002 for the desert tortoise. On March 13, 2018, the USFWS issued a new Biological Opinion and completed the section 7 formal consultation on the Wildlife Service's WDM program for multispecies issues in Arizona. Details can be found in those documents for those *may affect* species. In the formal consultations for federally listed T&E species, Conservation measures, RPA, or RPM were addressed along with an incidental take statement, where appropriate, with species-specific terms and conditions. WS-Arizona abides by these and has not impacted any federally listed T&E species in Arizona while conducting PDM since the BOs were written. From FY11 to FY15, WS-Arizona worked in the range of the Mexican gray wolf, black-footed ferret, California condor, and bald eagle. WS-Arizona did not incidentally take or adversely affect any of these species, or any other federally listed species, while conducting PDM from FY11 to FY15. Therefore, WS-Arizona has not cumulatively added to any known adverse take of federally listed species.

WS-Arizona has conducted PDM to protect black-footed ferret from predation by other predators and the potential for disease spread (especially distemper) from predators to ferrets. Coyotes were a primary cause of predation on ferrets at three reintroduction sites in Arizona, Montana, and South Dakota (Biggins et al. 2006). It has been found that PDM, especially prior to the establishment of a new ferret colony, is essential for their survival (Breck et al. 2006). In one of the first releases, 34 of the 39 ferrets released were killed by predators. It was found that controlling predators in the area prior to the release as well as managing predators sporadically thereafter helped the ferret population get established and maintain viability. The ferret population in Arizona has been declining due to disease, predation, climate and other environmental factors. The USFWS (2013) states that regular monitoring for diseases in sympatric predators at reintroduction sites should continue.

A Memorandum of Understanding (MOU) was signed by the Service, the Natural Resources Conservation Service, U.S. Geological Survey, APHIS WS, and the Western Association of Fish and Wildlife Agencies (USFWS 2013). Its purpose is to facilitate cooperative conservation efforts among the parties in concert with willing landowners so as to maintain ranch land in prairie habitats, and to maintain the livestock operations that they support, while providing for the conservation and recovery of several wildlife species associated with prairie dogs, especially the black-footed ferret. While participation in this MOU is voluntary, it indicates the intention of several Federal and State agencies to continue to contribute to black-footed ferret recovery.

WS-Arizona has the potential to adversely affect 14 T&E or sensitive species in Arizona, but did not adversely impact any of these species from FY11 to FY15 in the range where they are considered sensitive. From FY11 to FY15, WS-Arizona conducted PDM projects that benefitted T&E or sensitive species. WS-Arizona anticipates that PDM will continue to have only minimal adverse impacts on T&E or sensitive species, but that additional PDM projects may be conducted in the future for the protection of T&E or sensitive species, benefitting their populations. However, even if WS-Arizona has additional PDM projects, WS-Arizona does not anticipate that it will have significant adverse impacts on listed species. WS-Arizona consulted with USFWS under Section 7 of the ESA to insure no adverse impacts to federally listed T&E species (USFWS 2016). On June 27, 2017, the USFWS issued a biological opinion on WS's WDM program with regard to its effects on ocelots in Arizona. On March 13, 2018, WS-Arizona completed the multi-species section 7 formal consultation with the USFWS and were issued a new Biological Opinion on the Wildlife Service's WDM program in Arizona.

4.2.3. Impacts on Public and Pet Safety

4.2.3.1. Alternative 1 - No Federal WS-Arizona PDM

Under this alternative, WS-Arizona would not provide assistance with PDM and, therefore WS-Arizona would have no direct effect on public safety or pets. ADA and AGFD would probably still provide some level of PDM without federal supervision. Private efforts to reduce damage would likely increase. Compared to the current program alternative, private individuals could have negative effects on public and pet safety by incorrectly or irresponsible implementing PDM. This would result from untrained and unlicensed individuals using PDM methods and toxicants, both legal and illegal. As previously discussed, it is possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants with unknown impacts on HHS and the environment. In addition, private individuals are not accountable and could conduct PDM legally or illegally.

AGFD currently does not issue aerial shooting permits to the public. It is unknown whether or not they would in the future. If aerial shooting permits were issued, the chance of accidents would likely increase because private pilots would most likely not receive the same level of training as WS pilots and low-level flying has inherent risks associated with it. As can be seen with the accident rates of non-agency pilots, it is expected that more accidents would occur under this Alternative. Additionally, without aerial shooting, it is anticipated that private individuals would increase their PDM ground efforts to compensate for the same level of management that WS provided from aerial shooting. This would increase risks with the use of ground PDM methods.

Under this alternative, WS-Arizona would not be able to respond to predator HHS complaints. AGFD may or may not be able to respond in a timely manner. HHS problems associated with predators could increase, but some damage problems could either go unresolved or be handled by private individuals with similar risks described above. Alternative 1 would have the greatest potential for negative impacts on HHS, pets, and the environment.

4.2.3.2. Alternative 2 - Technical Assistance Only

Under this Alternative, WS-Arizona would provide advice or guidance on PDM techniques and methods, but would not conduct any operational PDM in attempting to assist in resolving damage complaints. This Alternative would be almost identical to Alternative 1, except that those people receiving technical assistance would be more apt to conduct PDM with less risk to the public. So this Alternative would have fewer negative consequences than Alternative 1, but be more similar to Alternative 1 than Alternative 5.

4.2.3.3. Alternative 3 - Nonlethal Required before Lethal Control

This alternative would require that resource owners use nonlethal techniques prior to WS-Arizona implementing lethal PDM methods to resolve a damage problem. Most PDM methods with the potential for negative impacts on the physical environment, pets or HHS, such as toxicants, could be used to a greater extent under this alternative as compared to Alternative 5. Therefore WS-Arizona would have less potential for impact on HHS and pet safety, and the environment but other entities would have a greater potential for impact. Private citizens, frustrated by the lack of WS-Arizona response, could conduct lethal PDM at a similar level compared to Alternatives 1 and 2. Many of these individuals would use PDM methods and toxicants, but illegal toxicant use might also adversely impact the environment, pets and HHS. Traps, snares, and firearms used by novices could result in greater adverse effects on HHS and the environment. WS-Arizona would not conduct as much aerial shooting under this Alternative, so associated risks from other methods would increase. This Alternative would have a slightly higher negative impact than Alternative 5, but less than Alternatives 1 and 2.

4.2.3.4. Alternative 4 - Corrective PDM Only When Lethal PDM Methods are Used

Alternative 4 would not allow WS-Arizona to conduct preventive operational PDM. Therefore, WS-Arizona would not have any direct impact on pet or HHS, or on the environment with PDM methods used to prevent damage from occurring. Most preventive work by WS-Arizona is focused on areas of historic loss of livestock to coyotes, at airports to prevent wildlife strikes, and for other wildlife species potentially subject to predation. Much of the work for livestock and wildlife protection is conducted with aerial shooting in concert with PDM on the ground. PDM, including aerial shooting, may be implemented in these historic loss areas by individuals with less experience than WS-Arizona personnel resulting in greater impacts on pet and HHS. However, many private citizens would involve WS-Arizona after damage had occurred. Therefore, it is believed that fewer would become frustrated to the point of using illegal methods. These increased private PDM activities, though, would lead to potentially similar cumulative impacts as those described under the No Federal Program Alternative, but only for a small portion of the projects. Impacts and hypothetical risks from illegal toxicant use under this alternative would probably be similar to the Preferred Alternative or slightly higher. Therefore, it is concluded that pet and HHS, as well as the environment would be at greater risk under Alternative 4, but much less than with Alternatives 1 and 2, similar to Alternative 3, and more than the Preferred Alternative, Alternative 5.

4.2.3.5. Alternative 5 - Continue the Current Federal PDM Program (the Preferred Alternative)

The use of PDM methods by WS-Arizona poses little potential hazards to WS-Arizona employees or to the public because all methods and materials are consistently used in a manner known to be safe. While some of the materials and methods used by WS-Arizona have the potential to represent a threat to HHS if used improperly, problems associated with their misuse have rarely occurred. This favorable record is due to training and certification programs for WS-Arizona personnel, such as for use of the M-44 (ADA tests applicators) and compliance with chemical use, firearms (mandatory firearms training every 2 years - WS Directive 2.615), and aviation safety (pilot and gunner certification and training). WS-Arizona stresses the proper and safe use of PDM methods and safety through training, policies and SOPs. The risk to HHS is further reduced because most WS-Arizona PDM methods are used in areas where public access is limited. Additionally, WS-Arizona prominently posts warning signs to alert the public when and where, in the general area, devices or traps are deployed. WS-Arizona coordinates with cooperators or landowners about where and when PDM methods are to be used, thereby decreasing the likelihood of conflicts with the public.

Impacts on HHS and environment under the Preferred Alternative would be no different than the current program since the WS-Arizona SOPs to protect the public and environment would remain the same. Under Alternative 5, WS-Arizona has a uniform statewide policy which allows WS-Arizona personnel to use PDM methods in areas where they may not have been used before. Even so, WS-Arizona would have minimal, if any, effects on HHS on these new properties and the same positive effects as far as protecting the public from predators.

From FY11 to FY15 WS-Arizona used 56.2 cc of euthanizing drug Sodium Pentobarbitol (97%), 47.77 cc of ketamine/xylazine and 3500mg of Telazol® compounds for immobilizing animals. WS-Arizona used 40 M-44s in FY11 and 73 in FY 12 for an average of 23 M-44s used annually. WS-Arizona has not used an M-44 since April 2012 WS-Arizona also used a total of 15 large gas cartridges, 2 in FY11, 1 in FY12, and 12 in FY15 for an average of 3 large gas cartridges used annually. This is very minimal use of chemicals. When WS-Arizona chemical methods including those referenced above are used in accordance with label directions, they are highly selective for the target individuals or populations. WS-Arizona use of these drugs and pesticides in PDM following all applicable restrictions and regulatory requirements has negligible impacts on the environment and do not represent a risk to the public.

Potential Effects from Aerial shooting on HHS and the Environment. The following discussion addresses concerns raised by the public about the potential for aircraft accidents associated with WS-Arizona' aerial shooting operations to cause catastrophic ground fires and pollution as a result of spilled fuel and oil. Information was obtained from Mr. Norm Wiemeyer, Chief, Denver Field Office of the National Transportation Safety Board, the agency respondible for investigating aviation accidents).

Major Ground or Forest Fires. Mr. Wiemeyer stated he had no recollection of any major fires caused by any government aircraft; he has been in his position since 1987. In addition, there are no reports of fires caused by WS aircraft in other states. The period of greatest fire danger typically occurs during the summer months, but WS-Arizona ordinarily conducts few, if any, aerial shooting operations during the summer. Since this discussion, no such fires have been caused by WS aircraft.

Fuel Spills and Environmental Hazard from Aviation Accidents. The National Transportation Safety Board stated that aviation fuel is extremely volatile and will evaporate within a few hours or less to the point that even its odor cannot be detected (N. Wiemeyer, National Transportation Safety Board, pers. comm., 2000). Jet A fuel does not pose a large environmental problem if spilled. It is a straight chained hydrocarbon with little benzene present and microbes would quickly break-down any spill residue through aerobic action. The quantities used by WS aircraft are relatively small (52 gallon maximum in a fixed-wing aircraft and 91 gallon maximum in the helicopters used by WS), and during much of each flight the amount of fuel on board would be considerably less than these maximum amounts. In some cases, not all of the fuel would be spilled. Thus, there should be little environmental hazard from unignited fuel spills.

Oil and Other Fluid Spills. For privately owned aircraft, the aircraft owner or his/her insurance company is responsible for clean-up of spilled oils and other fluids, but only if required by the owner or manager of the property on which the accident occurred. In the case of BLM, USFS, and National Park Service lands, the land managing agency generally requires soil to be decontaminated or removed and properly disposed. With the size aircraft used by WS, the quantities of oil capable of being spilled in any accident are small (*i.e.*, 6-8 quarts maximum for piston engines and 3-5 quarts for turbine engines) with minimal chance of causing environmental damage. WS uses single engine model aircraft, so the greatest amount of oil that could be spilled in one accident would be about 8 quarts.

Petroleum Biodegradation. Petroleum products degrade through volatilization and bacterial action, particularly when exposed to oxygen (EPA 2000). Thus, small quantity oil spills on surface soils can be expected to biodegrade readily. Even in subsurface contamination situations involving underground storage facilities, which would generally be expected to involve larger quantities than would ever be involved in a small aircraft accident, EPA guidelines provide for natural attenuation or volatilization and biodegradation to mitigate environmental hazards (EPA 2000). Thus, even where oil spills in small aircraft accidents are not cleaned up, the oil does not persist in the environment or persists in very small quantities. Also, if accidents were to occur, they would generally happen in remote areas away from human habitation and drinking water supplies. Thus, the risk to drinking water is expected to be exceedingly low or nonexistent.

Human Safety Consequences of Aerial Shooting Accidents. Beyond environmental consequences, other issues related to aviation accidents include the loss of aircraft and risks to the public and crew members. WS' use of aircraft is quite different from general aviation (GAV) use. The environment in which WS conducts aerial shooting is inherently a higher risk environment than that for GAV. Low-level flights have hazards such as power lines and trees, and the safety margin for error during maneuvers is diminished compared to high-level flights. In 1998, WS commissioned an independent review of its aerial shooting operations as a result of several accidents. The panel made several recommendations to WS regarding enhanced aerial safety. WS implemented most all of these recommendations by 2001. WS has implemented an Aviation Safety Program to support aerial activities and recognizes that an aggressive overall safety and training program is the best way to prevent accidents. While the goal of the aviation program is to have no accidents, accidents may still occur, especially those involving mechanical failure. WS agency pilots and contractors are highly skilled with commercial pilot ratings and they have passed proficiency tests in the flight environment encountered by WS. WS pilots, gunners, and ground crews are trained in hazard recognition and shooting is only 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 WS operations are mindful of this requirement. Because of the remote locations in which WS conducts aerial operations, the risk to the public from aviation operations or accidents is extremely minimal.

Although safety is a priority, accidents have happened in WS aerial operations and this is a concern to WS. Because accidents have also been a concern to the public, we analyzed them in this EA comparing them to GAV accidents. Accidents included in this analysis include those that occurred from 2006 to 2015, starting prior to the independent review (Table 25). The aviation industry standard for expression of accidents is the number of accidents per 100,000 hours flown. Because WS-Arizona flies a low number of hours annually (ave. 86.24 hrs/year from FY11 to FY15), it is statistically invalid to analyze accidents on a statewide basis. A more appropriate analysis of accidents would look at accidents nationwide during WS aerial shooting activities. At the national level, WS hours flown annually have ranged from 10,000 to as many as 11,000, and totaled about 100,000 hours in the 9 year period depicted in Table 25. Therefore, although still relatively low compared to GAV, national level data provide a more appropriate statistical basis for comparison.

Table 25. WS aerial shooting hours in the WS Western Region, WS accidents for 2006-2015 and GAV hours and accidents for 2006-2015.

WS Aviation Accidents Compared to General Aviation						
Year	WS Hours Flown	WS Accidents	CP Hrs Flown	CP Accidents	GAV Hours*	GAV Accidents*
2006	10,226	1	7,384	0	23,963,000	1,523
2007	9,709	2	6,268	0	23,819,000	1,654
2008	10,048	0	6,739	0	22,805,000	1,568
2009	10,094	0	6,018	0	20,862,000	1,480
2010	9,832	0	5,073	0	21,688,000	1,440
2011	9,906	1	3,943	0	23,963,000	1,470
2012	11,021	0	3,652	0	20,881,000	1,470
2013	10,426	0	4,225	0	19,492,000	1,224
2014	9,755	1	3,888	0	18,103,000	1,221
2015	10,094	1	4,728	0	N/A	N/A
Total	101,111	5	51,918	0	195,576,000	13,050
Accident Rate	4.9/100,000		0/100,000		6.7/100,000	
WS Acc. Rate	4.9/100,000					

CP - Contract Pilots for WS GAV - General Aviation H - Helicopter
* National Transportation Safety Board Aviation Statistics unavailable for 2015 (NTSB 2016).

Nationwide, WS had an accident rate of 4.9/100,000 (includes some non-low-level flying) compared to an accident rate of 6.7/100,000 for GAV. However, the difference between the WS accident rate and GAV accident rate is statistically insignificant (p=0.19, J. Shivik, WS National Wildlife Research Center, 2005, pers. comm.). WS in the Western Region had an overall accident rate of about 4.9/100,000 (Table 25). In a separate analysis, WS agency pilots with agency-owned and rented aircraft had an accident rate of 6.2/100,000 hours while WS contract pilots with their own aircraft had an accident rate of 51.7/100,000 hours. To put these into perspective, GAV had an accident rate during the same time of 6.9/100,000 hours. The Department of Interior flies about 100,000 hours annually with a smaller proportion of low-level flying than WS and had an accident rate average of about 8.5/100,000 hours (National Business Center 2004).

GAV has 4 categories of aviation including personal/business, aerial application (includes aerial chemical application (*e.g*., crop-dusting) and herding (ranching activities)), instructional, and corporate. From 1990 through 1999 GAV had an accident rate of about 8/100,000 (the accident rate is lower now as it dropped below 8 in 1996 and has remained there. Of these categories, aerial application (crop dusting) which is low level flying had a little over 9/100,000 hours and personal/business had the highest with about 11/100,000. Corporate aviation had the lowest accident rate at less than 1/100,000 hours (National Transportation Safety Board 2003). The latter is expected because this category involves larger aircraft, jets, and turboprops associated with high-altitude flying.

WS established the WS Aviation Training Center (ATOC) with the goal of reducing pilot error accidents to zero. The aviation safety program includes regular training for pilots and gunners as well as enhanced pilot training and evaluation. The ATOC provides pilots with rigorous training which includes the use of simulators. Fixed-wing aircraft are used more often today than are helicopters. If helicopters are used, they must be turbine powered. WS contract pilots are now being screened more thoroughly and are held to the same training standards as agency pilots to help reduce their accident rate. WS is hiring more agency pilots rather than contracting out services and certifies all pilots prior to their working for WS. No aviation accidents have occurred in Arizona. Additionally, WS did not have any aviation accidents in either 2008, 2009, 2010, 2012 or 2013.

WS complies with all FAA issued Service Bulletins, Airworthiness Directives, aircraft manufacturing recalls, and similar documents. These, though, may not be distributed by the FAA in a timely manner after a mechanical problem or concern has been identified. Notably, WS has been responsible for notifying the FAA of 2 discrepancies (identified aircraft problems), one involving turbine engines was issued to the public in an Airworthiness Directive.

The WS accident rate is within the norms of aviation and WS aerial shooting accidents have not involved the general public. WS flight crews understand the risks involved. Risks, though, are considered and expected to remain low. In addition, security measures have been taken to reduce the risk of aircraft theft (post 9/11). Accidents involving WS aircraft are within the expected norms. WS will continue to strive to further reduce these, thereby minimizing potential risks.

4.2.4. Effects on Sociocultural Resources

Recreation encompasses a wide variety of outdoor entertainment in the form of consumptive and non-consumptive uses. Consumptive uses of public lands include activities such as hunting, fishing, and rock-hounding. Non-consumptive uses include activities such as bird watching, photography, camping, hiking, biking, rock climbing, winter sports, and water sports. Recreationists are members of the general public that use public lands for one of the above or other activities. Recreation on private lands is restricted by landowners and, thus, should not be impacted as much as on public lands. PDM is conducted mostly for the protection of livestock on grazing allotments in these areas. Livestock are typically not grazed near high public-use areas where recreation occurs.

Native American Indian Cultural Resource Concerns
PDM activities on lands managed by Native American Indian tribal governments would only be conducted at the request of a tribe and, therefore, any tribe requesting assistance would have opportunity to discuss potential concerns with any potentially affected cultural or other resource. As discussed in Section 1.4.1, during the preparation of this EA, all federally recognized Native American Indian tribes in Arizona were offered the opportunity for consultation, comment, or involvement in the EA process. The Bureau of Indian Affairs and the White Mountain Apache Tribe has also been asked to be a consulting agency for this EA. No concerns were raised by tribes. While no tribes have indicated a desire to formally participate in the preparation of this EA, WS-Arizona is available at any time to assist tribes with PDM.

Impact of PDM on Private Recreational and Commercial Fur Harvest
A concern that has arisen is the impact that PDM would have on hunters. Game and non-game wildlife populations are not significantly impacted by WS-Arizona PDM take allowing hunters ample

opportunities for pursuit during seasons set by AGFD or Tribes. WS-Arizona PDM is directed to target individuals in a given area, mostly on tribal and private lands, and can be conducted in low to high density predator areas. Typically, WS-Arizona works on a property until damage is effectively reduced. This can take longer than hunters would tend to stay or be allowed to legally harvest in a given area. Additionally, WS-Arizona only conducts PDM in a small portion of Arizona (usually less than 5% of the state). Private fur harvesters tend to hunt where furbearer populations are high. When the only monetary benefit is fur value, they cannot make a profit by pursuing individual depredating coyotes in local areas where numbers are low. In addition, furs are only prime in the winter months and are not of value at other times of year when PDM is frequently needed. The typical strategy of private fur takers is to hunt the more easily lured animals in a population, which would tend to be the younger and less experienced animals, and to move on to other areas. With coyotes, older individuals are the most prone to being livestock and wild ungulate killers (Connolly et al. 1976; Gese and Grothe 1995). Thus, offending animals may not be taken before the private fur taker moves on, which means depredation losses would often be about as severe as they would without private fur harvest. This issue remained basically the same under all of the alternatives.

Effects of WS-Arizona PDM on Unique Characteristics of Geographic Areas
A number of different types of federal lands considered in this EA exist within the state of Arizona, including WAs, Wilderness Study Areas (WSAs), Future Planning Areas, National Conservation Areas, National Historic Sites, and Areas of Critical Environmental Concern which currently have special designations because of their unique characteristics and may require special considerations for conducting PDM. These are collectively referred to as Special Management Areas (SMAs) and can be managed by BLM, USFS or other entities. Table A-4 (Appendix A) shows the current SMAs in Arizona. WS-Arizona recognizes that some persons interested in SMAs may feel that any PDM activities in these areas adversely affect aesthetic and natural qualities or values and the ecosystem. WS-Arizona conducts PDM as allowed to reduce damage in the SMAs. Many SMAs allowed grazing long before being so designated and continue to allow it. PDM has been conducted on some of these areas. However, WS-Arizona has conducted PDM on only a few SMA grazing allotments for the protection of livestock in the last few years and anticipates that this would be the level in the future. Current laws and regulations allow the public and WS-Arizona to conduct PDM activities in SMAs under certain limitations, but PDM in SMAs is only a very minor component of the current program. Currently, private individuals using firearms and trail hounds can hunt or conduct PDM in most SMAs under AGFD regulations. These activities are not restricted by BLM or USFS in most SMAs. Further discussion of specific WS-Arizona activities on SMAs in Arizona continues below.

BLM SMAs. The Wilderness Act preserves management authority for fish and wildlife within the state for those species under state jurisdiction. Some portions of wilderness areas in Arizona have historic grazing allotments and WS-Arizona may conduct limited damage management in compliance with federal and Arizona laws. WS-Arizona only provides assistance to requesting entities in designated wilderness areas when allowed under the provisions of the specific wilderness legislation and as specified in MOUs between APHIS-WS and the land management agency.

The Wilderness Act does not prohibit WDM within designated wilderness. With certain exceptions, the Act prohibits using motorized equipment and motorized vehicles such as ATVs and landing of aircraft. The BLM may approve wildlife damage management in wilderness study areas and wilderness areas (BLM Manuals 6330 and 6340 respectively). WS-Arizona works closely with the BLM in cooperatively implementing their respective interagency MOU for operations in wilderness and wilderness study areas.

BLM Manual 6340-Management of Designated Wilderness Areas, Section 1.6 Policy. C. Managing Resources and Resource Uses in Wilderness, 21. Wildlife c. Project implementation: viii. Wildlife Damage Control. Wildlife damage control in wilderness may be necessary to conserve Federally listed threatened, endangered species, or candidate species, to prevent transmission of diseases or parasites affecting wildlife and humans, or to prevent serious losses of domestic livestock. Refer to MOUs between the Animal and Plant Health Inspection Service (APHIS) and the Federal administering agencies regarding permissible action in wilderness. Proposals that would involve uses generally prohibited under Section 4 (c) of the Wilderness Act will be considered and may be authorized by the Federal administering agency through the MRDG. The BLM should consider the following when reviewing wildlife damage control actions within wilderness areas:
A. Control measures should be implemented by the Animal and Plant Health Inspection Service the BLM, the State fish and wildlife agency, or other approved State agency, pursuant to cooperative agre~ments or memoranda of understanding.
B. Control measures should be directed at the individual animals causing the problem.
C. Acceptable control measures include lethal and nonlethal methods. Criteria for choosing a particular method include need, location, environmental conditions, the preservation of wilderness character, and applicable Federal and State laws. Only the minimum amount of control necessary to solve the problem should be used.
D. Wildlife may be killed, hunted, or otherwise controlled if necessary to protect federally listed threatened or endangered species, to prevent transmission of diseases or parasites affecting humans, or to prevent transmission of diseases or parasites affecting other wildlife.
E. Wildlife may be killed, hunted, or otherwise controlled if necessary to prevent serious losses of domestic livestock. In such cases, control must be directed only at the individual animals causing the problem. F. Killing, hunting, or otherwise controlling nonnative species also may be necessary to reduce conflicts with native species. Killing, hunting, or otherwise controlling native species, including those reintroduced, to reduce conflicts with other native species (other than covered under sub-section viii.E, above) is not permitted, unless mutually agreed upon between the State agency and the BLM, and is consistent with preservation of wilderness character.
G. Nonnative, domestic, and feral animals maybe killed, hunted, or otherwise controlled by Federal and State agencies to protect wilderness character.
H. Poisons should be used only where other measures are not practicable, subject to additional restrictions:

I. Use only registered pesticides according to label directions and applied only by certified pesticide applicators.

II. In selecting pesticides, give preference to those that will have the least impact on non-target species and on the wilderness environment.

III. Place temporary warning signs at the entrance to the area where pesticides are being used to warn the public of any dangers to themselves or their pets. Maps that adequately indicate where the pesticides will be placed should be posted at access points, and made available to the public in the local office and through local public media outlets.

WS-Arizona PDM in WAs, WSAs, and other SMAs would be conducted in compliance with any and all federal and state laws and regulations that have been determined to apply to WS-Arizona activities. WS-Arizona PDM in SMAs has occurred only to a very minor degree in the current program and the need for future activity in SMAs is expected to remain minor. BLM has not imposed any restrictions on most PDM methods in any SMAs in the state. Previously, the only exception was in the BLM Interim Management Policy and Guidelines for Lands Under Wilderness Review (BLM 1995), which established several restrictions on PDM in WSAs. That policy did not purport to restrict in such areas the use of other PDM methods including those that are also involved in hunting and private or state agency PDM activities, such as the use of firearms or trail hunting dogs. Therefore, WS-Arizona use of such methods under WS authorities would be consistent with BLM management direction in such areas. BLM revised its policy for management of WSAs in 2004 (C. McCluskey, Senior Wildlife Specialist, BLM, pers. comm. 2005) and we are awaiting final interpretation of the effect of the policy changes. WS-Arizona did not aerial shoot in any of the WSA portions of BLM grazing allotments associated with WSAs from FY11 to FY15.

WS-Arizona conducts an annual coordination process with BLM to provide the BLM with the opportunity to identify any conflicts that WS-Arizona activities might have with established management plans or goals for SMAs. If WS-Arizona activities are to be found to conflict with such management plans or goals, then WS-Arizona would either avoid conducting the activity or would engage in further NEPA analysis as appropriate in coordination with the BLM. From FY11 to FY15, WS-Arizona did not conduct PDM in any BLM SMA except in FY 05 on Agua Fria National Monument for the protection of antelope; this PDM activity was requested by AGFD because of low recruitment.

USFS SMAs. WS-Arizona follows policies outlined in the USFS Manual (USFS 2006), particularly Section 2323, and the National MOU between USFS and WS-Arizona when conducting PDM in USFS SMAs such as WAs, WSAs, and Future Planning Areas. Additionally, the Land and Resource Management Plan (LRMP) provides guidance for USFS to determine if PDM objectives are compatible with land management objectives. For example, WS-Arizona does not conduct PDM in USFS specially designated areas (i.e., trailheads, campgrounds) except for emergency human health situations. Proposed WS-Arizona PDM plans are reviewed by USFS during the work planning process to ensure that areas of conflict with the LRMP, including any SMAs, do not exist. Therefore, we do not expect WS-Arizona PDM to have any adverse effect on wilderness characteristics or management objectives of SMAs. Proposed PDM in USFS SMAs would primarily be limited in scope to grazing allotments with a limited buffer zone for the protection of livestock, but could also on occasion occur for the protection of wildlife if requested. PDM in SMAs would not impair the values of such areas and the intent of Congress designating them as such.

Other SMAs. "Areas of Critical Environmental Concern" and certain other types of SMAs are managed for the protection of certain qualities or values such as biological, riparian, cultural, historic, scenic, geological, paleontological, recreation, rangeland, or sensitive plant species. PDM could on occasion be requested to occur in such an area. Methods of PDM that WS-Arizona might use operationally on such areas (*e.g.*, aerial shooting, ground-based shooting) do not affect any of these resource values. If an SMA has been specifically designated to protect a wildlife species that could potentially be impacted by PDM (these species are discussed in Section 3.2.2 of this EA) then special restrictions might be needed. In general, PDM has not been needed in these areas primarily because livestock are not often allowed to graze on them. However, it may be conducted in the future on such areas if the need arises, such as during a HHS crisis. Similar to other types of BLM and USFS SMAs discussed above, hunting and PDM by private individuals using firearms and trail hounds generally is not restricted in SMAs. The relevant land management agency (*e.g.*, USFWS, National Park Service, BLM, and USFS) is responsible for identifying any conflicts that PDM might have with the management of an SMA in the annual interagency coordination work planning process. If, for example, the respective federal land management agency determines that an area with special management emphasis is to be closed to all access, to the use of firearms, or to aerial shooting, then WS-Arizona would abide by those restrictions unless provided a special exemption. WS-Arizona only conducted PDM at Kofa National Wildlife Refuge in FY05 for protection of bighorn sheep from mountain lions but none were taken. Additionally, WS-Arizona conducted coyote and badger damage management in Casas Grande Ruins National Monument where the coyotes were damaging historic resources (digging into historic ruins) and presenting a threat to HHS (coyotes were unafraid of visitors and would approach them).

SMAs in Arizona. Arizona has many SMAs (Table A-4). These areas were analyzed to determine potential impacts of the current WS-Arizona program to their unique characteristics. PDM as conducted by WS-Arizona does not have an impact on cultural, historical, geological, and plant resources because habitat is not impacted by WS-Arizona in PDM. PDM has no potential to affect scenic qualities and has only minor potential to affect aesthetic qualities of SMAs because WS-Arizona works on relatively few SMAs as discussed in this section. WS-Arizona PDM does not impact fish, invertebrates, and plants in Arizona. Although WS-Arizona has the potential to take some species of terrestrial vertebrates as discussed in Section 2.2.2.2 in PDM, WS-Arizona is not likely to impact these species under the current program (see Sections 4.2.1.5 and 4.2.4.). Several SMAs have been set aside for wildlife protection, especially many of the T&E and sensitive species listed in Tables 8, A-1, and A-2 (these are discussed in Sections 2.2.2.2 and 4.2.2.5 and potential effects are considered in detail statewide, whether they occur on an SMA or elsewhere). As discussed in Section 2.2.2.2, the current WS-Arizona PDM program has little potential to affect these species.

Unique features of current designated WAs, National Monuments and Historic Sites, WSAs, Future Planning Areas, and Natural Areas are primarily scenery, native communities with rare plants and animals, and geological, cultural, historical, and paleontological values. Table A-2 lists the number of species being monitored in Arizona by different agencies or Tribes and many of these species occur in SMAs. Of the species being monitored, WS-Arizona PDM has not impacted any species in designated SMAs. Section 2.2.2.2 identified T&E and sensitive species that could potentially be impacted by WS-Arizona PDM, but as discussed in Section 4.2.2 and 4.2.2.5, none have been impacted more than minimally by WS-Arizona PDM. However, WS-Arizona PDM could have benefits for several species as discussed in 1.2.4 and 1.2.4.1. From FY11 toFY15, WS-Arizona conducted PDM in few SMAs, Agua Fria National Monument, Casa Grande National Monument, and Santa Teresa WA, in Arizona and had little impacts on any species in them. WS-Arizona expects that PDM will continue to have low impacts in the future.

Conclusions about Information on SMAs in Arizona. WS-Arizona analyzed Arizona SMAs (Table A-4, Appendix A) to determine potential impacts of the current WS-Arizona program to their unique characteristics. PDM as conducted by WS-Arizona does not have an impact on cultural, historical, geological, and plant resources in SMAs because habitat is not impacted by WS-Arizona conducting PDM. PDM has no potential to affect scenic qualities and has only minor potential to affect aesthetic qualities of SMAs because, as discussed in this section, WS-Arizona works on relatively few SMAs. WS-Arizona PDM does not impact fish, invertebrates, and plants in Arizona. Although WS-Arizona has the potential to take some species of terrestrial vertebrates as discussed in Section 2.2.2.2 in PDM, WS-Arizona is not likely to impact these species under the current program (see Chapter 4). Several

SMAs have been set aside for wildlife protection, especially many of the T&E and sensitive species listed in Tables 8, 9 and 10 (these are discussed in Sections 2.2.2.2 and 4.2.2 of this EA and potential effects are considered in detail statewide, whether they occur on an SMA or elsewhere). As discussed in Section 2.2.2.2, the current WS-Arizona PDM program has little potential to affect these species.

Unique features of current designated WAs, National Monuments and Historic Sites, WSAs, Future Planning Areas, and Natural Areas are primarily scenery, native communities with rare plants and animals, and geological, cultural, historical, and paleontological values. Table A-2 (Appendix A) lists the number of species being monitored in Arizona by different agencies or Tribes and many of these species occur in SMAs. Of the species being monitored, WS-Arizona PDM has not impacted any species in designated SMAs. Section 2.2.2.2 identified T&E and sensitive species that could potentially be impacted by WS-Arizona PDM, but as discussed in Chapter 4, none have been impacted more than minimally by WS-Arizona PDM. However, WS-Arizona PDM could benefit several species as discussed in 1.2.4. From FY11 to FY15, WS-Arizona conducted PDM in few SMAs, Agua Fria National Monument, Casa Grande National Monument, and Santa Teresa WA, in Arizona and had little impacts on any species in them. WS-Arizona expects that PDM will continue to have low impacts in the future.

Impacts of Predator Removal on the Public's Aesthetic Enjoyment of Predators

Wildlife is generally regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Some members of the public have expressed concerns that PDM could result in the loss of aesthetic benefits to the public, resource owners, or local residents. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful.

WS-Arizona PDM activities occur on a relatively limited portion of the total area in Arizona, and the portion of various predator species' populations removed through WS-Arizona PDM activities is typically low (see Chapter 4). In localized areas where WS-Arizona removes some portion of the predator population, dispersal of predators from adjacent areas typically contributes to repopulation of the area within a few weeks to a year, depending on the level of predator removal and predator population levels in nearby areas. Most of the species potentially affected by WS-Arizona PDM activities are relatively abundant, but are not commonly observed because many of these species are secretive and nocturnal. The likelihood of getting to see or hear a predator in some localized areas could be temporarily reduced as a result of WS-Arizona PDM, but because there is already a low likelihood of seeing a predator, this temporary local reduction in public viewing opportunity would not likely be noticeable in most cases. Impacts of WS-Arizona PDM on overall predator populations would be relatively low under any of the alternatives being considered in this EA, and opportunities to view, hear, or see evidence of predators would still be available over the vast majority of public land areas of the state since WS-Arizona conducts PDM on a small percentage lands.

Humaneness of PDM Methods

The issue of humaneness, as it relates to the killing or capturing of wildlife, is an important but very complex concept that can be interpreted in a variety of ways. Humaneness is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. People concerned with animal welfare are concerned with minimizing animal suffering as much as possible, or eliminating unnecessary suffering. The determination of what is unnecessary suffering is subject to debate (Schmidt 1989). 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 initiates 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, 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."

Animal welfare organizations are concerned that some methods used to manage wildlife damage expose animals to unnecessary pain and suffering. Research suggests that with methods such as restraint in foothold traps, changes in the blood chemistry of trapped animals indicate "stress." Blood measurements of fox indicate that this is the case for fox that have been held in traps (Gorajewska et al. 2015). The situation is likely to be similar for other animals caught in traps, snares, or chased by dogs.

The killing of predators during the spring months does have the potential to result in litters of coyotes, red fox, and badgers becoming orphaned. When WS-Arizona conducts aerial shooting activities during the April-June period, aerial shooting crews will sometimes kill one or both of a pair of coyotes that likely have a den of pups in the vicinity. WS-Arizona's field personnel typically search both from the air and on the ground in a concerted effort to locate the den in these cases in order to dispatch the pups, typically through the use of EPA-registered fumigant (large gas cartridges). If the den cannot be located, pups may sometimes be fed and cared for by one or more members of a social group of coyotes associated with that den (Bekoff and Wells 1982). There are likely some cases where the killing of coyotes, red fox, or other predators may result in the orphaning of young animals that are still dependent on parental care. The only way to totally avoid this circumstance would be to refrain from conducting any predator removal efforts during this period of time. Unfortunately, this is also the period during which some of the most serious predation problems occur, such as coyotes killing young lambs to feed their pups (Till and Knowlton 1983).

Selectivity of wildlife damage methods is related to the issue of humaneness in that greater selectivity results in less potential suffering of non-target animals. Methods vary in their selectivity for non-target animals. The selectivity of each method is augmented by the skill and discretion of the WS Specialist applying the technique and by specific measures and modifications designed to reduce or minimize non-target captures. All WS personnel are trained in techniques to minimize the risk of capturing non-target wildlife.

Analysis of this issue must consider not only the welfare of the animals captured, but also the welfare of humans, livestock, and some T&E species 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. Use of livestock guarding animals is commonly considered a humane management alternative, but in some areas, livestock guarding animals and dogs used to pursue mountain lions or black bears may also be injured or killed.

The challenge in coping with humanenss is how to achieve the least amount of animal suffering with the constraints imposed by current technology. WS-Arizona 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 using best management practices. WS and the NWRC are striving to bring additional nonlethal 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 nonlethal damage management methods are not practical or effective. WS-Arizona supports the most humane, selective, and effective damage management techniques and will continue to incorporate advances into program activities. WS-Arizona personnel conducting PDM are highly experienced professionals skilled in the use of management methods and committed to minimizing pain and suffering. WS Program Directives, SOPs, and training work to ensure that WS-Arizona's PDM methods are used in a manner that is as humane as possible and selective. Other practices which help to improve the efficacy, selectivity, and humaneness of WS-Arizona's use of PDM methods include implementing Trapping Best Management Practices where appropriate for PDM actions and complying with AGFD regulations on trap check intervals.

Wildlife Values and Ethical Perceptions of PDM

Ethics can be defined as the branch of philosophy dealing with values relating to human conduct with respect to the rightness or wrongness of actions and the goodness and badness of motives and ends (Costello 1992). Individual perceptions of the ethics of PDM and the appropriateness of specific management techniques depend on the value system of the individual. These values are highly variable (Schmidt 1992, Teel et al. 2002), but can be divided into some general categories (Kellert and Smith 2000, Kellert 1994 Table 3-10). An individual's values on wildlife may have components of various categories and are not restricted to one viewpoint. The tendency to hold a particular value system varies among demographic groups.

Views on ethics of wildlife management often contain an emotional component that can vary depending on location and species being considered, can change over time, or can be inconsistent (Haider and Jax 2007, Littin et al. 2004). Various types of viewpoints can influence ethics and value systems. For example, one major factor influencing value systems is the degree of dependence on land and natural resources as indicated by rural residency, property ownership, and agriculture or resource dependent occupations (Kellert 1994). People in these groups tend to have a higher tendency for utilitarian and dominionistic values. Socioeconomic status also influences wildlife values with a higher occurrence of naturalistic and ecologistic value systems among college educated and higher income North Americans (Kellert 1994). Age and gender also influence value systems with a higher occurrence of moralistic and humanistic values among younger and female test respondents (Kellert 1980, 1994).

A recent study by George et al. (2016) replicated the research of (Kellert 1985) evaluating human uses and values toward animals. The study found that favorable ratings for predators (coyotes and wolves) had increased since the study by Kellert with positive attitudes towards these species increasing 47% and 42% respectively and that overall attitudes towards wildlife appeared to be shifting from more dominionistic and utilitarian values to more mutualistic values in which the wildlife are viewed as part of an extended family deserving of caring and compassion and wherein the value of predators in ecosystems is valued. This shift is consistent with success of recent ballot measures intended to improve animal welfare through regulation of domestic animal housing standards and legislation banning or placing severe restrictions on use of devices such as foothold traps.

Individual relationships with the species in question still appear to influence attitudes towards wildlife. For example, Treves (2013) found that public attitudes towards wolves may be increasingly negative among residents of areas occupied by wolves, especially those negatively impacted by wolves. Increasing urban residence has been increasingly associated with positive attitudes towards wildlife, and positive attitudes of this population likely outnumber opinions from more rural areas. However, like livestock producers in areas with wolves, attitudes of urban/suburban residents may be influenced by experiences in their area. George et al. (2016) noticed a decrease in positive attitudes towards raccoons and hypothesized that one of the potential reasons could be increased conflicts with raccoons (property damage, health and safety concerns) that are experienced in urban/suburban areas.

Many philosophies on human relationships with animals can be considered relative to ethical perceptions of PDM techniques. Some of the more prevalent philosophies are discussed here, although there may be others that influence wildlife management decisions.

One philosophy, animal rights, asserts that all animals, both human and nonhuman, are morally equal. Under this philosophy, animals should not be used (for research, food and fiber production, recreational uses such as hunting and trapping, zoological displays, and animal damage management, etc.) or considered acceptable unless that same action is morally acceptable when applied to humans (Schmidt 1989).

Another philosophy, animal welfare, does not promote equal rights for humans and nonhumans but focuses on reducing pain and suffering in animals. Advocates of this philosophy are not necessarily opposed to utilitarian uses of wildlife, but they are concerned with avoiding all unnecessary forms of animal suffering. However, the definition of what constitutes unnecessary is highly subjective (Schmidt 1989). In general, only a small portion of the U.S. population adheres to the animal rights philosophy, but most individuals are concerned about animal welfare.

A third philosophy takes the view that overpopulation of an animal species (whether natural, man-induced, or artificial) leads to increased animal suffering when the population suffers malnutrition, disease outbreaks of epidemic proportion, or populations crashes due to exceeding the environmental carrying capacity. Advocates for this approach suggest that humans are obligated to manage animal populations in a manner that reduces potential suffering to a minimal level (Beauchamp and Frey 2011). Similarly, some individuals may feel that humans have a moral obligation to correct environmental impacts that result from the human introduction of invasive species or species which have become extremely abundant due to their ability to thrive in human-altered environments.

When evaluating issues related to the ethics of conserving or controlling nature, another approach is to consider the reason for the action as the determination of whether the action is ethical or not. In this approach, one model involves assessing actions from the human point of view (anthropocentric) or from a more general view of all living organisms (biocentric) that considers any harm to living creatures that can be avoided as immoral (Haider and Jax 2007). These approaches have been considered for conservation decisions, but could also be applied to PDM decisions such as those discussed in this EA.

A simple model for determining the ethics of a potential action proposes assessing whether the action is necessary, and whether it is justified. In this model, if "yes" is the answer to both questions, the action is ethical (Littin and Mellor 2005). Although the considerations relating to each of these questions may involve several factors, only the two basic questions need to ultimately be answered using this model.

Yet another approach developed a set of six major criteria that can be used to design a pest control program that is ethically sound (Littin et al. 2004). The six major criteria are:

1. The goals, benefits, and impacts of action must be clear.
2. The action should only be taken if goals can be achieved.
3. The most effective methods must be used to achieve goals.
4. The methods must be used in the best ways possible.
5. The goals must be assessed.
6. Once goals are achieved, processes should be in place to maintain results.

Using this model, an ideal project is one that follows all six criteria above (a "gold standard" project). If not all can be followed, an ethically sound pest control program can still be conducted if the project is conducted in a way that moves toward to the "gold standard". With unlimited funding and time available, achieving a "gold standard" project may be possible. The challenge in coping with this type of model is how to achieve the best project (as close to the "gold standard" as possible) with the least amount of animal suffering within the constraints imposed by current technology and funding. The need for action is established in Chapter 1 of this EA. There are individuals who contest that the need for action is of sufficient scale to warrant management; however, state and federal agencies and elected representatives, have, through promulgation of regulations which permit the actions proposed in this alternative and allocation of funding to PDM, determined that there is sufficient need for action. Project objectives are established through consultation with cooperators. WS-Arizona uses the WS Decision model to select methods that are effective and appropriate for the given location. WS-Arizona personnel are trained in the safe and effective use of PDM methods, and the IWDM strategy and WS Decision model would be used to maximize program efficacy while also minimizing risk of adverse environmental effects. The WS Decision model includes project monitoring and ongoing revision of management actions as needed throughout the process. All WS-Arizona activities include consultation with cooperators on short-term strategies to address the problem and long-term approaches to reduce or eliminate the risk of recurring problems.

The issue of ethics is evolving over time (Perry and Perry 2008), but no one commonly-accepted standard for the evaluation of ethics relating to control of animal pests exists. Any of the above models, alone or in combination, may provide additional consideration of the ethics of a proposed action. WS has numerous policies, directives, and SOPs that provide direction to staff on how to acheive the most appropriate and effective wildlife damage management program possible. Many of these guidance documents incorporate aspects of the ethical considerations discussed above. Directives pertaining to WS' activities may be located using the WS home page at http://www.aphis.usda.gov/wildlifedamage.

4.2.4.1. Alternative 1 - No Federal WS-Arizona PDM

Under this alternative, WS-Arizona would not provide assistance with PDM and, therefore would not have any effect on recreation. WS-Arizona PDM would not have any impact on hunting and nonconsumptive uses because it would not be conducted. AGFD or ADA would probably provide some level of direct PDM assistance. State-conducted PDM would similarly affect recreation as described under the Preferred Alternative (Alternative 5). However, with no federal participation, WS-Arizona would have no impact. Private efforts to reduce or prevent depredations would likely increase. This could result in less experienced persons implementing PDM methods leading to a greater impact on recreation than described under the Preferred Alternative. As discussed relevant to other issues, it is possible that the frustration caused by the inability of less experienced persons implementing PDM to reduce losses could lead to the illegal use of toxicants which, in turn, could impact recreationists and their pets. This activity could also have minor impacts on game species, as described for predators and non-target species. Aerial shooting would probably not be used as much under this alternative because it requires pilots experienced with low level flying and a permit from ADA, which currently they do not issue to private pilots. Therefore, recreationists would be minimally affected, if at all, by this PDM method. PDM activities by non-federal entities may cause damage to the environment from off-road vehicle use where WS-Arizona would normally aerial gun. This is because much of the environment is sensitive to disturbance and vehicles can leave long-lasting scars, especially when vehicles are used during the wet season. These scars can be an eyesore to recreationists. Therefore, it is likely that slightly greater negative impacts could occur under this alternative when compared to the Preferred Alternative.

Alternative 1 would not affect SMAs because there would be no federal involvement in PDM. Without a federal program to provide assistance, individuals affected by predator damage could conceivably have a negative effect on SMAs under this alternative, for the same reasons described elsewhere with no program. This alternative would likely have a greater negative effect on recreation on public lands including SMAs than would the Preferred Alternative.

Under Alternative 1, livestock predation rates would be expected to increase. It has been determined that livestock losses are expected to be higher in areas without effective PDM (Bodenchuk et al. 2002, Shwiff and Merrell 2004, Taylor et al. 2009). Therefore, more domestic animals, including livestock and pets, would suffer inhumanely from injuries caused by predation than under the current program.

4.2.4.2. Alternative 2 - Technical Assistance Only

Under this alternative, WS-Arizona would only provide advice or guidance on PDM techniques and methods. WS-Arizona would not conduct any operational PDM in attempting to assist in resolving damage complaints, and therefore, would not have any impact on recreational use of public lands in Arizona. This Alternative would cause many of the same problems discussed under Alternative 1 above, although at a reduced level because those people receiving advice could make wiser choices when conducting PDM on public lands. However, this alternative could result in slightly greater negative impacts on recreation than would the Preferred Alternative. Impacts to SMAs would likely be minimal, but would likely be greater than under the Preferred Alternative.

Under this alternative, WS-Arizona would not be involved in PDM and therefore, would not employ methods viewed by some persons as inhumane. Local governments and private individuals would probably provide some level of professional direct control assistance with PDM (but without federal supervision) and would continue to use the PDM methods considered inhumane by some individuals, but at lower levels. Local governments and private individuals, though, would no longer receive training/assistance from WS-Arizona, nor would these entities benefit from research by WS focused on improving humaneness, selectivity and nonlethal methods. Moreover, private individuals, who are no longer provided professional assistance from WS-Arizona and have experienced resource losses, could conduct lethal control activities on their own. This could have the potential for increased and unnecessary pain and suffering to target and non-target species. Use of foothold traps, snares and shooting by private individuals would probably increase. This could result in less experienced persons implementing use of PDM methods such as traps without modifications like the underpan tension devices that exclude smaller non-target animals. Greater take and suffering of non-target wildlife could result. It is possible that frustration caused by the inability of resource owners to reduce losses could lead to illegal use of chemical toxicants. The illegal use of toxicants could result in increased animal suffering.

Under this alternative, predation rates would be expected to increase. It could be expected that livestock losses would most likely increase in areas without effective PDM. Therefore, more domestic animals, including livestock and pets, would suffer inhumanely from injuries caused by predation than under the current program.

Therefore, this alternative would likely result in more negative impacts with regard to humaneness than the current program. This is primarily due to the fact that more private individuals would attempt to alleviate predator damage without professional training and guidance and more domestic animals would be lost to predation.

This Alternative may be more acceptable to animal rights activists and to a wider range of animal welfare advocates because WS-Arizona would not be involved in the lethal removal of predators.

Livestock producers and others who receive services from WS-Arizona are likely to perceive this alternative as an unethical restriction of their access to legally available damage management techniques from professional, accountable WS personnel. Livestock producers and others who receive services from WS-Arizona may also perceive this alternative as an imposition of additional costs of livestock production upon them that results in further unacceptable losses. People concerned about the use of public resources to reduce damage (e.g. enhance profit) on private and public lands may find this alternative preferable to the proposed action because they do not support any PDM for the protection of private property, including livestock.

4.2.4.3. Alternative 3 - Nonlethal Required before Lethal Control

WS-Arizona would minimally affect recreationists with the Nonlethal Required before Lethal Alternative. In areas where nonlethal PDM had already been implemented and found to be ineffective, the full array of PDM methods could be used. Effects of PDM would likely be considered minimal to recreationists as analyzed in the EA. However, some individuals would implement lethal control on their own because WS-Arizona might seem unresponsive. This could have adverse effects on recreationists as discussed under Alternatives 1 and 2. The effects on recreation under Alternative 3 would probably be somewhat less than Alternatives 1 and 2, but more than the effects discussed for Alternative 5. Impacts on SMAs under this alternative would be similar to the Preferred Alternative, Alternative 5. Although the effectiveness may not be as high as Alternative 5; this alternative would allow the use of all methods eventually. Some producers may cause problems in SMAs similar to those listed for Alternatives 1 and 2, but at a much reduced rate since coordinated assistance would still be available.

The amount of suffering by target and non-target wildlife under this alternative would initially be less than under the proposed action because fewer animals would be taken if proactive preventive activities by WS-Arizona were allowed. Private individuals would increase their use of foothold traps, snares, and shooting for preventive control activities where producers feel WS-Arizona could not resolve a damage problem in a timely manner because nonlethal control measures needed to be implemented first. Lack of preventive predation management with aerial shooting may also result in increases in WS-Arizona's use of traps and snares for corrective PDM and associated risks to non-target species. Suffering of livestock because of injuries caused by predation would likely increase under this alternative because PDM actions by WS-Arizona could not be implemented until after the onset of depredation and after nonlethal methods were proven insufficient.

Alternative 3 would still be unacceptable to animal rights advocates and many individuals because it permits lethal removal of predators and because of the risks associated with likely increases in use of traps and snares. However, a larger number of animal welfare advocates would find this alternative more acceptable than the current program because it provides an assurance that predators would not be killed unless a nonlethal alternative has been tried. Livestock producers may perceive this alternative as an unjustified imposition of additional costs of production, and potentially, additional losses to resource owners may be borne (since most livestock producers already implement some form of nonlethal protective measures and need assistance when those have failed). Individuals concerned about the use of public resources to enhance private profit are unlikely to perceive this alternative as an improvement over Alternative 5 (preferred alternative).

4.2.4.4. Alternative 4 - Corrective PDM Only When Lethal PDM Methods are Used

WS-Arizona would minimally affect recreationists with the Corrective PDM Only Alternative. In areas where preventive control would have been used by WS-Arizona, PDM could be implemented by resource owners. Resource owners implementing PDM could have an effect on recreationists, but impacts would be minimal compared to Alternatives 1 and 2. However, some of these impacts may be prevented with nonlethal methods. Under Alternative 4, aerial shooting would be used less because it is the most commonly used preventive method that is perceived to impact SMAs. The most typical method that would be prevented from being used would be aerial shooting coyotes prior to lambing and calving or for wildlife protection. Much more effort would be expended following losses with PDM on the ground and aerially and more losses would be incurred by the resource owner as has been shown (Wagner 1997, Wagner and Conover 1999). Therefore, more time may be required by WS-Arizona to stop damage problems when they arise with the potential of impacting recreation. Resource owners conducting their own preventive PDM would have similar impacts as those described under Alternatives 1 and 2, but for WS-Arizona PDM activities would be closer to Alternative 5.

4.2.4.5. Alternative 5 - Continue the Current Federal PDM Program (the Preferred Alternative)

WS-Arizona is aware that most recreationist concerns regarding PDM center around perceived impacts on hunting, photography, wildlife viewing, and enjoyment of seclusion. The issue was discussed in Chapter 2 and WS-Arizona' SOPs are included in Appendix 2. In its current PDM activities, WS-Arizona has had only minor, if any, effects on recreational opportunities on public lands in Arizona. Impacts on recreation such as hunting and non-consumptive uses would be similar to the current program under the PDM on Federal Lands EA (WS 1999a) since PDM would be similar to that which was analyzed previously. Measures and SOPs developed to protect recreation resources under the Preferred Alternative would be similarly implemented. WS-Arizona would receive input and advice from BLM and USFS for the WP regarding PDM in SMAs, especially as they relate to concerns that a proposed PDM program might represent a conflict with RMPs and LRMPs. Impacts on SMAs would continue to be very minimal and would be conducted in response to livestock or wildlife losses.

Game and non-game wildlife populations are minimally impacted by WS-Arizona' take on public lands (Table 26) allowing hunters' ample opportunities for pursuit. Recreationists interested in wildlife viewing and photography opportunities also have ample areas in Arizona that are suitable for seeing abundant wildlife. Information is presented in Table 26 which gives the amount of BLM and USFS lands worked, the number of allotments where WS-Arizona conducted PDM, and the animals taken from FY11 to FY15. WS-Arizona PDM activities are of low magnitude compared to animal populations as discussed in this chapter of the EA. In fact, WS-Arizona PDM activities may benefit certain wildlife populations (*e.g.*, PDM focused for the protection of T&E species) thereby increasing viewing or photography opportunities of less abundant species. WS-Arizona conducted PDM on an average of 11.3% and 7% of BLM and USFS lands in Arizona. Thus, WS-Arizona does not conduct PDM on more than 89% of BLM and 95.9% of USFS lands in Arizona giving recreationists ample opportunity to see or pursue predators. Table 26 provides the predators taken for the past 5 FYs on BLM and USFS lands which averaged 13 coyotes, 10 mountain lions, and 1 black bear combined. WS-Arizona has conducted PDM on BLM and USFS in Mojave, Graham and Greenlee counties, and to a lesser extent in Cochise, Coconino, Pima, and Pinal counties using several available PDM methods including ground hunting and aerial shooting, trailing dogs, and cage traps. WS-Arizona does not anticipate that this acreage will increase substantially because PDM is conducted on allotments where cooperative funding is provided. However, WS-Arizona anticipates that new allotments will be worked and some will no longer have PDM conducted on them, thus somewhat balancing out the amount of acreage worked.

This Alternative may be unacceptable to Animal Rights advocates, individuals with strong humanistic and moralistic values, and to others with strong emotional or spiritual bonds with certain wildlife species. Some individuals assert that killing the offending animal is not the response of a moral or enlightened society. Response of other individuals and groups would vary depending on individual assessments of the need for damage management, risk to the target animal population, risk to non-target species and individuals, the degree to which efforts are made to avoid or minimize the pain and suffering associated with the various management techniques, and the perceived humaneness of individual methods. Increasing portions of the population showing mutualistic values (Georges et al. 2016) will be concerned regarding humaneness of individual method and potential for any level of lethal PDM to adversely impact predator populations and ecosystems.

Table 26. All target species killed and area and number of allotments worked by WS-Arizona Specialists from FY11 to FY 15 on BLM and USFS lands in Arizona

Land Area with PDM, Allotments, and Species Take on BLM and USFS Lands in Arizona from FY 11 to FY15												
Land Class	BLM						USFS					
Fiscal Year	FY11	FY12	FY13	FY14	FY15	Ave.	FY11	FY12	FY13	FY14	FY15	Ave.
Arizona Lands (mi 2)	15,469						14,922					
Lands with PDM (mi 2)	2,247	2,505	1,181	1,547	1,280	1,752	1,076	960	1,091	1,122	968	1043
% Lands with PDM	14.5%	16.2%	7.6%	10.0%	8.3%	11.3%	7.2%	6.4%	7.3%	7.5%	6.5%	7.0%
Total Allotments w/ PDM	20	26	23	30	22	24	21	20	19	25	22	21
TARGET SPECIES KILLED												
Fiscal Year	FY11	FY12	FY13	FY14	FY15	Ave.	FY11	FY12	FY13	FY14	FY15	Ave.
Coyote	69	81	25	33	53	52	26	5	16	-	16	13
Mountain Lion	12	10	16	5	6	10	6	22	10	6	8	10
Black Bear	-	-	-	-	-	-	2	3	1	-	-	1
Feral Dog	-	-	-	-	-	-	-	-	-	-	-	-
Feral Cat	-	-	-	-	-	-	-	1	-	-	-	0.2
Striped Skunk	-	-	-	-	-	-	2	1	-	-	-	0.6
Hooded Skunk	-	-	-	-	-	-	-	-	-	-	-	-
W. Spotted Skunk	-	-	-	-	-	-	-	-	-	-	-	-
Hog-nosed Skunk	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	81	91	41	38	59	62	36	32	27	6	24	25

On federal lands, WS-Arizona coordinates with the land management agency through WPs and designates different work zones on maps to reduce potential problems. WS-Arizona and the land management agencies identify and WS-Arizona avoids high-use recreational areas when conducting PDM actions. Furthermore, upland game and other high-use hunting areas are delineated by AGFD, USFS, or BLM. If WS-Arizona works in these areas, PDM equipment is removed a week or more prior to the hunting season as appropriate. WS-Arizona does not conduct PDM in high-use recreational areas except for the purposes of HHS or if recreational use is seasonal and livestock are grazed during the off-season. High use recreation and other sensitive areas are identified at the site-specific level on WS-Arizona WP maps which are modified as new damage situations arise. Human safety zones, planned control areas, and restricted or coordinated control areas are identified through interagency communications.

WS-Arizona also reduces conflicts with recreationists due to the inherent features of PDM. WS-Arizona conducts PDM on public lands almost entirely for protection of sheep and cattle on grazing allotments or for other wildlife protection (*e.g*., black-footed ferrets). Many of these areas are generally not used extensively by recreationists. Most recreational areas are set aside for that specific purpose and grazing is not allowed. The highest seasonal PDM activity for the protection of livestock coincides with lambing and calving which is mostly in the spring, although some calving may occur in the fall. During this time, aerial shooting is the method of choice because many of the grazing areas allow poor access and driving conditions are usually limited by wet or snow covered roads (northern Arizona). Many recreationists, as well as WS-Arizona personnel, may not have good access to these public lands due to this seasonal limitation. WS-Arizona currently averages about 12.4 minutes of flight time per square mile annually on the small proportion of BLM lands flown (Table A-3 and Table 23). On a land area basis, WS-Arizona conducted aerial shooting for PDM 11.3% of the BLM lands and 7% of USFS lands in Arizona and only for a very minimal fraction of the year. Therefore, the vast majority of public lands are not exposed to WS-Arizona aerial shooting. Additionally, WS-Arizona conducted PDM with all methods on an average of 11.3% of the BLM lands and 7% of the USFS lands in Arizona from FY11 to FY15 (Table 26), again showing the minimal amount of public lands covered by WS-Arizona. Most recreationists are totally unaware of PDM actions and the quality of their outdoor experience is not compromised. Thus, WS-Arizona has little impact on most recreation activities and nonconsumptive uses.

WS-Arizona recognizes that some individuals interested in SMAs may feel that any PDM activities in these areas adversely affect their aesthetic and natural qualities, value, and the ecosystem. The different SMAs were listed in Chapter 2 WS-Arizona abides by all associated laws, regulations, and policies (*e.g.,* the Wilderness Act) to minimize any effect on the public while conducting PDM as allowed to reduce damage in the SMAs. Many SMAs allowed grazing long before being designated as such and PDM has historically been conducted on many of these areas (typically for as long as grazing has been allowed). However, WS-Arizona conducts PDM on only a few SMA grazing allotments for the protection of livestock. WS-Arizona has also conducted PDM on SMAs for the protection of historic and natural resources, and not livestock. The current program alternative has a minimal effect on BLM and USFS SMAs such as WAs, WSAs, campgrounds, research natural areas, trailheads, and National Conservation Areas. WS-Arizona complies with WS-Arizona guidelines and policies when conducting PDM in these areas. Current laws and regulations allow the public and WS-Arizona to conduct PDM activities in SMAs under certain limitations.

Chapter 2 of this EA discussed the issue of WS-Arizona PDM activity in SMAs such as WAs and WSAs and Appendix 2 contains WS-Arizona' SOPs to ensure no adverse effects in SMAs. PDM is only conducted in designated WAs, WSAs, or other SMA when allowed by the legislation that designated the SMA such as a WA, or under regulations and, where applicable, policies developed by USFS, BLM, or other agency for PDM in these areas. PDM in SMAs is only a very minor component of the current program. Currently, private individuals using firearms and trail hounds can hunt or conduct PDM in most WAs and WSAs. These activities are not restricted and are allowed by BLM, USFS, or AGFD regulations.

WS-Arizona PDM under the Preferred Alternative has little impact on most recreation and nonconsumptive uses. The Preferred Alternative has minimal effects on SMAs.

4.3. SUMMARY AND CONCLUSIONS

Impacts associated with activities under consideration here are not expected to be "significant" or substantial. Based on experience, impacts of the PDM methods and strategies considered in this document are very limited in nature. The addition of those direct and indirect effects and impacts to past, present and reasonably foreseeable future actions would not result in cumulatively significant environmental impacts. Monitoring the impacts of the program on the populations of both target and non-target species will continue. All predator control activities that may take place will comply with relevant laws, regulations, policies, orders and procedures, including the ESA, Migratory Bird Treaty Act and Federal Insecticide, Fungicide, and Rodenticide Act.

The Preferred Alternative and Current Program Alternatives are likely to have the lowest cumulative effect on target species since a professional program with federal oversight and research programs would be expected to remove only those individuals or groups of depredating and potentially depredating animals after nonlethal options have been determined to be ineffective or impractical. Alternatives that inhibit WS-Arizona would be likely to draw upon other public agencies or private individuals, but probably also individuals with lesser skills or experience in wildlife damage management. These individuals would be likely to take action and would not be expected to be as effective and selective for target animals. For similar reasons, the non-target species affected would be expected to be the lowest under the Preferred Alternative. The humane treatment of animals is likely to be highest under these two alternatives, according to perspectives of wildlife professionals, but perhaps not viewed as such by some members of the public who are opposed to PDM. The Proposed and Current Program Alternative is expected to be the most effective in resolving predator damage.

Under the No Federal PDM Program Alternative, WS-Arizona would have no impact on the issues evaluated. This alternative would likely result in the greatest negative environmental impact when professional and accountable assistance is not available.

The Nonlethal Methods Only Alternative could affect WS-Arizona's ability to quickly address wildlife threats and damage problems by limiting control actions that could be used. Continued or increased threats to agricultural producers, property owners and human safety would be likely to occur due to the restrictions placed on this management program. The No Federal Program and Nonlethal Methods only alternative would, to varying degrees, not allow WS-Arizona to effectively respond to wildlife threats quickly or adequately. These alternatives do not fully support the APHIS-WS Directive 2.101, which addresses APHIS-WS policy for applying IWDM. However, components of the restricted methods alternative are preferred since lethal methods are considered only when nonlethal methods have been determined by the wildlife professional to be either ineffective, inhumane, not biologically sound or not economically feasible.

CHAPTER 5: RESPONSE TO COMMENTS PROVIDED DURING THE PUBLIC COMMENT PERIOD

1. **The EA Ignores the multiple benefits from predators such as recreation and ecosystem services and thereby seeks to rationalize the irrational PDM program.**

   Refer to Section 2.2.4 of the EA. WS-Arizona recognizes that native predatory wildlife plays a vital role in a healthy ecosystem and provides recreation for the public in the form of wildlife viewing and hunting; however, predatory animals can also cause damage or pose a threat to natural resources, T&E species, and human health and safety.

2. **The Agency fails to adequately justify the need for predator damage management.**

   See EA Section 1.2 for further discussion of predator conflicts in Arizona. The WS-Arizona program carries out its federal wildlife damage management responsibility (Animal Damage Control Act of March 2, 1931, as amended, 7 U.S.C. 426-426b and the Act of December 22, 1987, 7 U.S.C. 426c) to solve problems that occur when human activities and wildlife conflict, while recognizing that wildlife is an important public resource valued by the American people.

3. **The draft has very little scientific evidence suggesting that lethal predator control is effective in protecting livestock.**

   The EA provides analysis of the effectiveness of the WS PDM program in section 2.3.11 of the EA, including a review of the available scientific literature.

4. **Most of the data cited in support of predator control is decades out of date.**

   This EA uses the best available information from wildlife management agencies, including AGFD, and peer-reviewed literature to assess potential impacts to predator and non-target wildlife species.

5. **Recent literature calls into question efficacy of lethal predator control (Wielgus & Peebles 2014; Berger 2006, Harper et al. 2008; Musiani et al. 2003; Peebles et al. 2013, Teichman et al. 2016).**

   Section 2.3.11 of the EA addresses the efficacy of the APHIS-WS program in depth, including the literature cited by the commentor(s). WS-Arizona applies an IWDM approach using the WS Decision Model (see chapter 1.4.2 to effectively apply available methods to prevent or resolve wildlife damage. In selecting damage management techniques for specific wildlife damage situations, consideration is given to the species responsible and the frequency, extent, and magnitude of damage. In addition to damage confirmation and assessment, consideration is given to the status of target and potential non-target species, local environmental conditions, relative costs of applying management techniques, environmental impacts, and social and legal concerns. These factors are evaluated in formulating management strategies, giving preference to available and effective nonlethal strategies, and often include the application of multiple techniques. Typically, multiple nonlethal strategies have previously been deployed by the resource owner prior to requesting WS-Arizona assistance with lethal methods. WS-Arizona gives preference to non-lethal methods when practical and effective.

6. Recent literature states that hunting cougars may increase conflicts with livestock. (Wielgus and Peebles 2014, Teichman et al. 2016).

Commenters also asked WS-Arizona to consider Wielgus and Peebles (2014), Harper et al. (2008), and Musiani et al. (2005). These studies are all specific to wolf damage management which is outside the scope of this EA. Nonetheless, we did review these studies for information which might be applicable to PDM as proposed in this EA. We have determined that all three studies are not of utility in assessing the efficacy of PDM actions conducted by WS-Arizona primarily because of disparities in the scale of the analysis and the scale of the intended impacts of PDM actions conducted by WS. Specifically, all three studies analyze impacts of wolf damage management actions at the regional scale. Use of lethal methods to reduce damage by and conflicts with predators as 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 behavior of mammalian predators and the targeted nature of the management effort, these removals are not intended or expected to have regional-level impacts on livestock losses (Bradley et al. 2015). Additional problems with study design, data analysis and findings of Wielgus and Peebles (2014) have also been identified during review by the NWRC (Memo from J. Young NWRC to J. Suckow, WS Western Regional Director, 8 July 2015). Difficulties with the analytical process used by Wielgus and Peebles (2014) were also identified by Poudyal et al. (2016). Consequently, we did not use findings from Wielgus and Peebles (2014) in the analysis.

In response to the Teichman et al study: “Hunting as a management tool? Cougar-human conflict is positively related to trophy hunting”. The authors recommend that targeting individuals causing the conflict may be an effective way to address human conflicts with large carnivores and caution against the use of hunting as a tool for managing conflict with larger predators. This conclusion supports PDM which focuses on managing the individual cougars responsible for causing damage or posing a threat to HHS. WS-Arizona PDM is significantly different than using hunting as a form of wildlife management at the state level, in which the AGFD has management authority for setting seasons and harvest limits for managing wildlife populations in Arizona.

7. **Carnivores may increase prey kills as a result of stress from shootings. Cited (smith et al. 2015).**

    As noted in Section 2.3.11: The reference to Smith et al. (2015) is not relevant to the EA because it makes a mistaken analogy to PDM. Smith et al. (2015) assesses the impact of human disturbance (development), not PDM, on mountain lion predation rates. Smith et al. (2015) notes that levels of chronic disturbance associated with development result in mountain lions not consuming all of their kills and an increase in the number of animals the lions killed to meet energetic demands. The study makes no reference to PDM for livestock protection as currently conducted by WS-Arizona.

    EA Section 4.2.2 E3 further analyzes the potential effects on wildlife from gunshot noise. Also, 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. (EA 4.2.4 Effects on Sociocultural Resources: Humaneness of PDM Methods)

8. **There are problems with the agency's reliance on these records, which are based solely on unverified reports by ranchers. First, the NASS figures likely reflect an inherent bias: Livestock owners who have become dependent on Wildlife Services' assistance readily understand that the more losses they report, the greater the public-relations boost that the agency receives.**

    WS-AZ does not agree that NASS figures reflect an inherent bias. This comment is addressed in Section 2.3.1.3 of the EA. NASS is the National Agricultural Statistics Survey section of the US Department of Agriculture. It conducts the most comprehensive surveys of the status of agriculture in the US. The results of NASS surveys used in this EA are those that are pertinent to Arizona, either nationally, or statewide, and are the most recent.

9. **WS verifies only a fraction of livestock losses reported and WS-Arizona should not rely on "unverified" losses to justify an extensive predator killing program.**

Not all livestock lost to predators are reported to WS-Arizona. The need for action for the PDM program in Arizona is not solely focused on protecting livestock, but also protecting property, protecting human health and safety, and protecting natural resources (Section 1.2 of the EA).

Loss estimates in the EA are not exaggerated. WS-Arizona used the best available information on livestock losses due to predation, including WS-Arizona data on verified and reported losses and NASS livestock loss reports. EA Section 1.2.1.1 discusses the relationship between losses confirmed and reported to WS-Arizona and total livestock losses in the State. Establishment of an independent authority to confirm all losses is unrealistic. That independent authority would have to identify and confirm losses soon after they occur or decay and scavenging will destroy evidence indicating the species which caused the damage. It would not likely be able to do that. Searching for lost animals, especially in large grazing allotments or pastures, in areas with rough terrain, and areas with extensive shrubs or trees, can be extremely labor intensive. Therefore, staffing for this type of effort would cost too much. In general, this level of intensive monitoring has only been feasible for limited-scale research projects. Similarly, costs associated with locating and confirming all, or at least a significant majority of, predator losses statewide in a compensation only alternative are also likely to meet or exceed WS-Arizona PDM program costs, even if resources are reallocated from current operational and technical assistance projects to confirming losses.

10. The EA's tabulation of reports of damages and verified losses is likewise unavailing in establishing a need for action because it reveals that the economic harm caused by Arizona's wildlife is miniscule. "Between FY11 and FY15, Wildlife Services-Arizona received reports or verified predator livestock losses, including animals injured or killed, annually averaging 192 animals valued at about $75,398 (Table 2)" (EA p. 23). Yet in 2012 (the year for which data is available), agriculture generated $3.7 billion in annual sales from farm and ranch commodities in Arizona (EA p. 21). Using that available sales data means that, on average, livestock losses comprises 0.002% of Arizona's total agricultural revenues each year.

Section 1.2.1.1 of the EA was augmented with increased discussion of the contributions of livestock to the economy and the effects of predation on the livestock industry. While livestock losses to predation may not represent a large threat to the entirety of livestock in Arizona, they can be devastating to individual producers. Losses are not distributed evenly across all producers.

11. **The EA does not consider how predator control affects wildlife damage to field crops.**

    WS-Arizona disagrees with this comment. EA section 1.2.1 address this concern**.**

12. **The EA fails to consider that coyotes consume herbivores, diminishing competition with livestock for native forage.**

    WS-Arizona covers PDM Impact on Biodiversity and Ecosystem Resilience in Section 4.2.2. of the EA.

13. **Removing one predator can disrupt the social structure of the population. (Rutledge et al. 2010)**

    Numerous studies cited in the EA do not support this claim. (EA Section 4.2.2)

14. **WS-Arizona fails to consider mortality counts of young animals that are left orphaned.**

    There is no way to accurately predict the number or the fate of orphaned animals due to numerous unpredictable factors. The killing of predators during the spring months does have the potential to result in litters of coyotes, red fox, and badgers becoming orphaned. When WS-Arizona conducts aerial shooting activities during the April-June period, aerial shooting crews will sometimes kill one or both of a pair of coyotes that potentially have a den of pups in the vicinity. WS-Arizona's field personnel typically search both from the air and on the ground in a concerted effort to locate the den in these cases in order to dispatch the pups, typically through the use of EPA-registered fumigant (large gas cartridges). If the den cannot be located, pups may sometimes be fed and cared for by one or more members of a social group of coyotes associated with that den (Bekoff and Wells 1982). There are likely some cases where the killing of coyotes, or other predators may result in the orphaning of young animals that are still dependent on parental care. The only way to totally avoid this circumstance would be to refrain from conducting any predator removal efforts during this period of time. Unfortunately, this is also the period during which some of the most serious predation problems occur, such as coyotes killing young lambs to feed their pups (Till and Knowlton 1983). (EA Section 4.2.4)

15. **WS fails to examine whether lethal control is needed given the array of nonlethal methods.**

    WS-Arizona disagrees with this comment. Alternatives 1, 2, and 3 examine this claim.

16. **The EA fails to articulate the need for PDM on the basis of human health and safety (HHS).**

    WS-Arizona disagrees with this comment. Refer to EA Section 1.2.3 titled Human Health and Safety.

17. **PDM for the protection of HHS could be handled by private sector, police, or public education campaigns.**

    Many agencies, and the public do not have the skills or authority to resolve wildlife damage issues. Agencies and the public enter into cooperative agreements with WS due to our professional skill set and authorities to resolve these issues. Throughout the year WS participates in numerous educational events to assist the public in wildlife identification, problem solving and nonlethal management. Public education is supported by WS-Arizona but HHS requests often require a quick response to address problem

18. **The EA shows only $220 losses in HHS; all related to skunks or feral dogs.**

    It is difficult to attribute a dollar figure on threats and potential threats to HHS from predator species. (EA Table 5). $220 was attributed to the cost of providing technical assistance for HHS related concerns.

19. **The EA fails to address public safety risks associated with PDM methods (m-44).**

    WS-AZ has not used M-44s since 2012.WS-Arizona personnel must be certified to use the M-44. The EPA label for the M-44 also has restrictions to further enhance the safe use of the product. All WS personnel must abide by policies in WS Directive 2.415 and the EPA label when using M-44s. Use of the M-44 is addressed in Section 3.1.5.

20. **Attacks on humans from predators such as mountain lions and black bears are extraordinarily rare. (Sweanor and Logan 2009, Mattson et al. 2011; Herrero et al. 2011).**

    WS-Arizona recognizes that attacks on humans from mountain lions and black bears are rare, and states the fact repeatedly in the EA, however attacks do occur and have had fatal consequences. Attacks from mountain lions and black bears have been documented in Arizona. It is in WS mission to protect human safety from animals that pose a threat to public safety.

21. **Mountain lions could indirectly save people from death by reducing vehicle collisions with deer (Gilbert et al. 2016).**

AGFD is the agency responsible for managing mountain lion populations within the state of Arizona. Arizona does not have an identified deer management problem. Deer numbers are considered to be low and collisions with deer are minimal.

22. Killing predators to support game populations is unjustifiable.

WS-Arizona does not agree with this comment. Further explanation is provided in Section 1.2.4 of the EA. Under the North American Model of Wildlife Conservation: Wildlife resources are a public trust. Allocation of wildlife is by law. Wildlife can be killed only for a legitimate purpose. http://wildlife.org/wp-content/uploads/2014/05/North-American-model-of-Wildlife-Conservation.pdf

23. Killing carnivores fails to grow deer herds. (Hurley et al (2011).

Under certain conditions, predators, especially coyotes and mountain lions, can have a significant adverse impact on mule deer, bighorn sheep, and pronghorn antelope populations, and this predation is not necessarily limited to sick or inferior animals (Pimlott 1970, Shaw 1977, Bartush 1978, USFWS 1978, Trainer et al. 1983, Hamlin et al. 1984, Neff et al. 1985, Wehausen 1996, Kamler et al. 2002). Carrera et al. 2015 observed that differences in diet quality of mule deer may be related to trade-offs incurred through predation risk, where mule deer inside the enclosure are maximizing their energy intake without the burden of predator avoidance and vigilance. (EA Section 1.2.4).

Between 1997 and 2002, Hurley et al. (2011) studied the effects of increased harvest rates on coyotes and mountain lions in southeastern Idaho. Coyote predation on neonatal fawns during summer was offset by increased malnourishment during winter, indicating total annual coyote mortality was largely compensatory. The degree to which coyote predation was either additive or compensatory was influenced by alternate prey and weather conditions. During periods of low lagomorph (i.e., rabbits) or microtine populations (i.e., voles, shrews and field mice) and mild winter conditions, coyote predation was partially additive. Coyotes are considered a facultative predator of mule deer (Ballard et al. 2003) (i.e., they do not tend to typically predate upon deer, but may do so if circumstances such as deep snow make mule deer easier to obtain) readily available such as deep snow) and prefer small mammals. Results from the southeastern Idaho study were consistent with other coyote removal studies reviewed by Ballard et al. (2003). Conversely, mountain lion predation of mule deer in southeastern Idaho was considered largely additive (Hurley et al. 2011). Mule deer survival and recruitment increased with lion removal resulting in slight population increases during the most intense mountain lion removal periods (IDFG 2008).

Further information on this topic is provided in section 1.2.4.1 of the EA.

24. The justification for the EA's "need for action" are either unreliable or inconsequential. The result is that, even disregarding the excessively-narrow purpose-and-need statement which omits the positive values of wildlife, the very foundation of the EA simply cannot stand.

Comment noted: WS-Arizona does not agree with this comment. The need for action is addressed in chapter 1 of the EA. Section 1.2.4 Protection of Natural Resources further addresses positive values of wildlife.

25. EIS is required for the PDM program because the proposed action triggers numerous "significance" factors.

We do not agree that an EIS is needed and Section 1.6.4. of the EA addresses this issue. However, WS-Arizona's proposed action will not result in widespread reductions in predator populations. Data presented in Chapter 4 and analyses of impacts on target predator populations, non-target species and ecosystems for each of the alternatives indicate that WS actions only involve a small portion of the land within the state and that impacts of WS-Arizona predator removals are within the sustainable harvest threshold for target species. Population reductions, particularly of coyotes, which are subject to the most intensive removal, will be localized and would only persist for a year or less before immigration, compensatory mortality and births among remaining animals restore populations to pre-removal levels (Section 4.2.1. in the EA).

Reasons for the scope of the analysis are presented in Section 1.6. This EA emphasizes substantive issues as they relate to specific areas whenever possible. However, the issues that pertain to predator damage and resulting management are the same, for the most part, wherever they occur. We have determined that a more detailed and more site-specific level of analysis would not substantially improve the decision-making (Eccleston 1995). In terms of considering cumulative effects, one EA analyzing impacts for the entire State of Arizona provides a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. WS-Arizona's determination to prepare an EA is consistent with APHIS NEPA implementing regulations (7 CFR Part 372) specifying the types of actions normally requiring an EA, but not necessarily an EIS.

A decision will be determined based on this analysis of whether the proposed action or the other alternatives could potentially have significant direct, indirect or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS. If WS-Arizona makes a determination through this EA that the proposed action or the other alternatives could have a significant impact on the quality of the human environment, then WS-Arizona would publish a notice of intent to prepare an EIS and this EA would be the foundation for developing the EIS.

26. A recent review of studies conducted in Treves et al. (2016) concluded that lethal methods are not effective at reducing predator damage and studies comparable to controlled laboratory tests were necessary to further evaluate lethal predator management to establish its effectiveness.

Appendix C of the EA addresses the Treves et al (2016) paper in detail. APHIS-WS agrees that predation damage management tools and techniques must be based on rigorous, scientifically-sound principles. But, field and laboratory studies require different study designs. APHIS-WS scientists do not agree with Treves et al.'s assessment that existing research is flawed.

27. The EA fails to analyze the fact that the current program of providing highly subsidized lethal control—paid for by taxpayers at every level of government—de-incentivizes ranchers to take actions to prevent predation.

It is a false statement that WS provides PDM free of charge to ranchers. A combination of federal, state, and/or cooperative dollars are used to support producers. In some cases, producers may pay into a larger organization that in turn, pays WS-Arizona to support its constituency.

WS-Arizona also considers all viable methods (lethal and nonlethal) when addressing predator damage. This comment is further addressed in Section 2.3.5 of the EA.

28. WS must openly analyze the reputable opinions contrary to its proposed action. An EIS is needed to give these issues full consideration.

WS-Arizona has considered the literature, opinions, and comments provided by the public during 2 public review periods. The analysis in the EA reflects this and the analysis will indicate if a FONSI can be reached or if an EIS is necessary.

29. The predator killing program involves scores of unique areas such as designated Wilderness and Wilderness study areas.

PDM in Wilderness Areas and Wilderness Study Areas would be conducted in accordance with each land management agency's Wilderness Policies, guidance documents, MOUs, and the provisions identified in annual work plans (e.g., BLM Manual 6340, and WS authorities). WS-Arizona meets annually with each land management agency to review the agencies annual work plans. WDM would be performed in accordance with the enacting legislation and wilderness rules and regulations that pertain to WS-Arizona PDM. Currently, WS-Arizona does not have any agreements in place to conduct PDM on Wilderness Areas or Wilderness Study areas in Arizona. WS-Arizona will not conduct any PDM on wilderness areas until a Minimum Requirements Analysis has been completed by the land management agency.

30. PDM creates serious cumulative impacts on a range of species and on Arizona's environment.

WS-Arizona disagrees with this claim. Cumulative effects are addressed throughout Chapter 4 of the EA. This EA resulted in a Finding of No Significant impact (FONSI) on the quality of the environment.

31. The agency should analyze whether predators have adequate refuge where they are not subject to predator control, hunting, or other lethal management.

WS-Arizona relies on the AGFD data and the Biological Opinion of the USFWS to ensure that WS-Arizona impacts to predator populations are not significant. WS-Arizona conducts PDM on only a small fraction of the total land As of July 2016, WS-Arizona had 580 active cooperative agreements in place on approximately 10.9 million acres or about 15% of the state's land area. Even though 580 active agreements are in place on approximately 15% of the lands in Arizona, WS-Arizona does not conduct PDM activities on every property under agreement each year.

32. The argument is not compelling that PDM only occurs on a fraction of the land because wildlife habitat on exists on a fraction of the land.

WS-Arizona does not agree with this comment. Arizona has extensive mountains, deserts, and range lands that are high quality wildlife habitat. Section 1.2.1.1. of the EA details land ownership and use in the state of Arizona. Also, noted in Section 2.2.1: some persons believe PDM interrupts the *balance of nature* and this should be avoided. Others believe that the *balance* has shifted to unfairly favor generalist species, including predators. Several species' populations have steadily increased over the past several years due to the adaptability of these wildlife to human-made environments, and damage from these species has increased accordingly (International Association of Fish and Wildlife Agencies 2004).

33. The EA fails to comply with NEPA requirements for taking a "hard look" at all of its proposed actions.

WS-Arizona disagrees with this comment. Chapter 3 of the EA provides a detailed description of the proposed action. The effects of the proposed action are analyzed extensively in Chapter 4 of the EA.

34. Lethal removal of predators may result in an ecological trophic cascade.

Analysis of the potential for WS-Arizona's actions to result in a trophic cascades can be found in Section 4.2.2. of the EA.

35. Removal of coyotes harms species diversity.

EA Section 4.2.2 contains numerous studies related to this comment**.**
While removing animals from small areas at the appropriate time can protect vulnerable resources (such as birthing and young livestock), immigration of coyotes from the surrounding area quickly replaces the animals removed and maintains biodiversity (Stoddart 1984).

36. WS proposal to remove keystone species across the state is inconsistent with protecting the region's environment and wildlife.

Refer to Impact on Trophic Cascades Including Prey Populations and Potential for mesopredator Release (EA section 4.2.2) for detailed information and studies related to this topic.

37. The draft EA only covers impacts on predators, including coyotes, black bears, mountain lions, bobcats, foxes, raccoons, and skunks. Yet APHIS-Wildlife Services now kills hundreds of other kinds of animals each year as part of its Wildlife Damage Management Program, including birds and rabbits...

This EA analyzes the WS-Arizona PDM program. Birds and rabbits are not within the scope of this EA because the EA is a mammalian predator species specific EA. WS Arizona's work involving species not covered in this EA are covered under other NEPA documents. Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (CEQ 1508.25).

38. The EA should further consider the "similarity of appearance" of target animals to the Mexican gray wolf.

The Arizona Program is part of the Interagency Field Team that manages Mexican wolves. USFWS has provided hands on capture training to WS-Arizona at Sevietta National Wildlife Refuge and other holding facilities. The conservation measures consisted of two opinions - a BO for naturally occurring Mexican wolves and a Conference Opinion for the reintroduced NEP Mexican wolves. WS-Arizona has not taken an incidental wolf in at least the last 35 years, but has the potential with the reintroduced population, though this is minimized following the USFWS (1998a) and January 2015 10j conservation measures. (EA Section 2.2.2.2).

39. Lethal management of coyotes should be carefully considered to be placing Mexican wolves in grave peril.

Conservation measures for Mexican wolves were considered in the analysis and are outlined in Section 2.2.2.2.of the EA.

40. EA fails to consider the impacts of public lands grazing that the WS program supports.

Public lands grazing is not regulated by WS. WS may assist livestock producers that use public lands through an MOU or a cooperative service agreement. (EA section 1.6)

41. If WS is essential to support livestock producers, then the significant impacts of public livestock grazing are connected actions.

Determinations to allow livestock grazing on public lands and the manner in which livestock grazing is managed on public lands have been made by Congress and State legislatures, and the applicable State and federal land management agencies, and not WS. WS lacks jurisdiction to allow or to prohibit livestock grazing on public lands. Because it has no ability to control that livestock grazing, NEPA's rule of reason does not require WS to analyze the impacts of livestock grazing as a connected action. Environmental impacts of livestock grazing on federal lands is already addressed by the applicable land management agency and is not relevant to this EA, as grazing on public lands is under the jurisdiction and authority of the relevant land management agency.

Although some persons may view WS PDM actions as causing indirect effects on rangeland and riparian areas by facilitating the continuation of livestock grazing in such areas, as discussed above, such livestock grazing now takes place and there is no reason to think it will not continue to take place, with or without PDM assistance from the WS program. For example, grazing occurs now on most BLM and USFS grazing allotments in the state without assistance from WS on those allotments. Thus, the majority of livestock grazing activity on public federal lands in Arizona is not receiving any WS-Arizona PDM assistance and such grazing is part of the existing environmental status quo. (EA section 2.3.7)

42. WS should expand its analysis to investigate the presence/absence of predators on the landscape in context of herbivore behavior. Livestock grazing has an adverse effect on the ecosystem, specifically riparian areas. Removal of predators increases herbivore damage to sensitive habitats, while predator reintroduction leads to "bottom-up" recovery of riparian areas

Section 2.3.7 of the EA discusses Effects of Livestock Grazing on Riparian Areas and Wildlife Habitat as a Connected Action to WS's PDM Activities. The EA also addresses impacts to herbivores in the section titled: Impact on Trophic Cascades Including Prey Populations and Potential for Mesopredator Release in Section 4.2.2 of the EA.

43. The EA does not include a cost benefit analysis of PDM.

When identifying site specific strategies for use by the cooperator, WS employees take into consideration factors such as the cost of implementing the method relative to factors such as the size of the operation, magnitude of the conflict and likelihood that the incident will recur. However, the cost of management may sometimes be secondary because of overriding environmental, legal, public health and safety, animal welfare or other concerns.

WS-Arizona has had an effective PDM program in place for decades. Therefore, livestock losses in Arizona are the losses that occur with this PDM program in place and losses are expected to be low. Furthermore, livestock producers generally do not wait for losses to accumulate to a high level before taking PDM action or requesting assistance from WS-Arizona or other entities, but often, for the protection of the livestock under their care, attempt to act before such losses become unacceptable. The reports of livestock losses in the EA do not reflect the losses that might have occurred had actions not been taken to limit losses.

Comparisons of livestock losses to existing program costs in a system with an ongoing PDM program are not a valid measure of the efficacy of the PDM program. The issue is not the amount of PDM that occurs, but the level of loss prevented. Predicting the level of loss that might have occurred in the absence of a PDM program is challenging. Few producers are willing to allow predation to occur without responding, even if losses are compensated. Past studies that have attempted to assess losses in the absence of a PDM program have exceeded the level of compensation funding which precipitated a change in the experimental design of the projects (O'Gara et al. 1983).

Public commenters have expressed a concern that lethal PDM methods are not effective at reducing livestock losses. Although it is impossible to accurately determine the amount of livestock PDM saves from predation, it can be estimated. (EA section 2.3.8).

44. The EA does not include Arizona WS annual budget.

WS-Arizona's annual budget is $1.74 million dollars in total, which includes federal, interagency, and cooperative funding. .

45. WS-Arizona fails to acknowledge that there are compensation programs in place, such that many or most losses do not in fact cause economic hardship.

WS considered compensation programs in Section 3.2 of the EA, noting that they decrease incentive to livestock producers to limit predation by implementing non-lethal/preventative management methods, instead sacrificing livestock to carnivores for money. The only compensation programs in place in Arizona are for Mexican wolf predation.

46. WS-Arizona fails to acknowledge that any economic hardship that would occur to a public lands rancher is balanced out by the significant public subsidies that public lands ranching receives.

WS does not subsidize livestock production nor does WS pay compensation for livestock losses. The role WS serves is to assist the American public (i.e., not just livestock producers, but the greater agricultural community, state and federal agencies, private and public organizations, educational centers, tribes, and the general public) to resolve conflicts that arise with wildlife, which are a publicly-owned resource. WS serves to provide federal leadership in resolving these conflicts and is publicly accountable for the work that is performed (e.g., all activities are summarized and made available to the public via the WS website, activities are inspected by the Office of Inspector General when they receive allegations of wrongdoing and whose findings are made available to the general public, and WS makes all planning decisions in accordance with the National Environmental Policy Act processes). The EA addresses cumulative effects of PDM along with grazing in Section 2.3.7 of the EA. Issues of whether or not livestock grazing on public lands is or should be subsidized are outside the scope of this EA.

47. **WS should not exist for the primary purpose of boosting livestock producer profits.**

WS does not exist for the primary purpose of boosting livestock producer profits, instead providing a wide variety of services to anyone experiencing conflicts with wildlife.

48. **WS-Arizona should consider the value of ecosystems services lost and non-consumptive use revenue (i.e. money spent by eco-tourists and wildlife watchers) by killing predators.**

Effects of the proposed action on sociocultural resources, such as those non-consumptive uses of wildlife, are addressed in Section 4.2.4.5 of the EA.

49. **WS-Arizona does not commit to additional NEPA analysis on possible impacts to wilderness character from activities such as aerial shooting of coyotes.**

WS-Arizona does not agree with this comment. A response to this comment and WS-Arizona impact on wilderness is addressed in section 4.2.4.5 of the EA.

50. **WS-Arizona work plans are completed without any public process and are insufficient to inform the public about impacts of WS activities on wilderness character.**

Section 1.6.2 of the EA outlines WS-Arizona's compliance with the Wilderness Act. WS-Arizona has stated that prior to conducting any work in Wilderness Areas, a Minimum Requirements Analysis would be conducted in cooperation with the land management agency. PDM in Wilderness Areas would be conducted in accordance with each land management agency's Wilderness Policies, guidance documents, MOUs, and the provisions identified in work plans (e.g., BLM Manual 6340, and WS authorities). The need to reduce impacts to recreation and strategies used to minimize risks are developed on a case by case basis using the WS Decision Model and in consultation with cooperating agencies during the work plan process. Strategies are updated annually or more often as needed depending on circumstances. A description of strategies commonly used by WS to minimize impact on recreation has been added to the EA Section 4.2.4 analysis of impacts on "Effects in Sociocultural Resources".

51. **WS fails to adhere to Wilderness Study Area (WSA) provisions which significantly degrades the wilderness character and quality. WS conducted no impact analysis or even description of baseline conditions in any WSA.**

WS-Arizona is not currently being requested to work in any specific WSA. However, should a request arise, PDM would be conducted within the constraints of this EA (as with any other PDM in the state) and in consultation with the appropriate land management agency to ensure there would be no adverse effects.

A minimum requirements analysis will be completed prior to WS-Arizona working in any WA or WSA. Work plan and interagency consultation procedures are described in EA section 3.2.20.

52. There is no discussion of how WS will ensure compliance with legislative mandates governing each WSA.

As outlined in Section 3.2.20 of the EA, WS-Arizona coordinates activities in WAs and WSAs with the land managing agency as necessary to ensure no adverse effects to the areas.

53. If Wildlife Services proceeds with Predator Damage Management activities in designated wilderness or WSAs without the required analysis—as it appears it intends to do—it will be violating laws including but not limited to NEPA, NFMA, FLPMA, the Wilderness Act, and others.

WS-Arizona complies with all applicable laws and regulations, as described in Section 1.6.2. of the EA. WS-Arizona describes the process for evaluating and conducting work in WAs and WSAs in Section 3.2.20. of the EA.

54. EA sets no limits on trap-check intervals, nor discusses the ethics and humaneness of trap wait times.

WS-Arizona disagrees with this comment. WS-Arizona personnel comply with the AGFD daily trap check law. (EA section1.6B). Section 2.2.4.1 discusses the humaneness of methods used by WS-Arizona.

55. A 24-hour trap check period is an ethical baseline that WS must adopt. This issue must receive further analysis in the EIS, including adoption of a 24-hour mandatory trap-check period, when used on private lands.

The Arizona Administrative Code, Title 12. Natural Resources, Chapter 4. Game and Fish Commission, R12-4-307 states in relation to trapping regulations states that a trapper shall inspect traps daily. WS-Arizona personnel comply with the daily trap check law. (EA section1.6B)

Humaneness of PDM Methods is addressed in section 2.2.4.1 and 4.2.4 of the EA. WS Program Directives, SOPs, and training work to ensure that WS-Arizona's PDM methods are used in a manner that is as humane as possible and selective. Other practices which help to improve the efficacy, selectivity, and humaneness of WS-Arizona's use of PDM methods include implementing Trapping Best Management Practices where appropriate for PDM actions and complying with AGFD regulations on daily trap check intervals.

56. **It is unlawful for a citizen to kill wildlife using "any leg-hold trap, any instant kill body gripping design trap, or by poison or snare on any public land, including state owner or state leased land, lands administered by the United States forest service, the federal bureau of land management, the national park service, the United States department of defense, the state parks board and any county or municipality." ARS 301(D). The federal agency should be subjected to the same regulations, without exemption.**

    ARS 17-301, prohibits the use of foothold traps, snares, and poisons to take wildlife on federal, state, county, or city land in Arizona, with exceptions for the protection of HHS, wildlife disease surveillance, scientific research, wildlife relocation, aquatic wildlife management, and non-furbearing rodent control. WS-Arizona abides by these laws and exemptions (EA section 1.6.3)

57. **The EA does not include any discussion of WS institutional ethics and enforcement rules.**

    APHIS-WS has directives in place (WS Directive 1.301) that define institutional ethics rules. All WS directives are available for viewing on the WS website. Section 4.2.4 discusses the ethics of PDM.

58. **The EA fails to analyze a reasonable range of alternatives and fails to fairly analyze the alternatives that it does analyze.**

    WS-Arizona disagrees with this comment. WS-AZ believes that the EA analyzes an adequate range of Alternatives and further provides a fair and complete analysis of the Alternatives considered in this EA.

59. **EA fails to describe its current program in adequate detail making it impossible to understand or evaluate the full scope of the action or its impacts.**

    We do not agree. The EA provides ample information on PDM projects to protect agricultural resources, property, human health and safety, and natural resources. Chapter 1 outlines the purpose and need for WS-AZ PDM. Chapter 2 covers the Issues and potential effects of the WS-AZ PDM program. Chapter 3 covers the Alternatives considered in detail. Chapter 4 covers the Environmental analysis of the effects of each Alternative.

60. **EA Fails to provide maps or identify areas restricted to PDM activities.**

    An updated map on PDM restricted areas to protect Ocelots is included in the Appendix section of the EA.

61. The WS decision model is discussed in vague detail giving no way to provide a measure of success, how often or what the results of the action are.

Refer to (EA Section 3.1.5.3) Selection of an Integrated Wildlife Damage Management (IWDM) Strategy Using the APHIS-WS Decision Model.

62. A valid EA would need much more site-specific information about what the local impacts of actions will be on local environments, such as county-wide EAs

The issue of site specific analysis is discussed in Section 1.5.4 of the EA. Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (CEQ 1508.25).

63. EA provides no limits or caps on how much PDM it can conduct.

This is a false statement. WS-Arizona has assessed for a maximum take level on each of the target species analyzed in this EA. (EA chapter 4). Population information, take data, and applicable sustainable harvest information are analyzed to determine the likelihood and amount (where applicable) of potential impact to the seven predator species, as well as other species that have been taken in past years.

64. The EA should have at the very least included some caps on Predator Damage Management and its impacts, such as the number of days or hours of coyote gunning that it will conduct and the maximum number of animals of each species that it will kill with each method. As an additional example, the public deserves to know the maximum number of dangerous cyanide M-44s that will be set in the state per year.

The EA provides detailed analysis of each species' population and WS harvest and estimated cumulative harvest levels with the best available data. (EA chapter 4). WS-AZ has not used M-44s since 2012.WS-Arizona personnel must be certified to use the M-44. The EPA label for the M-44 also has restrictions to further enhance the safe use of the product. All WS personnel must abide by policies in WS Directive 2.415 and the EPA label when using M-44s. Use of the M-44 is addressed in Section 3.1.5.

65. The description of the no federal PDM alternative states that other entities would most likely replace Wildlife Services' lethal activities (EA p. 93).

State agencies, producers or non-WS agents would still have the option of implementing lethal PDM measures on their own. This has proven to be true in other states. Under the No Federal WS AZ PDM Alternative, WS-Arizona would not provide assistance with PDM and, therefore would not have any effect on target predator populations in Arizona. However, Arizona state agencies (ADA and AGFD), and private entities or organizations conducting PDM could increase their efforts in proportion to the reduction of federal services. ADA's and AGFD's portion of the cooperative program with WS-Arizona would probably still provide some level of PDM, but without federal involvement. AGFD currently uses houndsmen and hires coyote trappers outside of WS on an annual basis.

66. The EA uses this in the analysis to state that this alternative would have about the same impacts on the ground as the preferred alternative, or maybe even worse impacts due to the use of less experienced personnel in the private sector (EA p. 164). But would those personnel be allowed to operate on public lands? The EA does say that some private entities are licensed to conduct aerial gunning, but would they be able to do the same amount as APHIS-Wildlife Services? This seems unlikely since the number of planes would presumably significantly decrease. While some private control would occur, would it really make up for the significant loss in federal funding? This also seems unlikely. Ranchers and other private interests would need to pay the private entities far more than currently without the federal subsidies. Would they be willing to do so? For these reasons, this alternative should also consider the possibility that lethal control would decrease in favor of use of non-lethal alternatives.

WS-Arizona has a long history of conducting PDM in Arizona, so the presence of WS is likely to have reduced the need for other entities to do such work. However, it is legal for other entities to conduct most of the types of work that WS does in the state, and while there may be an initial lag in services available from non-WS entities, it is likely that the demand for PDM would not decrease and other entities would begin to conduct PDM for profit. It is also likely that in the absence of WS-Arizona, producers would conduct their own PDM, which is analyzed under Alternatives 1, 2, and 3 in the EA. As discussed in Section 4.2.1.1, untrained or less proficient individuals conducting PDM may result in adverse effects to the environment. WS-Arizona does not have the authority to decide whether or not private entities are allowed to conduct PDM on "public" or federal lands. Aerial PDM is conducted by the private sector or state wildlife management agencies on a large scale in other states such as Texas and Utah.

67. The EA fails to consider reasonable alternatives.

WS-Arizona disagrees with this comment. WS-AZ believes that the range of Alternatives that are analyzed in this EA are sufficient.

68. EA discards numerous reasonable alternatives without presenting any valid reason for doing so.

WS-Arizona disagrees with this comment. WS-AZ believes that the range of Alternatives that are considered in this EA is sufficient.

69. **The EA should consider the Alternative for providing compensation for livestock losses. The EA rejects this alternative on the primary basis that current law allegedly does not authorize expenditure of funds appropriated for Wildlife Services for reimbursement. This rationale is particularly weak and inaccurate considering federal programs currently exist to compensate ranchers for cattle lost to carnivores. The 2014 Farm Bill made permanent the Livestock Indemnity Program and the Livestock Forage Disaster Program.**

    WS considered compensation programs in the EA, noting that they actually decrease incentive to livestock producers to limit predation by implementing non-lethal/preventative management methods, instead sacrificing livestock to carnivores for money. (EA section 3.2.6)

70. **The program compensates producers for attacks by wild animals. Moreover, this excuse fails because it ignores the fact that under NEPA, an agency has a duty to consider all reasonable alternatives, even ones outside of its jurisdiction, i.e., ones that would require a change in law or policy. Therefore, Wildlife Services should have analyzed the possibility that such funds would be appropriated.**

    This comment is addressed in Section 2.2.12.6.2 of the EA.

71. **The statements about compensation providing poor incentives to livestock owners to limit predation or damages with Predator Damage Management strategies applies equally to Wildlife Services' lethal control programs.**

    WS-Arizona disagrees with this comment. Operational management is primarily lethal management when nonlethal methods failed to reduce damage to acceptable levels as discussed in Alternative 5 of the EA.

72. **CBD requests that WS fully consider the alternative that would only allow it to conduct PDM on private lands.**

    Section 3.2.19 of the EA discusses the reasoning that the Alternative of "*WS-AZ Would be Prohibited from Operating on Federal Lands*" was considered but not analyzed in further detail.

73. **WS retains the discretion to decide the extent of its involvement in PDM, and it could make a policy decision to only provide its services on private lands. No statute, regulation, or other authority prevents WS from considering and implementing this alternative. The analysis of this alternative should consider the ecosystem, aesthetic, and recreation benefits that would occur on public lands from such a decision.**

APHIS-WS' mission (USDA APHIS WS 2009), developed through a strategic planning process (USDA APHIS WS 2009), is "*To provide Federal leadership in managing conflicts with wildlife.* WS relies on the federal, state, and tribal land managers within Arizona to determine if and when to allow WS to conduct PDM operations on their lands. (EA section 1.6) Section 3.2.19 provides information on why the *WS-Arizona Prohibited from Operating on Federal Lands* Alternative was considered but not analyzed in further detail.

74. Additional NEPA documents are required to examine impacts from damage management of non-predators, impacts of any wildlife damage management that target endangered species or "rare-occurrence request" species, or any management that occurs in wilderness areas or WSAs.

This EA notes that any field activities outside the scope of this PDM EA and or activities associated with T&E species would be covered in other National Environmental Policy Act (NEPA) documents. (EA section 1.1.1)

75. In the draft EA, WS explains (p. 14) that PDM could be initiated to target endangered species, including the Mexican gray wolf, jaguar, and ocelot and that any field activities associated with those species would be covered in other NEPA documents and not in this EA. Given the protections of the Endangered Species Act, any field activities affected these highly endangered animals would require analysis specific to the planned activities. Consultation under the ESA would be required.

This EA notes that any field activities outside the scope of this PDM EA and or activities associated with T&E species would be covered in other National Environmental Policy Act (NEPA) documents. (EA section 1.1.1). Section 3.2.2 of the EA includes WS-Arizona's formal and informal Section 7 consultations that includes USFWS Biological Opinions for the Mexican wolf, ocelot, jaguar, and a programmatic BO for additional T&E species in the state of Arizona.

76. The agency explains (p. 15) that species with "rare-occurrence requests," like kit foxes and river otters, are included within the scope of this EA. We praise the agency for considering impacts on these animals, rather than attempting to rely upon a categorical exclusion. However, the analysis in the draft EA is quite slim and relies heavily on the assumption that requests for damage management are unlikely. If the agency receives an unexpectedly high number of requests for such animals, that would require supplementation of the NEPA analysis.

WS-AZ agrees that if an unexpectedly high number of requests are received for these species, further consultation with AGFD will be initiated that could potentially warrant further NEPA analysis.

77. Commenter opposes killing wildlife.

WS-Arizona understands that some people are opposed to killing wildlife. WS-Arizona discussed the opposition to killing animals in Section 2.3.8. of the EA and considered alternatives comprised of only non-lethal techniques in Section 3.2 of the EA.

78. Commenter opposes taxpayer subsidies for PDM activities.

WS-Arizona addressed taxpayer expense of PDM in Section 2.3.5 of the EA.

79. Commenter states that protecting cattle causes global warming.

WS-Arizona addressed the impacts of livestock production on climate change in Section 2.3.2 of the EA.

80. Commenter states that they want public lands protected for wildlife.

The Federal Land Policy and Management Act of 1976 (Public Law 94-579; 94th Congress), which provides the federal policy for the management of federal lands, including the BLM and USFS lands, allows livestock grazing. Applicable state and federal laws and regulations (EA Sections 1.3.2 and 1.7.2) permit livestock producers, their employees, and private contractors to implement lethal PDM methods without involvement by WS on BLM and USFS lands. WS Arizona considered an alternative with no lethal PDM for livestock protection on public lands, but the alternative was not selected for reasons detailed in the analysis in section 3.2.19 of the EA.

81. Commenter states that they want bees to be saved.

WS-Arizona has not proposed any wildlife damage management for bees, nor is the proposed action likely to adversely affect bees.

82. AZGFD provided a comment letter concerning some of the data in the EA, and requesting miscellaneous edits and clarifications to the EA.

WS-Arizona received a letter from AGFD during public comment in June of 2017. WS-Arizona and AGFD subsequently met and discussed the issues AGFD raised in the letter, and WS-Arizona revised the EA accordingly, so that the Final EA reflects these changes.

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APPENDIX A. Tables of Sensitive Speices in Arizona

Table A-1. Sensitive species (T&E, rare, and indicator species) monitored by various agencies in Arizona (AGFD 2016).

Sensitive Species/Subspecies Group	USFWS	USFWS*	State	USFS	BLM	Navajo	Total**
Mammals	8	-	77	35	12	12	144
Shrews	-	-	3	5	-	-	8
Bats	1	-	21	6	8	1	37
Carnivores (bear, fox, wolf, big cats, mustelids)	4	-	9	4	-	5	22
Rodents (tree/ground squirrels, prairie dog, gopher, mice, rats)	3	-	38	20	4	4	69
Hoofed Mammals (deer, elk, antelope, bighorn)	1	-	6	0	-	2	9
Birds	7	27	92	37	14	25	202
Water Birds (grebe, pelican, waders, waterfowl, rails, plovers, terns)	2	9	12	1	1	2	27
Raptors (condor, hawks, eagles, kites, falcons, accipiters, owls)	2	9	19	8	7	10	55
Gamebirds (turkey, quail, grouse, pigeon)	1	-	3	4	-	2	10
Other birds (cuckoo, trogon, hummingbird, woodpecker, passerines)	2	9	58	24	6	11	110
Reptiles	4	-	58	15	6	2	85
Turtles	1	-	10	1	2	-	14
Snakes	3	-	28	10	-	1	42
Lizards	-	-	20	4	4	1	29
Amphibians	2	-	16	7	6	1	32
Salamanders	1	-	1	1	-	-	3
Frogs	1	-	11	5	5	1	23
Toads	-	-	4	1	1	-	6
Fish	19	-	38	13	8	7	130
Invertebrates	3	-	68	67	8	4	150
Plants	21	-	335	102	42	38	538
TOTAL	65	27	684	276	96	89	1237

* Migratory birds of management concern (USFWS 2008), but numbers do not include listed T&E species

** Total = the total number of species/subspecies - some agencies may monitor the same species and these are counted only once

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Table A-2. Special status species of those monitored by different agencies and Tribes from Table 10a that have the potential to be impacted by some aspect of PDM. Table does not include federally listed T&E species included in Table 10a.

Species	Scientific Name	Global Rank*	Locale	PDM	WS-Arizona PDM
Mammals					
American Water Shrew	*Sorex palustris*	G5		-	-
Arizona Shrew	*Sorex arizonae*	G3		-	-
Cockrum's Desert Shrew	*Notiosorex cockrumi*	GNR		-	-
California Leaf-nosed Bat	*Macrotus californicus*	G4		-	-
Mexican Long-tongued Bat	*Choeronycteris mexicana*	G4		-	-
Lesser Long-nosed Bat	*Leptonycteris curasoae yerbabuenae*	G4		-	-
Yuma Myotis	*Myotis yumanensis*	G5		-	-
Cave Myotis	*Myotis velifer*	G5		-	-
Long-eared Myotis	*Myotis evotis*	G5		-	-
Fringed Myotis	*Myotis thysanodes*	G4		-	-
Long-legged Myotis	*Myotis volans*	G5		-	-
Western Small-footed Myotis	*Myotis ciliolabrum*	G5		-	-
Arizona Myotis	*Myotis occultus*	G4		-	-
Western Red Bat	*Lasiurus blossevillii*	G5		-	-
Western Yellow Bat	*Lasiurus xanthinus*	G5		-	-
Spotted Bat	*Euderma maculatum*	G4		-	-
Townsend's Big-eared Bat	*Corynorhinus townsendii*	G3G4		-	-
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	G3G4T3T4		-	-
Allen's Lappet-browed Bat	*Idionycteris phyllotis*	G4		-	-
Brazilian Free-tailed Bat	*Tadarida brasiliensis*	G5		-	-
Greater Western Bonneted Bat	*Eumops perotis californicus*	G5T4		-	-
Underwood's Bonneted Bat	*Eumops underwoodi*	G4		-	-
Pocketed Free-tailed Bat	*Nyctinomops femorosaccus*	G4		-	-
Big Free-tailed Bat	*Nyctinomops macrotis*	G5		-	-
North Kaibab Mountain Cottontail	*Sylvilagus nuttallii grangeri*	G5T5		-,+	0
A Southwestern Cottontail	*Sylvilagus nuttallii pinetis*	G5T5		-,+	0
Antelope Jackrabbit	*Lepus alleni*	G5		-,+	0
Least Chipmunk	*Neotamias minimus*	G5		-.+	0
Colorado Chipmunk	*Neotamias quadrivittatus*	G5		-.+	0
Gray-collared Chipmunk	*Neotamias cinereicollis*	G4		-.+	0
Uinta Chipmunk	*Neotamias umbrinus*	G5		-.+	0
Harris' Antelope Squirrel	*Ammospermophilus harrisii*	G5		-.+	0
Prospect Valley White-tailed Antelope Squirrel	*Ammospermophilus leucurus tersus*	G5T1Q	N. Central	-.+	0
White Mountains Ground Squirrel	*Ictidomys tridecemlineatus monticola*	G5T3	NE	-,+	+
Black-tailed Prairie Dog	*Cynomys ludovicianus*	G4		-,+	+
Gunnison's Prairie Dog	*Cynomys gunnisoni*	G5		-,+	+
Kaibab Squirrel	*Sciurus aberti kaibabensis*	G5T3		-	0
Abert's Chuska Squirrel	*Sciurus aberti chuscensis*	G5T3		-	0
Chiricahua Fox Squirrel	*Sciurus nayaritensis chiricahuae*	G5T2	SE	-	0
Arizona Gray Squirrel	*Sciurus arizonensis*	G4	SE	-,+	0

Species	Scientific Name	Global Rank*	Locale	PDM	WS-Arizona PDM
Mt. Graham Red Squirrel	*Tamiasciurus hudsonicus grahamensis*	G5T1	SE	-,+	0
Southern Pocket Gopher	*Thomomys umbrinus intermedius*	G5T3		-	-
Mearns' Southern Pocket Gopher	*Thomomys bottae mearnsi*	G5T5		-	-
Harquahala Southern Pocket Gopher	*Thomomys bottae subsimilis*	G5TH		-	-
Springerville Pocket Mouse	*Perognathus flavus goodpasteri*	G5T3		-	-
Little Pocket Mouse	*Perognathus longimembris*	G5		-	-
Yavapai Arizona Pocket Mouse	*Perognathus amplus amplus*	G5T5		-	-
Wupatki Arizona Pocket Mouse	*Perognathus amplus cineris*	G5T3Q		-	-
Houserock Valley Chisel-toothed Kangaroo Rat	*Dipodomys microps leucotis*	G5T2Q	N. Central	+	0
Banner-tailed Kangaroo Rat	*Dipodomys spectabilis*	G5	SE	+	0
New Mexico Banner-tailed Kangaroo Rat	*Dipodomys spectabilis baileyi*	G5T4	NE	+	+
American Beaver	*Castor canadensis*	G5		-	-
Merriam's Deermouse	*Peromyscus merriami*	G5		+	+
Northern Rock Deermouse	*Peromyscus nasutus*	G5		+	+
Northern Pygmy Mouse	*Baiomys taylori*	G4G5		+	+
Yuma Hispid Cotton Rat	*Sigmodon hispidus eremicus*	G5T2T3		+	+
Yavapai Cotton Rat	*Sigmodon arizonae jacksoni*	G5TH		+	+
Colorado River Cotton Rat	*Sigmodon arizonae plenus*	G5T2T3		+	+
Yellow-nosed Cotton Rat	*Sigmodon ochrognathus*	G4G5		+	+
Stephen's Woodrat	*Neotoma stephensi*	G5		+	+
Arizona Montane Vole	*Microtus montanus arizonensis*	G5T4		-	-
White-bellied Long-tailed Vole	*Microtus longicaudus leucophaeus*	G5T3		-	-
Hualapai Mexican Vole	*Microtus mexicanus hualpaiensis*	G5T1Q		-	-
Navajo Mexican Vole	*Microtus mexicanus navaho*	G5T2Q		-	-
New Mexico Meadow Jumping Mouse	*Zapus hudsonius luteus*	G5T2		-	-
Gray Wolf	*Canis lupus*	G4G5		-,+	-,+
Mexican Wolf	*Canis lupus baileyi*	G4G5T1		-,+	-,+
Red Fox	*Vulpes vulpes*	G5		-,+	-,+
Kit Fox	*Vulpes macrotis*	G4	State	-,+	-,+
Black-footed Ferret	*Mustela nigripes*	G1		-,+	-,+
Striped Skunk	*Mephitis mephitis*	G5		-,+	-,+
Southwestern River Otter	*Lontra canadensis sonora*	G5T1	State	-,+	0
Jaguar	*Panthera onca*	G3		-,+	-,+
Ocelot	*Leopardus pardalis*	G4		-,+	-,+
White-tailed Deer	*Odocoileus virginianus*	G5		-,+	+
Sonoran Pronghorn	*Antilocapra americana sonoriensis*	G5T1	SE	-,+	+
American Pronghorn	*Antilocapra americana americana*	G5T5	North	-,+	+
Desert Bighorn Sheep	*Ovis canadensis nelsoni*	G4T4	South	-,+	+
Mexicana Desert Bighorn Sheep	*Ovis canadensis mexicana*	G4T3T4Q		-,+	+
Rocky Mountain Bighorn Sheep	*Ovis canadensis canadensis*	G4T4		-,+	+
Birds					
Golden Eagle	*Aquila chrysaetos*	G5	State	-	-
Crested Caracara	*Caracara cheriway*	G5	S Central	-	0

Species	Scientific Name	Global Rank*	Locale	PDM	WS-Arizona PDM
Blue Grouse	*Dendragapus obscurus*	G5	N Central	+	+
Gould's Turkey	*Meleagris gallopavo mexicana*	G5T3	SE	-, +	-,+
California Black Rail	*Laterallus jamaicensis coturniculus*	G4T1	SW	+	0
Yuma Clapper Rail	*Rallus longirostris*	G5T3	SW	+	0
Sora	*Porzana carolina*	G5	State	+	0
Western Snowy Plover	*Charadrius alexandrinus nivosus*	G4T3	State	+	0
Mountain Plover	*Charadrius montanus*	G2	State	+	0
Western Burrowing Owl	*Athene cunicularia hypugaea*	G4T4	State	-	0
Black-billed Magpie	*Pica pica*	G5	North	-	0
Brown Pelican	*Pelecanus occidentalis*	G4		-	0
American Bittern	*Botaurus lentiginosus*	G4		-	0
White-faced Ibis	*Plegadis chihi*	G4		-,+	-,+
Fulvous Whistling-Duck	*Dendrocygna bicolor*	G5		-,+	-,+
Wood Duck	*Aix sponsa*	G5		-,+	-,+
Harlequin Duck	*Histrionicus histrionicus*	G4		-,+	-,+
Mississippi Kite	*Ictinia mississippiensis*	G5		-,+	-,+
Bald Eagle	*Haliaeetus leucocephalus*	G5		-	-
Northern Goshawk	*Accipiter gentilis*	G5		-	-
Apache Northern Goshawk	*Accipiter gentilis apache*	G5T3Q		-	-
Ferruginous Hawk	*Buteo regalis*	G4		-	-
Gray Hawk	*Buteo plagiatus*	GNR		-	-
Peregrine Falcon	*Falco peregrinus*	G4		-	-
American Peregrine Falcon	*Falco peregrinus anatum*	G4T4		+	0
Dusky Grouse	*Dendragapus obscurus*	G5		+	0
Black Rail	*Laterallus jamaicensis*	G3G4		+	0
Yuma Ridgeway's Rail	*Rallus obsoletus yumanensis*	G5T3		+	0
Snowy Plover	*Charadrius nivosus nivosus*	G3T3		+	0
Thick-billed Parrot	*Rhynchopsitta pachyrhyncha*	G2		-,+	0
Whiskered Screech-owl	*Megascops trichopsis*	G5		+	0
Mountain Pygmy-owl	*Glaucidium gnoma gnoma*	G4G5T4		+	0
Cactus Ferruginous Pygmy-owl	*Glaucidium brasilianum cactorum*	G5T3		+	0
Common Nighthawk	*Chordeiles minor*	G5		-	0
Buff-collared Nightjar	*Antrostomus ridgwayi*	G5		-	0
Broad-billed Hummingbird	*Cynanthus latirostris*	G4		-	0
White-eared Hummingbird	*Hylocharis leucotis*	G5		-	0
Violet-crowned Hummingbird	*Amazilia violiceps*	G5		-	0
Blue-throated Hummingbird	*Lampornis clemenciae*	G5		-	0
Magnificent Hummingbird	*Eugenes fulgens*	G5		-	0
Lucifer Hummingbird	*Calothorax lucifer*	G4G5		-	0
Elegant Trogon	*Trogon elegans*	G5		-	0
Eared Quetzal	*Euptilotis neoxenus*	G3		-	0
Gila Woodpecker	*Melanerpes uropygialis*	G5		-	0
Arizona Woodpecker	*Picoides arizonae*	G5		-	0
Gilded Flicker	*Colaptes chrysoides*	G5		-	0
Northern Beardless-Tyrannulet	*Camptostoma imberbe*	G4		-	0
Olive-sided Flycatcher	*Contopus cooperi*	G4		+	0

Species	**Scientific Name**	**Global Rank***	**Locale**	**PDM**	**WS-Arizona PDM**
Buff-breasted Flycatcher	*Empidonax fulvifrons*	G5		+	0
Northern Buff-breasted Flycatcher	*Empidonax fulvifrons pygmaeus*	G5T5		+	0
Dusky-capped Flycatcher	*Myiarchus tuberculifer*	G5		+	0
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*	G5		+	0
Thick-billed Kingbird	*Tyrannus crassirostris*	G5		-,+	-,+
Rose-throated Becard	*Pachyramphus aglaiae*	G4G5		-,+	-,+
Desert Purple Martin	*Progne subis hesperia*	G5T4		-,+	-,+
Gray Jay	*Perisoreus canadensis*	G5		-,+	-,+
Pinyon Jay	*Gymnorhinus cyanocephalus*	G5		-,+	-,+
Mexican Chickadee	*Poecile sclateri*	G5		-,+	-,+
Pacific Wren	*Troglodytes pacificus*	G5		-,+	-,+
American Dipper	*Cinclus mexicanus*	G5		-,+	-,+
Black-capped Gnatcatcher	*Polioptila nigriceps*	G5		-,+	-,+
Azure Bluebird	*Sialia sialis fulva*	G5TU		-,+	-,+
Swainson's Thrush	*Catharus ustulatus*	G5		-,+	-,+
Gray Catbird	*Dumetella carolinensis*	G5		-,+	-,+
Le Conte's Thrasher	*Toxostoma lecontei*	G4		-,+	-,+
Sprague's Pipit	*Anthus spragueii*	G4		-,+	0
Loggerhead Shrike	*Lanius ludovicianus*	G4		-,+	-,+
Arizona Bell's Vireo	*Vireo bellii arizonae*	G5T4		-,+	-,+
Gray Vireo	*Vireo vicinior*	G4		-,+	-,+
Yellow Warbler	*Setophaga petechia*	G5		-,+	-,+
MacGillivray's Warbler	*Geothlypis tolmiei*	G5		-,+	-,+
Varied Bunting	*Passerina versicolor*	G5		-,+	-,+
Abert's Towhee	*Melozone aberti*	G3G4		-,+	-,+
Arizona Botteri's Sparrow	*Peucaea botterii arizonae*	G4T4		-,+	-,+
Rufous-winged Sparrow	*Peucaea carpalis*	G4		-,+	-,+
Vesper Sparrow	*Pooecetes gramineus*	G5		-,+	-,+
Five-striped Sparrow	*Amphispiza quinquestriata*	G4		-,+	-,+
Large-billed Savannah Sparrow	*Passerculus sandwichensis rostratus*	G5T2T3		-,+	-,+
Chihuahua Savannah Sparrow	*Passerculus sandwichensis rufofuscus*	G5T3		-,+	-,+
Baird's Sparrow	*Ammodramus bairdii*	G4		-,+	-,+
Arizona grasshopper sparrow	*Ammodramus savannarum ammolegus*	G5TU		-,+	-,+
Western Grasshopper Sparrow	*Ammodramus savannarum perpallidus*	G5TNR		-,+	-,+
Lincoln's Sparrow	*Melospiza lincolnii*	G5		-,+	-,+
Yellow-eyed Junco	*Junco phaeonotus*	G5		-,+	-,+
Pine Grosbeak	*Pinicola enucleator*	G5		-,+	-,+
Evening Grosbeak	*Coccothraustes vespertinus*	G5		-,+	-,+
Reptiles					
Painted Turtle	*Chrysemys picta*	G5		-,+	0
Western Painted Turtle	*Chrysemys picta bellii*	G5T5		-,+	0
Ornate Box Turtle	*Terrapene ornata*	G5		-,+	0
Desert Box Turtle	*Terrapene ornata luteola*	G5T4		-,+	0
Yellow Mud Turtle	*Kinosternon flavescens*	G5		-,+	0
Sonoyta Mud Turtle	*Kinosternon sonoriense longifemorale*	G4T1		-,+	0

Species	Scientific Name	Global Rank*	Locale	PDM	WS-Arizona PDM
Desert Mud Turtle	*Kinosternon sonoriense sonoriense*	G4T4		-,+	0
Arizona Mud Turtle	*Kinosternon arizonense*	G4		-,+	0
Mohave Desert Tortoise	*Gopherus agassizii*	G3		-,+	0
Sonoran Desert Tortoise	*Gopherus morafkai*	G4	SW	-,+	0
Banded Gila Monster	*Heloderma suspectum cinctum*	G4T4		-	0
Reticulate Gila Monster	*Heloderma suspectum suspectum*	G4T4		-	0
Sonoran Collared Lizard	*Crotaphytus nebrius*	G4		-	0
Texas Horned Lizard	*Phrynosoma cornutum*	G4G5	SE	-	0
Flat-tailed Horned Lizard	*Phrynosoma mcallii*	G3		-	0
Regal Horned Lizard	*Phrynosoma solare*	G5		-	0
Goode's Horned Lizard	*Phrynosoma goodei*	G3G4		-	0
Common Chuckwalla	*Sauromalus ater*	G5		-	0
Northern Sagebrush Lizard	*Sceloporus graciosus graciosus*	G5T5		-	0
Slevin's Bunchgrass Lizard	*Sceloporus slevini*	G4		-	0
Mohave Fringe-toed Lizard	*Uma scoparia*	G3G4		-	0
Yuman Desert Fringe-toed Lizard	*Uma rufopunctata*	G3		-	0
Mountain Skink	*Plestiodon callicephalus*	G4G5		-	0
Giant Spotted Whiptail	*Aspidoscelis stictogramma*	G4		-	0
Red-backed Whiptail	*Aspidoscelis xanthonota*	G2		-	0
Gila Spotted Whiptail	*Aspidoscelis flagellicauda*	G4		-	0
Arizona Striped Whiptail	*Aspidoscelis arizonae*	G2		-	0
Pai Striped Whiptail	*Aspidoscelis pai*	G3G4		-	0
Arizona Night Lizard	*Xantusia arizonae*	G1G2		-	0
Bezy's Night Lizard	*Xantusia bezyi*	G2		-	0
Rosy Boa	*Lichanura trivirgata*	G4G5		-	0
Variable Sandsnake	*Chilomeniscus stramineus*	G5		-	0
Tucson Shovel-nosed Snake	*Chionactis occipitalis klauberi*	G5T3Q		-	0
Sonoran Shovel-nosed Snake	*Chionactis palarostris*	G3G4		-	0
Organ Pipe Shovel-nosed Snake	*Chionactis palarostris organica*	G3G4T2		-	0
Eastern Yellow-bellied Racer	*Coluber constrictor flaviventris*	G5T5		-	0
Thornscrub Hook-nosed Snake	*Gyalopion quadrangulare*	G4		-	0
Hooded Nightsnake	*Hypsiglena sp. nov.*	G4		-	0
New Mexico Milksnake	*Lampropeltis triangulum celaenops*	G5TNR		-	0
Sonoran Whipsnake	*Coluber bilineatus*	G5		-	0
Brown Vinesnake	*Oxybelis aeneus*	G5		-	0
Saddled Leaf-nosed Snake	*Phyllorhynchus browni*	G5		-	0
Chihuahuan Black-headed Snake	*Tantilla wilcoxi*	G4		-	0
Yaqui Black-headed Snake	*Tantilla yaquia*	G4		-	0
Mexican Gartersnake	*Thamnophis eques*	G4		-	0
Northern Mexican Gartersnake	*Thamnophis eques megalops*	G4T3		-	0

Species	Scientific Name	Global Rank*	Locale	PDM	WS-Arizona PDM
Narrow-headed Gartersnake	*Thamnophis rufipunctatus*	G3G4		-	0
Green Ratsnake	*Senticolis triaspis*	G5		-	0
Northern Green Ratsnake	*Senticolis triaspis intermedia*	G5T4		-	0
Sonoran Coralsnake	*Micruroides euryxanthus*	G5		-	0
Banded Rock Rattlesnake	*Crotalus lepidus klauberi*	G5T5		-	0
Twin-spotted Rattlesnake	*Crotalus pricei*	G5		-	0
Tiger Rattlesnake	*Crotalus tigris*	G5		-	0
Arizona Black Rattlesnake	*Crotalus cerberus*	G5		-	0
New Mexico Ridge-nosed Rattlesnake	*Crotalus willardi obscurus*	G5T1T2		-	0
Arizona Ridge-nosed Rattlesnake	*Crotalus willardi willardi*	G5T4	SE	-	0
Western Massasauga	*Sistrurus tergeminus*	G3G4		-	0
Desert Massasauga	*Sistrurus tergeminus edwardsii*	G3G4T3T4Q		-	0
Amphibians-0					
Arizona Toad	*Bufo microscaphus0*	G3-4	Central	-	0
Sonoran Tiger Salamander	Ambystoma mavortium stebbinsi	G5T1		-	0
Sonoran Desert Toad	Incilius alvarius	G5		-	0
Sonoran Green Toad	*Anaxyrus retiformis*	G4		-	0
Arizona Treefrog	*Hyla wrightorum*	G4		-	0
Arizona Treefrog (Huachuca/Canelo DPS)	*Hyla wrightorum (Huachuca/Canelo Hills Pop.)*	G4T2		-	0
Lowland Burrowing Treefrog	*Smilisca fodiens*	G4		-	0
Baja Califorina Treefrog	*Pseudacris hypochondriaca*	G5		-	0
Western Barking Frog	*Craugastor augusti cactorum*	G5T5		-	0
Western Narrow-mouthed Toad	*Gastrophryne olivacea*	G5		-	0
Plains Leopard Frog	*Lithobates blairi*	G5		-	0
Chiricahua Leopard Frog	*Lithobates chiricahuensis*	G2G3		-	0
Relict Leopard Frog	*Lithobates onca*	G1G2		-	0
Northern Leopard Frog	*Lithobates pipiens*	G5		-	0
Tarahumara Frog	*Lithobates tarahumarae*	G3		-	0
Lowland Leopard Frog	*Lithobates yavapaiensis*	G4		-	0

Global Rank: G= Species rangewide T=Subspecies rangewide Q = Taxonomically invalid, but still listed by an agency 1= Very Rare 2 = Rare 3 = Uncommon or Restricted 4 = Apparently Secure 5 Demonstrably Secure

Arizona Game and Fish Department (AGFD). 2016. Arizona Game and Fish: Managing today for wildlife tomorrow. Website @ http://www.azgfd.gov/w_c/edits/hdms_species_lists.shtml. *Last visited 5/12/16*

APPENDIX B. Aerial PDM Time on Public Lands

Table A-3. WS-Arizona Aerial Shooting Time on Public Lands in Arizona from FY11 to FY15.

Property	Square Miles		FY11	FY12	FY13	FY14	FY15	Avg.
		Hrs Flown		1.90	2.00			0.78
		Coyotes		2.00	2.00			0.80
1	300.00	min/mi2		0.38	0.40			0.16
		Hrs Flown	1.40	1.00				0.48
		Coyotes	4.00	8.00				2.40
2	26.56	min/mi2	3.16	2.26				1.08
		Hrs Flown			1.80			0.36
		Coyotes			10.00			2.00
3	9.38	min/mi2			11.51			2.30
		Hrs Flown	3.00		4.00	4.60		2.32
		Coyotes	2.00		5.00	5.00		2.40
4	8.00	min/mi2	22.50		30.00	34.50		17.40
		Hrs Flown	4.50	3.90	2.80	5.10	15.40	6.34
		Coyotes	7.00	11.00	4.00	8.00	17.00	9.40
5	259.00	min/mi2	1.04	0.90	0.65	1.18	3.57	1.47
		Hrs Flown			1.50		3.00	0.90
		Coyotes			2.00		4.00	1.20
6	4.31	min/mi2			20.88		41.76	12.53
		Hrs Flown			0.80			0.16
		Coyotes			1.00			0.20
7	0.27	min/mi2			177.78			35.56
		Hrs Flown	1.50					0.30
		Coyotes	8.00					1.60
8	195.31	min/mi2	0.46					0.09
		Hrs Flown		0.80		1.50		0.46
		Coyotes		3.00		4.00		1.40
9	53.13	min/mi2		0.90		1.69		0.52
		Hrs Flown					1.00	0.20
		Coyotes					2.00	0.40
10	2.34	min/mi2					25.64	5.13
		Hrs Flown				0.50		0.10
		Coyotes						
11	36.00	min/mi2				0.83		0.17
		Hrs Flown				4.60		0.92
		Coyotes				3.00		0.60
12	80.00	min/mi2				3.45		0.69
		Hrs Flown		2.00	0.90	3.00	2.40	1.66
13	41.00	Coyotes		5.00	2.00	2.00	2.00	2.20

		min/mi2		2.93	1.32	4.39	3.51	2.43
		Hrs Flown		0.80				0.16
		Coyotes		2.00				0.40
14	34.38	min/mi2		1.40				0.28
		Hrs Flown			3.00	5.30	9.30	3.52
		Coyotes			10.00	11.00	28.00	9.80
15	31.02	min/mi2			5.80	10.25	17.99	6.81
		Hrs Flown			0.50			0.10
		Coyotes			2.00			0.40
16	17.19	min/mi2			1.75			0.35
		Hrs Flown				1.20		0.24
		Coyotes				2.00		0.40
17	34.00	min/mi2				2.12		0.42
		Hrs Flown			2.80	1.00	1.70	1.10
		Coyotes			9.00	3.00	2.00	2.80
18	119.33	min/mi2			1.41	0.50	0.85	0.55
		Hrs Flown	4.50	8.00	1.40	2.40	6.00	4.46
		Coyotes	6.00	9.00	2.00	3.00	6.00	5.20
19	168.00	min/mi2	1.61	2.86	0.50	0.86	2.14	1.59
		Hrs Flown					1.00	0.20
		Coyotes					2.00	0.40
20	12.00	min/mi2					5.00	1.00
		Hrs Flown					2.00	0.40
		Coyotes					16.00	3.20
21	10.94	min/mi2					10.97	2.19
		Hrs Flown			2.00			0.40
		Coyotes			1.00			0.20
22	39.00	min/mi2			3.08			0.62
		Hrs Flown	4.10	4.80	2.00	2.40	3.70	3.40
		Coyotes	7.00	6.00	3.00	1.00	4.00	4.20
23	280.00	min/mi2	0.88	1.03	0.43	0.51	0.79	0.73
		Hrs Flown				2.00		0.40
		Coyotes				4.00		0.80
24	84.38	min/mi2				1.42		0.28
		Hrs Flown		1.40				0.28
		Coyotes		12.00				2.40
25	6.50	min/mi2		12.92				2.58
		Hrs Flown				2.00		0.40
		Coyotes						
26	89.06	min/mi2				1.35		0.27
		Hrs Flown		2.30				0.46
		Coyotes		15.00				3.00
27	79.69	min/mi2		1.73				0.35

		Hrs Flown				1.00		0.20
		Coyotes				2.00		0.40
28	15.00	min/mi2				4.00		0.80
		Hrs Flown			1.00		0.50	0.30
		Coyotes			5.00			1.00
29	11.72	min/mi2			5.12		2.56	1.54
		Hrs Flown				2.40		0.48
		Coyotes				1.00		0.20
30	34.00	min/mi2				4.24		0.85
		Hrs Flown				1.00		0.20
		Coyotes				2.00		0.40
31	3.91	min/mi2				15.35		3.07
		Hrs Flown					1.90	0.38
		Coyotes					17.00	3.40
32	3.28	min/mi2					34.76	6.95
		Hrs Flown	2.50			1.20	1.50	1.04
		Coyotes	2.00			2.00	1.00	1.00
33	11.00	min/mi2	13.64			6.55	8.18	5.67
		Hrs Flown				2.00	3.00	1.00
		Coyotes				1.00	2.00	0.60
34	104.69	min/mi2				1.15	1.72	0.57
		Hrs Flown					2.70	0.54
		Coyotes					8.00	1.60
35	154.69	min/mi2					1.05	0.21
		Hrs Flown		1.90	1.80	2.00	1.50	1.44
		Coyotes		14.00	20.00	21.00	7.00	12.40
36	67.19	min/mi2		1.70	1.61	1.79	1.34	1.29
		Hrs Flown				2.40		0.48
		Coyotes				1.00		0.20
37	18.00	min/mi2				8.00		1.60
		Hrs Flown	2.00					0.40
		Coyotes	6.00					1.20
38	6.00	min/mi2	20.00					4.00
		Hrs Flown			1.20			0.24
		Coyotes			3.00			0.60
39	0.28	min/mi2			257.14			51.43
		Hrs Flown		1.00	0.90			0.38
		Coyotes		14.00	6.00			4.00
40	187.50	min/mi2		0.32	0.29			0.12
		Hrs Flown	29.90	3.60	59.40			18.58
		Coyotes	61.00	15.00	68.00			28.80
41	703.10	min/mi2	2.55	0.31	5.07			1.59
42	1224.30	Hrs Flown	24.50	24.30				9.76

		Coyotes	45.00	41.00				17.20
		min/mi2	1.20	1.19				0.48
		Hrs Flown				26.40	23.70	10.02
		Coyotes				74.00	38.00	22.40
43	156.25	min/mi2				10.14	9.10	3.85
		Hrs Flown					15.10	3.02
		Coyotes					15.00	3.00
44	93.75	min/mi2					9.66	1.93
		Hrs Flown	4.10		4.40			1.70
		Coyotes	3.00		15.00			3.60
45	83.03	min/mi2	2.96		3.18			1.23
		Hrs Flown	2.20					0.44
		Coyotes	2.00					0.40
46	89.50	min/mi2	1.47					0.29
		Hrs Flown	1.50	13.30	10.90			5.14
		Coyotes		22.00	8.00			6.00
47	83.03	min/mi2	1.08	9.61	7.88			3.71
		Hrs Flown	85.70	71.00	105.10	74.00	95.40	86.24
		Coyotes	153.00	179.00	178.00	150.00	171.00	166.20
Totals	5071.01	min/mi2	1.01	0.84	1.24	0.88	1.13	1.02

Table A-4. Arizona Special Managemnt Areas.

ARIZONA SPECIAL MANAGEMENT AREAS

NCA=National Conservation Area, NHS=National Historic Site, NM=National Monument,
NRA=National Recreation Area, RA=Recreation Area WA=Wilderness Area

Agua Fria NM
Apache Creek WA
Aravaipa Canyon WA
Arrastra Mountain WA
Aubrey Peak WA
Baboquivari Peak WA
Bear Wallow WA
Beaver Dam Mountains WA
Big Horn Mountains WA
Blue Range Primitive Area
Cabeza Prieta WA
Cactus Plain WSA
Canyon De Chelly NM
Casa Grande Ruins NM
Castle Creek WA
Cedar Bench WA
Chiricahua NM
Chiricahua WA
Coronado Nat'l Memorial
Cottonwood Point WA
Coyote Mountains WA
Dos Cabezas Mountains WA
Eagletail Mountains WA

East Cactus Plain WA
Escudilla WA
Fishhooks WA
Fort Bowie NHS
Fossil Springs WA
Four Peaks WA
Galiuro WA
Gibraltar Mountain WA
Gila Box Riparian NCA
Glen Canyon NRA
Grand Canyon NP
Grand Wash Cliffs WA
Granite Mountain WA
Harcuvar Mountains WA
Harquahala Mountains WA
Hassayampa River Canyon WA
Havasu WA
Hells Canyon WA
Hellsgate WA
Hoover Dam
Hot Well Dunes RA
Hubbell Trading Post NHS
Hummingbird Springs WA
Imperial Refuge WA
Ironwood Forest NM
Juniper Mesa WA
Kachina Peaks WA
Kanab Creek WA
Kendrick Mountain WA
Kofa WA
Lake Mead NRA
Las Cienegas NCA
Madera RA
Mazatzal WA
Miller Peak WA
Mingus Mountain RA
Montezuma Castle NM
Monument Valley Tribal Park
Mount Baldy WA
Mount Graham WSA
Mount Logan WA
Mount Nutt WA
Mount Tipton WA
Mount Trumbull WA
Mount Wilson WA
Mt. Wrightson WA
Muggins Mountain WA
Munds Mountain WA
Navajo NM
Needle's Eye WA
New Water Mountains WA
North Maricopa Mtns. WA
North Santa Teresa WA
Organ Pipe Cactus NM
Organ Pipe Cactus WA
Paiute WA
Pajarita WA
Paria Canyon-Vermilion Cliffs WA
Peloncillo Mountains WA
Pena Blanca RA
Petrified Forest NP
Pine Mountain WA
Pipe Spring NM
Pusch Ridge WA
Rawhide Mountains WA

Red Rock-Secret Mountain WA
Redfield Canyon WA
Rincon Mountain WA
Rucker Canyon RA
Rustler Park RA
Sabino Canyon RA
Saddle Mountain WA
Saguaro NP
Saguaro WA
Salome WA
Salt River Canyon WA
San Pedro Riparian NCA
Santa Teresa WA
Sierra Ancha WA
Sierra Estrella WA
Signal Mountain WA
South Maricopa Mtns. WA
Strawberry Crater WA
Sunset Crater NM
Superstition WA
Swansea WA
Sycamore Canyon WA
Table Top WA
Tonto NM
Tres Alamos WA
Trigo Mountain WA
Tumacacori NHS
Tuzigoot NM
Upper Burro Creek WA
Wabayuma Peak WA
Walnut Canyon NM
Warm Springs WA
West Clear Creek WA
Wet Beaver WA
White Canyon WA
Woodchute WA
Woolsey Peak WA
Wupatki NM

APPENDIX C. Response to 2016 Evaluation of Predator Control Studies by Dr. Adrian Treves, Miha Krofel, and Jeannine McManus

On September 1, 2016, researchers from the University of Wisconsin-Madison*, University of Ljubljana, and University of Witwatersrand released a publication entitled "Predator control should not be a shot in the dark" (Treves et al. 2016). The researchers evaluated 12 existing publications (5 non-lethal and 7 lethal methods) regarding the effectiveness of nonlethal and lethal methods for reducing predation on livestock. Their main conclusions included the following:

1. Predator control methods to prevent livestock loss have rarely been subject to rigorous tests using the "gold standard" for scientific inference (random assignment to control and treatment groups with experimental designs that avoid biases in sampling, treatment, measurement, or reporting)
2. Across the controlled experiments that they systematically examined, higher standards of evidence were generally applied in tests of non-lethal methods than in tests of lethal methods for predator control
3. Non-lethal methods were more effective than lethal methods in preventing carnivore predation on livestock generally; at least two lethal methods (government culling or regulated, public hunting) were followed by increases in predation on livestock; zero tests of non-lethal methods had counterproductive effects
4. All flawed tests came from North America; ten of 12 flawed tests were published in three journals, compared to four of 12 tests with strong inference in those same journals
5. Treves et al. (2016) recommend suspending lethal predator control methods that do not currently have rigorous evidence for functional effectiveness in preventing livestock loss until gold standard tests are completed.

Specific Points Regarding Treves' Article:

•Treves et al. (2016) recommend wildlife researchers apply the same standards used in controlled, laboratory settings to wildlife field research. Such standards (which involve randomized, controlled trials) are often not possible in field studies for a variety of reasons:

- First, it can be difficult to find comparable units for evaluation. In the case of predation management, finding multiple field study sites that not only prohibit predator control, but also allow ranching, is difficult. Almost by definition, ranchers with high predation rates usually try to control predators, and ranchers with minimal problems do not.
- Second, field studies involve a lot of variation. There are many factors from the weather to varying habitats to the movement of wildlife in and out of study areas that cannot be controlled and may impact results. This is the inherent nature of field work.
- Finally, to give sufficient statistical power, sample sizes must be large. Gathering sufficient data often involves multiple field seasons and field experts. Funding and other resources can limit the ability to conduct such studies.

•To conduct a completely randomized design as suggested by Treves et al. (2016) would result in inherently large variability among sites and would necessitate such a large sample size that it would not be possible or practical in most instances. Two alternative field designs that are commonly used in wildlife research include a switch-back and paired block approach.

- In the case of a predator control study, a switch-back design would involve at least two study areas, one (or more) with predator control and one (or more) without predator control. After at least 2 years of data collection, the sites would switch so that the one with predator control becomes the one without predator control and vice versa. An additional 2 years of data collection would occur. Wildlife Services researchers are currently involved in a controlled switch-back study like the one described above that is investigating the effectiveness of coyote control for reducing predation on deer populations in Utah.

- The paired block design, involves finding multiple sites that are similar that can be paired and compared. For each pair, one site would experience predator control and one would not.

•Treves et al.'s sloppy assessment of existing predation studies from North America and Europe causes us to question his ability to accurately critique the scientific literature. Treves et al.'s critique of a least two of the studies reviewed in their paper did not accurately interpret or represent the studies' designs and results.

- In regards to Wagner and Conover (1999), Treves et al. (2016) makes a fundamental error in interpreting the study design. When researchers make changes to the independent variable, they measure the changes in the dependent variable. The purpose of the study was to determine the impact of preventive aerial operations (independent variable) as currently practiced by the WS program on sheep losses the following summer (dependent variable) AND the need for subsequent corrective PDM (i.e., the use of traps snares and M-44s - also a dependent variable) during the subsequent summer. Treves et al. (2016) mistakenly characterize use of traps, snares and M-44s as independent variables which indicates a fundamental inattentiveness to the details of the study. This error led the authors to erroneously claim a variation that occurred in response to the treatment was either a willful misapplication of a control variable or a gross failure in study design. Wagner and Conover (1999) purposefully allowed corrective PDM to be conducted during the summer following aerial operations because, as practiced, it was highly improbable that preventive aerial operations would ever be used to the exclusion of all other methods for corrective PDM. Furthermore, if preventive aerial operations were effective, authors predicted one of two outcomes:

    1) losses on areas without aerial operations would be lower than losses in areas with aerial operations and there would be a corresponding decrease in use of traps, snares and M-44s; or,
    2) increased use of corrective predation management during the summer could be sufficient to keep losses at levels similar to areas with preventive aerial operations, but the amount of summer corrective predation damage management would be higher in areas without aerial operations.

    Traps, snares and M-44s pose substantially different risks to non-target species than aerial operations. Wagner and Conover (1999) felt that this information was important when making management decisions regarding the use of preventive aerial operations.

Treves et al. (2016) also states that the study is biased because "control pastures started with 40% higher sheep densities." However, Treves et al.'s calculation of sheep densities was based on incomplete information and is not a valid interpretation of the density of sheep during the study period. In the study, sheep were not permitted to disperse evenly throughout the grazing allotments, instead, herders move sheep bands through subsections of the allotments in accordance with established grazing management plans. Consequently, simply dividing the number of sheep on the allotment by the total size of the allotment, as was done, does not accurately reflect the density of sheep during the study.

Treves et al. states the study includes a reporting bias because "data was not presented" on livestock-guarding dogs. Wagner and Conover (1999) clearly states that one of the criterion used for pairing allotments was the presence or absence of livestock guarding dogs (LGD). They did not pair allotments with LGDs with allotments without LGDs. Failure to provide data showing that that number of treated allotments with LGDs matched the number of untreated allotments with LGDs does not constitute a reporting bias.

Treves et al. misrepresents another study conducted by Dr. Eric Gese (WS-NWRC) and a Utah State University collaborator on a study site in western Wyoming. Treves et al. confuses two different studies when citing Bromley and Gese (2009) on page 23. The Bromley and Gese (2001a, 2001b) study examined coyote predation on domestic sheep; in contrast, the Seidler and Gese (2012) study examined coyote predation on pronghorn fawns. While citing Bromley and Gese (2009), Treves et al. (2016) is actually referring to a paper published in 2001 (Bromley and Gese 2001a). As a reason for study bias, they mention that Bromley and Gese's study includes a high overlap between coyote territories. The statistics mentioned actually come from a completely different study (Seidler and Gese 2012) that was conducted in a different State (southeastern Colorado), 7 years later, and in a completely different system (i.e., no sheep). The Bromley and Gese (2001b) publication actually reports that coyote core areas overlapped only once (by 3%) and there was no significant difference in overlap among sterile and intact coyote packs. In fact, to eliminate a potential inaccurate assignment of the coyotes responsible for making a kill, Bromley and Gese used the actual locations of the radioed coyotes as the method of assigning which pack killed the sheep whenever there was overlap of territory boundaries between adjacent packs.

Additionally, Treves et al. incorrectly states that the estimates of weekly survival rates are not biologically significant. However, they used data from all the packs which is inappropriate as not all packs killed sheep. By only using data from sheep-killing packs and doing some simple math, they would have concluded that a weekly survival rate of 0.997 in the sterile packs equates to 94% of the lambs surviving for the next 6-months (beyond which they are no longer vulnerable to predation), versus a weekly survival rate of 0.985 in the intact packs which equates to 72% of the lambs surviving for the next 6 months. Therefore, sterilization would provide 22% higher survival of lambs which is quite biologically and economically significant to a livestock producer.

The correct references are:
Bromley, C., and E. M. Gese. 2001a. Surgical sterilization as a method of reducing coyote predation on domestic sheep. Journal of Wildlife Management 65(3):510-519.
Bromley, C., and E. M. Gese. 2001b. Effects of sterilization on territory fidelity and maintenance, pair bonds, and survival rates of free-ranging coyotes. Canadian Journal of Zoology 79(3):386-392.

Treves et al. (2016) include a paper by (Musiani et al. 2003) whereby they claim fladry (a method for controlling wolves) was experimentally tested. But in fact the experimental portion of the work was done on captive animals. The two field trials included in the paper did not meet the scientific standards outlined by Treves. This was either purposefully deceptive or sloppy.

Treves et al. (2016) selectively disregards studies from Australia. These studies are some of the more rigorous field studies on working livestock operations with free-ranging, native carnivores that evaluate the effectiveness of lethal control. Given their explicit desire to make generalization about predation control, it is odd that they would purposefully exclude this body of rigorous science.

WS understands and appreciates interest in ensuring PDM methods are as robust and effective as possible. WS supports the use of rigorous, scientifically-sound studies, but we realize there are many variables that cannot be controlled and assumptions that must be acknowledged when trying to answer complex ecological questions. We do not believe there is a single standard for conducting wildlife field studies and each approach or design has its own unique assumptions, drawbacks and challenges. WS does not believe that results from existing studies should be ignored. Wildlife research is inherently challenging because scientists are not working in a "closed" system. Science and the scientific method are a process. You build upon information gathered over years of study and experimentation. Results from one study lead to new questions and new studies.

WS' policies and decisions are based on the best available science. The National Environmental Policy Act (NEPA) requires federal agencies to evaluate environmental impacts into their decision making processes and ensures that environmental information is available to public officials and citizens before decisions are made and actions are taken. To fulfill this responsibility, Wildlife Services prepares analyses of the environmental effects of program activities as part of the NEPA process. A description of and citations for various wildlife damage management actions can be found in the program's Environmental Assessments and Environmental Impacts Statements which are available by State on the APHIS website.

Wildlife Services encourages the use of nonlethal predation damage management tools and techniques when feasible and practical, however, not all wildlife damage problems can be resolved using nonlethal techniques alone. Even with the use of single or combined nonlethal methods, livestock losses to predators often continue. When conducting lethal management activities, Wildlife Services evaluates all potential tools for humaneness, effectiveness, ability to target specific individual animals and/or species, and the potential impact on human safety. Professional organizations such as The Wildlife Society (TWS), whose 10,000 members include scientists, managers, educators and others, have long supported the use of lethal take. TWS's Standing Position Statement on Wildlife Damage Management states, "Prevention or control of wildlife damage, which often includes removal of the animals responsible for the damage, is an essential and responsible part of wildlife management." It is important to note that Wildlife Services is tasked with reducing wildlife damage. We do not manage wildlife populations. The management of predators and other wildlife is the responsibility of the States and other federal agencies. As such, any actions undertaken to reduce wildlife damage are conducted in collaboration with State agencies and under appropriate State and federal permits and laws.

APPENDIX D. Literature Submitted to WS-Arizona During Public Comment

The literature listed below was referenced or submitted by commenters and reviewed by WS-Arizona and incorporated in the the discussion and analysis in the EA, as appropriate.

Andelt, W. F. 1996. Carnivores. Pages 133-155 in P. R. Krausman, editor. Rangeland Wildlife. Society for Range Management, Denver.

Belsky, A. J. and J. L. Gelbard. 2000. Livestock grazing and weed invasions in the arid west. Oregon Natural Desert Association. Bend, OR: 3, http://www.publiclandsranching.org/htmlres/PDF/BelskyGelbard_2000_Grazing_Weed_Invasions.pdf.

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APPENDIX E. Updated Ocelot map and signed letter from APHIS WS to USFWS

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October 10, 2017

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RE: Amending of Section 7 Consultation on Wildlife Service's Wildlife Damage Management Program with Regard to Its Effects on Ocelots in Arizona (AESO/SE 22410-2010-F-0422-R001)

Dear Mr. Spangle:

I would like to take this opportunity to thank you and your staff in your timely efforts in updating the Ocelot Biological Opinion (BO) dated June 27, 2017. Your staff, especially Erin Fernandez, was very helpful in facilitating a quick update.

In the BO, the US Fish and Wildlife Service agreed to meet with Wildlife Services and develop a map that would replace the draft map in Appendix A. A meeting was held on August 24, 2017, in the US Fish and Wildlife Services' Arizona Ecological Services Field Office's regional office in Tucson, Arizona, with Wildlife Services and the Arizona Game and Fish Department.

The unanimous outcome of the meeting was an agreed upon map for "Ocelot Area of Possible Occurrence." The map is attached with this correspondence. As agreed by the US Fish and Wildlife Service on page 2 of the BO, the attached agreed upon map is being submitted for the record to complete, amend, and update the BO.

Please let me know if you need any further information in regards to the meeting or the map.

Regards,

Jason Suckow
Western Regional Director

Ocelot Area of Possible Occurrence