ENVIRONMENTAL ASSESSMENT

PREDATOR DAMAGE MANAGEMENT IN NEBRASKA

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WILDLIFE SERVICES

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CHAPTER 1. PURPOSE AND NEED

1.1 INTRODUCTION

This chapter provides the foundation for:

- Understanding why wildlife damage occurs and the practice of predator damage management (PDM);
- Knowing the statutory authorities and roles of federal and state agencies in managing damage caused by predators in Nebraska;
- Understanding how WS-Nebraska cooperates with and assists private and commercial resource owners and federal, tribal, state and local government agencies in PDM;
- 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-Nebraska;
- Understanding the reasons why private and commercial entities, tribes, and federal, state, and local government agencies request assistance from WS-Nebraska;
- Understanding the effectiveness and cost-effectiveness associated with PDM in the United States; and
- The public involvement and notification processes used by WS-Nebraska for this EA.

Chapter 2 identifies the issues analyzed in detail in this EA and describes the proposed action and alternatives evaluated in detail, with the rationale why some alternatives are not considered in detail, as required by the Council on Environmental Quality (CEQ) implementing regulations for NEPA at 40 CFR 1502.14(a). Chapter 3 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. Details of the different wildlife damage management (WDM) methodologies are included in Appendix B.

1.2 WHAT IS THIS EA ABOUT?

Wildlife Services (APHIS-WS), a program within the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), 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 four alternative approaches to managing predator damage (predator damage management; PDM) in Nebraska, including continuation of the current PDM program. The purpose of the EA is to assist WS-Nebraska to understand the options and the associated comparative impacts of each, and make an informed decision regarding managing the Integrated Predator Damage Management (IPDM) 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". To address damages associated with predators, WS-Nebraska uses an Integrated Wildlife Damage Management (IWDM) approach (WS Directive 2.105), also commonly known as Integrated Pest Management (IPM) in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is the application of safe and practical methods for the prevention and reduction of damage caused by wildlife based on local problem analyses and the informed judgment of trained personnel (Slate et al 1992). These methods include practices such as habitat and behavioral modification to prevent or reduce damage or may also require that the offending animal(s) be removed or that local populations or groups of the offending species be reduced through lethal methods. The imminent threat of damage or loss of resources is often sufficient for actions to be initiated and the need for PDM, or the reduction of human/predator conflicts, is derived from the specific threat to resources. Actions taken by WS-Nebraska using IPDM strategies will be addressed 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-Nebraska assistance provided to requesters for managing predator damage evaluated in this EA is simply a component of the total WS-Nebraska wildlife damage management activities conducted in Nebraska. NEPA analysis of other components of the WS-Nebraska activities that do not involve predators are evaluated in separate documents.

This EA also provides sufficient analysis of impacts to determine if and Finding of No Significant Impact "FONSI) or and Environmental Impact Statement (EIS) is appropriate. The alternatives considered in this EA vary regarding the degree of WS-Nebraska 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. For this EA, the following species are included as predators: coyote, striped skunk, raccoon, red fox, bobcat, badger, Virginia opossum, feral/free-ranging/hybrid dogs, feral/free-ranging/hybrid cats,

mink, cougar (mountain lion), and weasels (Section 3.2.1), listed in order of the proportion of take by WS-Nebraska in responding to requests for assistance.

The goal of the WS-Nebraska PDM program, as conducted in the current program in Nebraska, 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 2.3).

WS-Nebraska proposes to continue responding to requests for assistance for predator management 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 in predator damage management on all land classes, including federal, tribal, state, county, municipal, airports, and private properties in rural, urban and suburban areas where WS-Nebraska personnel have been and may be requested to assist, based on agreements between WS-Nebraska and the requesting entity. It also includes analysis of impacts of three other alternatives of predator damage management activities in Nebraska both involving and not involving WS-Nebraska.

The proposed action (Alternative 1), involves WS-Nebraska continuing to 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-Nebraska are encouraged to use reasonable and effective non-lethal management strategies and sound husbandry practices, when and where appropriate, to reduce ongoing conflict situations.

WS-Nebraska actions are conducted in accordance with applicable federal, state, tribal, and local laws, and in accordance with current agency Memoranda of Understanding (MOUs) and interagency agreements between WS-Nebraska and the various federal and state resource management agencies. WS-Nebraska cooperates with Nebraska Game and Parks Commission (NGPC), the Nebraska Department of Agriculture (NDA), and the Nebraska State Police (NSP), as appropriate, for actions involving PDM.

Wildlife is an important public resource greatly valued by people. Wildlife can generate positive or negative values depending on the perspectives and circumstances of individual people. In general, people regard wildlife as providing economic, recreational, and aesthetic benefits. Knowing that wildlife exists in the natural environment provides a positive benefit to many people. However, the behavior of animals may result in damage to agricultural resources, natural resources, property, and threaten human safety. Animals utilize habitats (*e.g.*, feed, shelter, reproduce) where they can find a niche. If their activities result in lost value of resources or threaten human safety, people often characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or pose a threat to human safety, people often

seek assistance. The threshold triggering a request for assistance is often unique to the individual person requesting assistance and many factors can influence why people request assistance (*e.g.*, economic, social, aesthetics). Therefore, what constitutes damage is often unique to the individual. What one individual considers damage, another may not. 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 human safety; 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. 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. PDM is conducted by WS-Nebraska only where a property owner or manager, including government, tribal, commercial, organizational, or private entity, has requested assistance and Work Initiation Documents (WIDs), MOUs, Interagency Agreements, Cooperative Agreements, and/or work plans are in place to authorize the work.

See Sections 2.5 through 2.6, and Appendix A for details on the four alternatives evaluated in this EA, and Chapter 3 for their associated impacts.

1.3 WHAT SPECIES ARE INCLUDED IN THIS EA?

This EA includes the following predator species (in order of proportion of take by WS-Nebraska; Table 1.). All species except for free-ranging/feral dogs and cats are managed under state law by the NGPC.

Table 1. Predator Species Included in Scope of this EA.

Common Name	Scientific Name	Managed By[1]
Coyote	*Canis latrans*	**NGPC**
Striped skunk	*Mephitis mephitis*	**NGPC**
Raccoon	*Procyon lotor*	**NGPC**
Cougar	*Puma concolor*	**NGPC**
Red fox	*Vulpes vulpes*	**NGPC**
Bobcat	*Lynx rufus*	**NGPC**
Badger	*Taxidea taxus*	**NGPC**
Virginia Opossum	*Didelphis virginianus*	**NGPC**
Free-ranging/feral cats	*Felis domesticus*	**Local Officials**
Free-ranging/feral dog	*Canis familiaris*	**Local Officials**
Mink	*Mustela vison*	**NGPC**
Weasels	*Mustela* spp.	**NGPC**

[1] NGPC: Nebraska Game and Parks Commission

1.4 WHAT IS WILDLIFE DAMAGE MANAGEMENT

In many cases, wildlife management agencies endeavor to affect the overall or regional population of a wildlife species, such as managing for an increase in the population of an endangered species or a popular game species. This is generally referred to as "wildlife management".

Wildlife Damage Management (WDM), on the other hand, focuses on addressing a specific damage situation, not broad-scale population management. In general, the goal of WDM is to alleviate the damage, without affecting overall or regional populations. The Wildlife Society, a non-profit scientific and educational association which represents wildlife professionals, recognizes WDM as a specialized field within the wildlife profession, and espouses adherence to professional standards for responsible WDM. Their official position on WDM is as follows (The Wildlife Society 2017):

> *"Wildlife sometimes causes significant damage to private and public property, other wildlife, habitats, agricultural crops, livestock, forests, pastures, and urban and rural structures. Some species may threaten human health and safety or be a nuisance. Prevention of control of wildlife damage, which often includes removal of the animals responsible for the damage, is an essential and responsible part of wildlife management. Before wildlife damage management programs are undertaken, careful assessment should be made of the problem, including the impact to individuals, the community, and other wildlife species. Selected techniques should be incorporated that will be efficacious, biologically selective, and socially appropriate."*

The Wildlife Society further "*recognize[s] that wildlife damage management is an important part of modern wildlife management*" (The Wildlife Society 2017).

1.4.1 What is Predator Damage Management and Integrated Predator Damage Management?

Managing damage caused by wildlife species identified as "predators" is known as predator damage management (PDM). PDM generally refers only to mammalian predator species, and excludes predatory bird species like raptors. When an integrated approach to PDM is used, it is often referred to as "integrated predator damage management". For WS-Nebraska, this distinction is purely academic, because the only predator damage management practiced by WS-Nebraska uses the integrated approach. Therefore, when we refer to PDM, we are intuitively referring to "integrated predator damage management". Throughout this EA, we will use the abbreviation "PDM" to refer to integrated predator damage management. This also helps distinguish integrated *predator* damage management (herein, PDM) from integrated *pest* damage management (IPDM), which includes the management of damaging insect pests.

Henceforth, all references to PDM in this document refer to integrated predator damage management.

1.4.2 Why do Wildlife Damage and Risks to Human Health and Safety Occur?

Wildlife is a valuable natural resource, long enjoyed by the American public for aesthetic, recreational, emotional, psychological, and economic reasons. Native wildlife in overabundance or individual animals that have learned and habituated to use resources supplied by humans, especially food, can lead to conflicts with humans. Introduced, feral, or invasive species may outcompete native species and cause damage to other resources. Wildlife can destroy crops and livestock, damage property and natural resources, including other species valued by humans, and pose serious risks to public and pet health and safety.

Across the United States, wildlife habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with the needs of wildlife, which increases the potential for conflict between humans and wildlife. With this continued and more intensive use of land by humans, introduction of domestic livestock, water resource management, urbanization, and other modern agricultural, cultural, and transportation practices associated with human development have caused substantial changes in the ways that humans and wildlife, especially predators, interact.

Human development and growth continue to put pressures on wildlife populations and their use of remaining habitat. Some species have the ability to be more flexible and adaptable than others, with highly adaptable and flexible species often reaching unnaturally high populations, and less adaptable species losing population numbers and distribution. Some animals and localized populations may adapt to change by using human infrastructure or concentrated agricultural practices for their life cycle needs, such as obtaining food and water, finding areas to breed or rest, and using human structures as shelter. Because humans tend to concentrate livestock, food crops, buildings, their pets, and even themselves in localized areas of intensive use, some wildlife species may find it easier to meet their life needs using human-subsidized assets. Where resources provided by humans overlap with occupied wildlife territory, the animals often learn to take advantage of those resources.

Many people moving from urbanized areas into the rural areas or newly developed areas are often not familiar with wildlife and their habits. Some individual animals can become habituated to the point that they lose their natural fear of humans, choosing to live near residences, prey on pets and livestock, and/or attack or intimidate people.

Wildlife may serve as reservoirs for disease and parasites. Diseased animals living near areas of human activity may transmit those diseases to livestock, people, and/or pets. These diseases may transfer to people directly through physical contact or may be transmitted to people via environmental contamination by feces and even tainted food products such as fresh produce or meat products.

Wildlife does not perceive the same values that humans perceive in the animals or plants they eat, the locations they choose to breed and live, or the health or safety concerns they cause to humans. They are simply using and adapting to the available habitats, including opportunities where humans provide easy food and living space. Wildlife's constant ability to adapt to changes in their environment for meeting their own needs for food, water, and shelter can create

tension and conflict where human needs for social and economic security and health and safety overlap.

1.4.3 How Do People Feel about Wildlife?

Schwartz et al. (2003) summarize how human attitudes towards large carnivores has evolved over time in Europe and North America from threats to life and property to utilitarian considerations, to valuing their intrinsic values.

Human perceptions, attitudes, and emotions differ depending on how humans desire to "use" different wildlife species and how they interact with individual or groups of animals. For example, seeing a group of deer in a field at dusk may be seen as a positive experience, while seeing the same group of deer feeding in your garden or commercial alfalfa field is frustrating. Watching a coyote feeding on rodents in the snow may be exciting, while having the same coyote foraging for food near or on your pets or farm animals on your property may be highly undesirable and even frightening. Raccoons in the neighboring forest patch may be enjoyable to watch, while the same raccoon in your garbage, henhouse, or attic is intolerable.

We also have cultural perceptions based on our experiences, upbringing, and even childhood stories. Wolves and coyotes may be considered as "bad" because they kill and eat animals we like or because they scare us, but also "good" because they look and behave like our own canine pets, and symbolize "the ecological wild." Some people spend substantial amounts of money to travel to see wildlife in their native habitats or even in zoos, while other people may spend equally substantial amounts of money to have animals removed or harassed away from their neighborhoods, livestock, crops, airports, and even recreational areas where the animals may cause damage or people may feel or be threatened. Some people are even happy just to know that certain types of animals still exist somewhere, even if they never have the opportunity to see them; they believe that their existence shows that areas of America are still "wild." At the same time, people will also expect to have animals that cause damage to property, economic security, or that pose a threat to people to be removed and sometimes killed, with justification.

The values that people hold regarding wild animals differ based on their past and day-to-day experiences, as well as the values held by people they trust. For example, people who live in rural areas that depend on land and natural resources tend to consider wildlife from a more utilitarian viewpoint, such as for hunting. Age and gender also influence viewpoints, with younger people and females tending to feel more emotional towards wildlife (Kellert 1994; Kellert and Smith 2000; Table 1.2):

Table 1.2. Basic Wildlife Values. (Adapted from Kellert (1994) and Kellert and Smith (2000)).

Term	Definition
Aesthetic	Focus on the physical attractiveness and appeal of wild animals
Dominionistic	Focus on the mastery and control of wild animals
Ecologistic	Focus on the interrelationships between wildlife species, natural habitats, humans, and the environment
Humanistic	Focus on emotional affection and attachment to wild animals
Moralistic	Focus on moral and spiritual importance of wild animals
Naturalistic	Focus on direct experience and contact with wild animals
Negativistic	Focus on fear and aversion of wild animals
Scientific	Focus on knowledge and study of wild animals
Utilitarian	Focus on material and practical benefits of wild animals

As summarized by Lute and Attari (2016), people have strong opinions about killing wildlife, dependent on a myriad of factors, such as social identity and experience and knowledge about different species. Determining whether an individual animal has intrinsic value (the inherent right of an entity to exist beyond its use to anyone else) is a predictor to support for conservation. Factors relevant to how people respond to wildlife can include intrinsic value attributions given to humans, some or all animals, ecosystems; considerations such as moral, economic factors, the practicality with which one views wildlife, and cost benefit analysis; and species characteristics, such as whether an animal is considered attractive, dangerous, endangered, familiar, nuisance, important to the economy, important to one's well-being, and important to ecosystems. The interactions of how individual people view themselves in relation to the environment, their economic security, the values associated with natural areas and property, and people's needs and desires within the context of their relationship with specific individual animals and species and their intrinsic values and flaws create highly complex attitudes and associated behaviors, including potentially mutually exclusive ones. Also, people may go to great lengths to save an individual identifiable person, but become numb to saving nameless masses ("psychic numbing").

Reflecting these tensions in our emotional and physical relationships with wild animals, national policies have changed over time. Policies towards wildlife species that are considered to be desirable because they are hunted, rare, or valued for other reasons have resulted in local, federal, and state governments using taxpayer money to manage those species for their continued existence and increased distribution, and population growth.

In the past, as settlers moved across the West, large predators such as bears, wolves, and cougars were perceived as inherent threats to safety and food supply. These species were feared and humans systematically extirpated or substantially reduced their population sizes in many areas through overhunting, local, state, and federal government and private predator removal programs, and/or habitat destruction. Taxpayer funds that were once used to directly reduce "undesirable" wildlife predator populations, such as wolves or grizzly bears, may now be used to protect and increase their populations and habitats, recognizing their inherent ecological and social values within the framework of potential competition over natural and human resources and values.

Lute and Attari (2016) recognize that conflicts with wildlife have been ongoing, especially as humans have made and continue to make substantial modifications to the environment and land uses that have created such conflicts, and that lethal control may be more cost-effective than sweeping habitat protection strategies. Their study suggests that people may rely on default strategies such as habitat and ecosystem protection and moral considerations rather than also considering economic and social costs necessary for navigating difficult trade-offs and nuances inherent decision-making regarding specific situations.

Trade-offs can and do occur between different conservation objectives and human livelihoods and conservation (McShane et al. 2011). The authors argue that many options exist in managing wildlife conflict in relation to protection of individual animals, populations, ecosystems, and human physical and economic well-being, and that these choices are "hard" because every choice involves some level of loss that, for at least some of those effected, is likely to be a significant one.

1.4.4 At What Point do People or Entities Request Help for Managing Wildlife Damage?

As a society, our attitudes have changed over time, and now those same species seen as conflicting with human values may be considered desirable, but even then, only under socially-acceptable circumstances. The tension regarding the use of public funds and/or lands to support a wide variety of private/individual uses or incomes (not only related to wildlife) is a federal and/or state governmental policy consideration. An example of this tension can involve individuals who believe, for example, that livestock producers should not be allowed to graze on public lands or that livestock losses to predation should be considered as a "cost of doing business."

When individual animals cause damage to property, agriculture, economic security, threaten the sustainability of managed or protected wildlife species, and/or threaten human and pet health and safety, there are many situations when people, government agencies, or commercial interests request private companies or federal or state governments to reduce, remove, kill, or disperse the animals or groups of animals causing the problems. When damage or losses have previously occurred and can be expected to occur again, people or agencies may request that animals or groups of animals be removed or dispersed to avoid further losses, even before the damage or losses reoccur. Often, without outside help, people or entities will try to resolve the problems

themselves, sometimes by attempting to prevent the damage from re-occurring, such as by building fences and other infrastructure, or by killing animals that they perceive are, and that may or may not be causing the problem, using traps, firearms, or toxic chemicals.

The term "damage" in the case of WDM is consistently used to describe situations where the individual person or entity has determined that the losses caused by wildlife triggers their threshold for requesting assistance or attempting to take care of the problem themselves. "Damage" may be defined as economic losses to property or assets, or threats to human or pet safety. However, "damage" may also be defined as a loss in the aesthetic value of property and other situations where the behavior of wildlife is no longer tolerable to an individual person or entity.

The threshold triggering a request for assistance in dealing with a particular damage situation is often unique to the individual person, entity, or agency requesting assistance. Therefore, what constitutes damage to one person or entity and considered intolerable may not even be considered a problem by another individual or entity.

Addressing wildlife damage problems requires consideration of both the resource owners' and society's levels of acceptability and tolerance, as well as the ability of ecosystems and local wildlife populations to absorb change without long-term or short-term adverse impacts.

"Biological carrying capacity," as we use it here, is the maximum number of animals of a given species that can, in a given ecosystem, survive through the least favorable conditions occurring within a stated time interval (in other words, the largest number of animals that can sustainably survive under the most restricting ecological conditions, such as during severe winters or droughts; The Wildlife Society 1980). The "wildlife acceptance capacity," or "cultural carrying capacity," is the limit of human tolerance for wildlife or its behavior and the number of a given species that can coexist compatibly with local human populations. Just the presence of a wild animal may be considered threatening or a nuisance to people with low tolerance or inexperience with the ways of wild animals, or when the animals are viewed as cruel, aggressive, or frightening. Those phenomena are especially important because they define the sensitivity of a person or community to coexisting with a wildlife species.

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 of people sharing that habitat is lower. Once the wildlife acceptance capacity is met or exceeded in a particular circumstance, people take or request help for taking action to alleviate the damage or address threats.

1.4.5 What Are the Science and Practices of Wildlife Damage Management?

With new science and changing societal values, governmental policies have changed to the extent that native wildlife populations are no longer managed by local, state, and the federal government for population suppression, extirpation from local areas, or even entire removal over large areas or regions, unless such management meets local objectives of protecting other valued

or rare wildlife populations or for reducing the threat of the spread of disease. Wildlife damage management focuses on addressing a specific situation, not broad-scale population management. The Wildlife Society, a non-profit scientific and educational association that represents wildlife professionals, recognizes that wildlife damage management is a specialized field within the wildlife management profession, and that responsible wildlife management, including WDM, requires adherence to professional standards.

The Wildlife Society has the following standing position on Wildlife Damage Management (WDM; The Wildlife Society 2016; http://wildlife.org/wp-content/uploads/2016/04/SP_WildlifeDamage.pdf):

> "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…
>
> "Wildlife sometimes causes significant damage to private and public property, other wildlife, habitats, agricultural crops, livestock, forests, pastures, and urban and rural structures. Some species may threaten human health and safety or be a nuisance. Prevention of control of wildlife damage, which often includes removal of the animals responsible for the damage, is an essential and responsible part of wildlife management. Before wildlife damage management programs are undertaken, careful assessment should be made of the problem, including the impact to individuals, the community, and other wildlife species. Selected techniques should be incorporated that will be efficacious, biologically selective, and socially appropriate.
>
> "The policy of The Wildlife Society in regard to wildlife [in part] and the alleviation of wildlife problems is to… Recognize that wildlife damage management is an important part of modern wildlife management."

Adapting the definition of Integrated Pest Management from the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; Section 1.15) to wildlife damage management, Integrated Wildlife Damage Management (IWDM) involves considering and applying options, tools, and techniques, either singly or in combination, for resolving the damage or threat of damage using a strategy that is sustainable and appropriate to the specific project circumstances in a way that minimizes economic, health, and environmental risks. When managing wildlife for meeting certain objectives related to damage or threats caused by species identified as "predators," it is called integrated predator damage management (IPDM).

The APHIS-WS program uses an Integrated Wildlife Damage Management (IWDM) approach (APHIS-WS Directive 2.105) in which a combination of methods may be used or recommended to reduce wildlife damage. The challenge is to develop strategies that include the most effective combination of techniques, for example, separating the asset to be protected from the problem animals, removing the problem animals before or when they cause the problem, harassing them away, and/or educating the resource owner on how to coexist with the animals or to remove the attractant.

Per APHIS-WS Directives 2.101 and 2.105, when selecting and applying a particular method or methods, "consideration must be given to the species responsible and the frequency, extent, and magnitude of damage. In addition to damage confirmation and assessment, consideration must be 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."

The APHIS-WS Directive 2.105 states:

> "The WS program applies the IWDM (commonly known as Integrated Pest Management) approach to reduce wildlife damage. As used and recommended by the WS program, IWDM encompasses the integration and application of all approved methods of prevention and management to reduce wildlife damage. The IWDM approach may incorporate cultural practices, habitat modification, animal behavior management [such as repellents, frightening devices, and physical exclusion], local population reduction [such as removing offending animals or groups of animals] or a combination of these approaches.

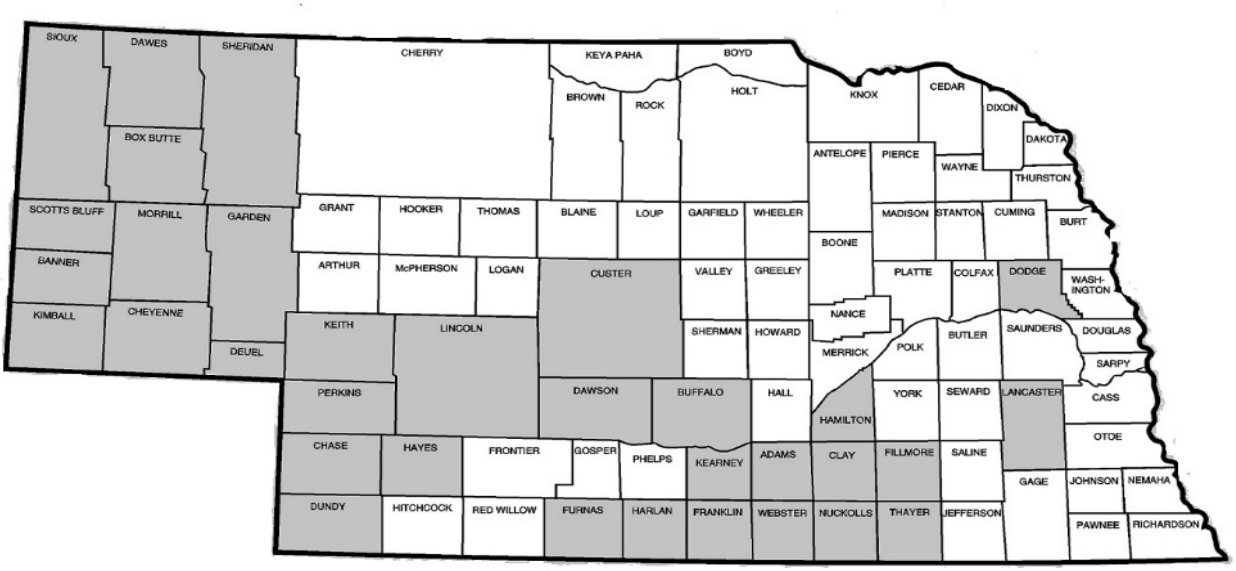
The selection of wildlife damage management methods and their application must consider the species causing the damage and the magnitude, geographic extent, duration, frequency, and likelihood of recurring damage. In addition, consideration is given to nontarget species, environmental conditions and impacts, social and legal factors, and relative costs of management options. WS personnel shall apply and use the IWDM approach to efficiently and effectively prevent or reduce damage caused by wildlife. In applying IWDM to wildlife damage management, the WS program may offer technical assistance, direct control, or a combination of both in response to requests for help with wildlife damage problems."

1.5 WHAT ARE THE NEEDS FOR THE WS-NEBRASKA PREDATOR DAMAGE MANAGMENT PROGRAM?

To provide efficient program support and assistance, at present WS-Nebraska primarily protects livestock on land owned or managed by private individuals or the State. In addition, WS-Nebraska has received requests to protect nesting sites of federally endangered waterfowl, interior least terns (*Sterna antillarum*), and piping plovers (*Charadrius melodus*) from predation. WS-Nebraska responds to requests for assistance associated with predators that are thought to be causing a threat to public health and safety, causing damage to property or predation on Nebraska Agriculture Resources.

Nebraska encompasses an area of about 77,277 mi². In Fiscal Year (FY) 2015, WS-Nebraska had agreements to conduct PDM on about 5% of Nebraska's lands. In Nebraska, land is owned and managed by private individuals, counties, municipalities, Tribes, the State (e.g., the Nebraska Game and Parks Commission(NGPC)), and federal agencies (e.g., the U.S. Fish and Wildlife Service (USFWS), Army Corp of Engineers (USACE), U.S. Forest Service (Forest Service),

Bureau of Land Management (BLM), etc.). WS-Nebraska currently cooperates with 33 counties (see Figure 1) in Nebraska.



The 33 counties cover approximately 21.5 million acres (about 43% of the state), consisting primarily of two major geographic regions, the Dissected Tilled Plans and the Great Plains. WS-Nebraska continues to receive requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety throughout the state of Nebraska. As proposed in this EA, WS-Nebraska works to protect livestock, wildlife, property, and public health and safety, as requested, on all land classes in Nebraska.

1.5.1 Damage Data by Resources Affected

Between FY 2010 and FY 2015 WS-Nebraska received 1,486 requests for PDM assistance with an average of 248 requests for assistance per year. The majority of damage reports received by WS-Nebraska are associated with predator damage to agricultural resources. WS-Nebraska received reports of 235 damage occurrence associated with predators during FY 2010, 294 occurrences in FY 2011, 270 damage occurrences during FY 2012, 257 damage occurrences during FY 2013, 204 damage occurrences during 2014 and 226 damage occurrences during 2015 (Table 3). Over 71% of the requests for assistance were associated with predator damage or the threat of damage to agricultural resources, primarily livestock. Over 47% of the total requests for assistance were associated with coyote damage or threats of damage. Of the requests for assistance associated with coyotes, nearly 97% were associated with agricultural resources, primarily predation on livestock.

Table 3 - Damage occurrences recorded verified and unverified by NE (FY2010 - FY2015)

Species	Resource Category				TOTAL
	Agriculture	Property	Human Safety	Natural Resources	
Badger	57	91	2	0	150
Bobcat	20	6	0	0	26
Feral Cat	0	1	7	0	8
Coyote	677	16	2	1	696
Feral Dog	11	1	0	0	12
Red Fox	115	14	2	2	133
Swift Fox	0	1	0	0	1
Mountain Lion	2	0	0	0	2
Mink	0	0	0	1	1
Virginia Opossum	4	24	3	1	31
River Otter	4	0	1	0	5
Raccoon	140	163	11	10	324
Spotted Skunk	0	0	0	0	0
Striped Skunk	20	68	7	0	95
Weasel	1	0	0	0	1
TOTAL	1051	385	35	14	1486

Table 4 – Yearly Damage occurrences recorded by NE (FY2010 - FY2015)

Year	Resource Category				Total
	Agriculture	Property	Human Safety	Natural Resources	
2010	**159**	**65**	**10**	**1**	235
2011	**200**	**85**	**6**	**3**	294
2012	**189**	**74**	**6**	**1**	270
2013	**190**	**60**	**1**	**6**	257
2014	**141**	**55**	**5**	**3**	204
2015	**172**	**47**	**6**	**1**	226
TOTAL	1051	386	34	15	1486

†This data only reflects unique occurrences of reported and verified damage

Five species of predators were responsible for over 94% of the requests for assistance, including coyotes (47%), striped skunks (6%), badger (10%), raccoons (22%), and red fox (9%).

In addition to reported and confirmed damage occurrences shown in Table 1, WS-Nebraska also receives requests for assistance to alleviate the threat of damage associated with predators. Table 5 shows the threat occurrences reported to WS-Nebraska from FY 2010 through FY 2015 by resource category. An appropriate response effectively timed can reduce damage (Wagner and Conover 1999).

Similar to damage occurrences, most threat occurrences reported to WS-Nebraska are associated with threats predators pose to agricultural resources. Of the 4,113 threat occurrences reported to WS-Nebraska from FY 2010 through FY 2015, 58% were associated with agricultural resources and of those reported occurrences, nearly 58% were associated with coyotes. Nearly all threat occurrences reported to agricultural resources were associated with threats to livestock. WS-Nebraska received two requests associated with threats to agricultural resources caused by river otter from FY 2010 through FY 2015. Of the human safety threats reported to WS-Nebraska in from FY 2010 through FY 2015, most requests for assistance were associated with disease transmission.

Table 5 - Threat occurrences recorded by NE (FY2010 - FY2015)

Species	Resource Category				TOTAL
	Agriculture	Property	Human Safety	Natural Resources	
Badger	81	95	14	7	197
Bobcat	11	6	5	2	24
Feral Cat	6	19	51	6	82
Coyote	1959	51	50	35	2095
Feral Dog	25	0	3	1	29
Red Fox	82	31	60	13	186
Swift Fox	0	2	0	0	2
Mountain Lion	18	0	8	0	26
Mink	1	1	0	19	21
Virginia Opossum	39	78	70	54	241
River Otter	2	0	0	1	3
Raccoon	130	234	147	128	639
Spotted Skunk	0	0	1	0	1
Striped Skunk	35	109	387	30	561
Weasel	4	0	0	2	6
TOTAL	2393	626	796	298	4113

Table 6 – Yearly threat occurrences recorded by NE (FY2010 - FY2015)

Year	Resource Category				Total
	Agriculture	Property	Human Health	Natural Resources	
2010	**418**	**132**	**123**	**18**	691
2011	**414**	**92**	**115**	**10**	631
2012	**361**	**110**	**191**	**55**	717
2013	**361**	**115**	**164**	**49**	689
2014	**430**	**97**	**117**	**63**	707
2015	**409**	**92**	**85**	**104**	690
TOTAL	2393	638	795	299	4125

Requests for assistance are an indication of need, but not all damage occurrences are reported to WS-Nebraska and people experiencing damage may use other entities for relief. Connolly (1992) determined that only a fraction of the total predation attributable to coyotes was reported to or confirmed by WS. Connolly (1992) also stated that based on scientific studies and livestock loss surveys generated by the National Agriculture Statistics Service (NASS), WS only confirms about 19% of adult sheep and 23% of the lambs actually killed by predators, nationwide. In most cases when addressing livestock predation, WS-Nebraska would not attempt to locate every incident of livestock reported by ranchers as being killed, but rather personnel would make a verification of losses which would establish a need for managing damage and what the appropriate methods would be using the WS Decision Model. Therefore, losses documented and reported by WS-Nebraska do not actually reflect the total number of livestock or other resource lost in Nebraska, but provides an index of the annual losses.

Agricultural

During 2001, estimated 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. In 2001, the NASS reported that raccoons were 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 and Table 4, of the predator damage and threat occurrences reported to WS-Nebraska from FY 2010 through FY 2015, most occurrences were related to

agricultural resources. On average, WS-Nebraska has received reports of or verified 574 damage or threat occurrences to agricultural resources per year in Nebraska (see Table 1 and Table 4).

Livestock Predation and Disease Threats

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). 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, those losses can be economically burdensome for the producers who do incur damage (Baker et al. 2008).

Of the predators that kill livestock, coyotes are likely responsible for the highest percentage of depredations (Knowlton et al. 1999, Shelton 2004, NASS 2005, NASS 2006, NASS 2010, NASS 2011). In a study of sheep predation on rangelands in Utah, coyotes accounted for 67% of depredated lambs, followed by cougar 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 and of those lambs killed by coyotes in the study more than 43% were 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).

Mountain lions are occasionally responsible for large losses of sheep and lambs, sometimes called "*surplus killing*", when only selected tissues or parts are consumed 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 sheep (McKinney 1996). Wade and Browns (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 corrals.

A positive correlation between predator concentrations and livestock losses due to predation often exists (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. In 2010, the NASS (2011) reported cattle and calf losses from animal predation totaled 219,900 head in the United States according to livestock producers. 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 with 53.1% of cattle and calf losses attributed to coyotes. Producers also attributed livestock losses to bobcats, mountain lions, and dogs. Producers spent nearly $188.5 million dollars on non-lethal methods to reduce cattle and calf losses from predation by animals in 2010 (NASS 2011). The primary non-lethal method employed by livestock producers was the use of guard animals with a reported 36.9% of producers using guard animals. Producers also reported using exclusion fencing, frequent checking, and culling as additional employed methods for reducing predation (NASS 2011).

In 2012, farm and ranch commodities generated over $24 billion in annual sales in Nebraska (NASS 2014). Of this, livestock production, primarily cattle and calves, sheep, swine, corn, soybeans and poultry, accounted for about 98% of total agricultural commodity cash receipts. Near the beginning of 2014, Nebraska livestock inventories included 6,150,000 cattle and calves, 71,771 sheep and lambs, 3,100,000 swine, and 25,840 goats (NASS 2014). In addition, farmers and ranchers produce other livestock, including native deer, bison, elk, equine, and poultry in Nebraska. The importance of cattle feeding to Nebraska's economy runs deeper than in other state. Nearly 5 million head are finished and marketed in Nebraska, a State with a population of 1.8 million residents. In 2014 Nebraska became the No. 1 state for all cattle on feed numbering 2,450,000 head. Nebraska has the top three beef cow counties in the U.S., including the national's No. 1 cow county- Cherry County, with nearly 166,000 cows. Custer County is No. 2 with 100,000 cows and Holt County is No. 3 with 99,000 cows. During 2014 Sheep and lamb inventory numbers have dropped in the United States over the last decade.[1] In 2011, farmers and ranchers maintained 880,000 head of sheep and lamps, which compared to 830,000 head in 2010, which was the lowest inventory recorded from 2002 to 2011 (NASS 2011).

The NASS (2010) reported that predators killed 400 adult sheep and 700 lambs in Nebraska during 2009, which were valued at $52,000 and $42,000, respectively. In 2009, the NASS (2010) reported that predators killed 23,000 adult sheep and 48,000 lambs in the State, which were valued at $2,254,000 and $3,120,000, respectively. In 2004, survey participants identified coyotes as responsible for 60% of the sheep losses associated with animal predators, while dogs accounted for 20% of the losses, while coyotes and dogs were responsible for 80% and 6.7% of lamb losses, respectively (NASS 2005).

Cattle and calf predation losses due to predators in Nebraska totaled 500 and 2,200 head valued at over $1.4 million in 2005 (NASS 2006) and 200 and 2,200 head valued at over $1 million in 2010 (NASS 2011). Of the animal predators identified nationwide causing losses to cattle in 2010, mountain lions, and coyotes, were responsible for about 59% and 39% of the losses, respectively (NASS 2011). Of the calf loss, coyotes, and mountain lions were responsible for

[1]Sheep inventories in the United States, including Nebraska, have shown long-term downward trends as the demand for lamp meat and wool has declined.

59.5% and 37.5% of the losses, respectively (NASS 2011). 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).

The NASS (2005) reported that many Nebraska sheep and goat producers used non-lethal methods to reduce predator damage. Producers in Nebraska used fencing (35.9%), guard dogs (44%), night penning (56.7%), donkeys (7.7%), frequent checks (9.2%), lamb shed (45.1%), culling (16.9%), llamas (10.9%), bedding change (9%), herding (5.5%), carrion removal (8.8%), other nonlethal methods (6.8%), and frightening tactics (2.5%) to reduce predation. The NASS (2011) also reported that Nebraska cattle producers used guard animals (8.5%), culling (41.1%), frequent checks (47.9%), and exclusion fencing (42.7%) to reduce predation.

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 predator management.

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.

During requests for assistance received by WS-Nebraska, cooperators often report or WS-Nebraska verifies through site visits, damage associated with various species of predators in Nebraska. Between FY 2010 and FY 2015, those persons requesting assistance reported to WS-Nebraska or WS-Nebraska verified more than $939,656 in livestock losses associated predators (specifically coyotes, feral dogs, bobcats, raccoons, opossum, striped skunks, and red fox) in Nebraska (see Table 5). Coyotes killed or injured at least 9 adult cattle and 828 calves in Nebraska between FY 2010 and FY 2015, which were valued at $573,708. From FY 2010 through FY 2015, WS-Nebraska also received reports of or verified feral dogs killing or injuring cattle in the State. Coyotes, mountain lion, red fox, and feral dogs were identified or reported killing 431 sheep valued $103,517 while coyotes, red fox, feral dogs, raccoons and bobcats killed 3,594 domestic chicken in the State valued at $66,235. Also, coyotes killed or injured 28 goats valued at $3,934.

Table 7. Verified and unverified livestock killed or injured by predators and recorded by WS-Nebraska, FY 2010 – FY 2015†

Species	Livestock Resource													
	Cattle[1]		Sheep[1]		Goat[1]		Exotic[2]		Poultry		Other[3]		Total #	Total Value
	#	Value	#	Value	#	Value	#	Value	#	Value	#	Value		
Coyote	837	$567,269	431	$97,173	28	$3,934	420	$97,480	1174	$26,772	15	$65,280	65	$ 1,231
Badgers	-	-	-	-	-	-	-	-	65	$1,231	-	-	129	$11,797
Feral Cat	-	-	-	-	-	-	-	-	-	-	-	-	0	-
Feral Dog	6	$6,439	18	$2,400	-	-	-	-	14	$177	1	$300	2915	$857,888
Bobcat	-	-	5	$2,500	-	-	-	-	122	$1,797	2	$7,500	39	$9,316
Raccoon	-	-	-	-	-	-	1150	$16,000	570	$10,368	-	-	1450	$22,050
Mink	-	-	-	-	-	-	-	-	-	-	-	-	0	-
Opossum	-	-	-	-	-	-	-	-	19	$756	-	-	2	$6,000
River Otter	-	-	-	-	-	-	-	-	-	-	-	-	0	-
Striped Skunk	-	-	-	-	-	-	-	-	190	$3,700	5	$50	19	$756
Spotted Skunk	-	-	-	-	-	-	-	-	-	-	-	-	0	-
Red Fox	-	-	6	444	-	-	24	$672	1420	$20,934	-	-	1720	$26,368
Swift Fox	-	-	-	-	-	-	-	-	-	-	-	-	0	-
Mountain Lion	-	-	1	$1,000	-	-	1	$5,000	-	-	-	-	195	$3,750
Weasel	-	-	-	-	-	-	-	-	20	$500	-	-	20	$500
TOTAL	**843**	**$573,708**	**461**	**$103,517**	**28**	**$3,934**	**1,605**	**$119,132**	**3,594**	**$66,235**	**23**	**$73,130**	**6,554**	**$939,656**

†Data reflects losses reported to WS-Nebraska in Nebraska and reflects the actual number of livestock killed or injured by predators. [1]Includes adults and young. [2]Includes exotic pen-raised animals, such as deer, antelope, and non-native species raised for commercial purposes [3]Other hoofed livestock, such as swine, llamas, alpaca, and horses

Livestock reported or verified as being killed by coyotes in Nebraska between FY 2010 and FY 2015 were valued at $857,888, which represented nearly 91% of the value of livestock lost to predators. The value of damage caused by predators that is documented by WS-Nebraska 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 one incident than species that are smaller. Damage reported to or verified by WS-Nebraska fluctuate 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 Nebraska, coyotes inflicted the most damage in value and coyotes and striped skunks were responsible for the most requests for assistance. The monetary losses from livestock predation reflects losses that occurred and that have been reported to or verified by WS-Nebraska, but is not reflective of all livestock losses occurring in Nebraska since not all livestock lost to predators are reported to WS-Nebraska.

In addition to direct livestock losses to 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, cattle could become infected with rabies after being

bitten by infected animals, such as skunks and fox. If exposure to the rabies virus is not identified early and treated, rabies is nearly always fatal.

The domestic cat has been found to transmit *Toxoplasma gondii* to both domestic and wild animal species. 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. Fitzgerald et al. (1984) documented that feral cats transmitted *T. gondii* to sheep in New Zealand, resulting in ewes aborting fetuses. 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.

1.5.2 Damage occurring to other Agricultural Resources

Besides livestock losses and injuries, predators in Nebraska can also damage other agricultural commodities. Predators, such as coyotes, badgers skunks, and raccoons, have damaged field crops such as alfalfa, corn, fruits, and nuts. Damage could also occur to beehives, haystacks, and livestock feed, eggs, range/pasture, and irrigation systems. The burrowing and digging behavior of some predators, such as fox and coyotes, can cause damage to pastures and fields used for hay. The burrowing and digging leaves the ground uneven, which can damage mowing and planting equipment. During FY 2010 to FY 2015, raccoons caused $26,368 in damages to crops in Nebraska. Although damage to other agricultural resources has occurred and could occur, damage or the threat of damage to those resources occurs infrequently in Nebraska.

1.5.3 Property

Predators can cause damage to a variety of property types in Nebraska. Property damage can occur in a variety of ways and can result in costly repairs and clean-up. Predator damage to property occurs primarily through direct damage to structures. Accumulations of fecal droppings can cause damage to buildings and other structures where raccoons or feral cats frequent. Aircraft striking mammals can also cause substantial damage requiring costly repairs and aircraft downtime. Raccoons and skunks can cause damage to property by digging under porches, buildings, homes, and many other places. Skunks and raccoons can cause damage to lawns and landscaping while diffing for grubs and insects

Airports provide ideal conditions for many wildlife species due to the large open grassy areas adjacent to brushy, forested habitat used as noise barriers. Access to most airport properties is restricted so predators living within airport boundaries are not harvestable during hunting and trapping seasons and would be insulated from many other human disturbances.

The civil and military aviation communities have acknowledged that the threat to human health and safety from aircraft collisions with wildlife is increasing (Dolbeer 2000, MacKinnon et al. 2001, and Dolbeer 2009). Collisions between aircraft and wildlife are a concern throughout the world because wildlife strikes threaten passenger safety (Thorpe 1996), result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996, Robinson 1996, Thorpe 1997, Keirn et al. 2010). Aircraft collisions with wildlife can also erode public confidence in the air transport industry as a whole (Conover et al. 1995).

Between 1990 and 2012, there were 2,946 reported aircraft strikes involving terrestrial mammals in the United States (Dolbeer et al. 2013). The number of mammal strikes actually occurring is likely to be much greater, since Dolbeer (2009) estimated 39% of civil wildlife strikes are actually reported. Civil and military aircraft have collided with a reported 36 species of terrestrial mammals from 1990 through 2010, including raccoons, fox, cats, coyotes, opossums, dogs, and striped skunks (Dolbeer et al. 2013). Of the terrestrial mammals reported struck by aircraft, 35% were carnivores (primarily coyotes), causing over $4 million in damages (Dolbeer et al. 2013). Aircraft striking coyotes have resulted in 12,249 hours of aircraft downtime and nearly $3.6 million in damages to aircraft in the United States since 1990 (Dolbeer et al. 2013). Aircraft strikes involving dogs have caused over $382,000 in damage in the United States since 1990 (Dolbeer et al. 2013).

In addition to direct damage, an aircraft striking a mammal can pose serious threats to human safety if the damage from the strike causes a catastrophic failure of the aircraft leading to a crash. For example, damage to the landing gear during the landing roll and/or takeoff run can cause a loss of control of the aircraft, causing additional damage to the aircraft and increasing the threat to human safety. Nearly 63% of the reported mammal strikes from 1990 through 2012 occurred at night, with 64% occurring during the landing roll or the takeoff run (Dolbeer et al. 2013).

Airports in Nebraska have requested assistance with managing threats to human safety and damage to property associated with predators present inside the area of operations of airports. The infrequency of predator strikes does not lessen the need to prevent threats to human safety and the prevention of damage to property. Preventing damage and reducing threats to human safety is the goal of those cooperators requesting assistance at airports in Nebraska given that a potential strike could lead to the loss of human life and considerable damage to property.

Wildlife populations near or found confined within perimeter fences at airports can be a threat to human safety and cause damage to property when struck by aircraft. Those wildlife confined inside an airport perimeter fence would not be considered distinct populations nor separate from those populations found outside the perimeter fence. Wildlife found within the boundaries of perimeter fences originate from populations outside the fence. Those individuals of a species inside the fence neither exhibit nor have unique characteristics from those individuals of the same species that occur outside the fence; therefore, those individuals of a species confined inside an airport perimeter fence do not warrant consideration as a unique population under this analysis.

WS-Nebraska has responded to requests from airports, landowners, and other property owners to alleviate property damage from predators in Nebraska. WS-Nebraska has responded to requests for assistance associated with the threat of coyotes being struck by aircraft at airports, raccoons and skunks burrowing into or under homes, skunks and raccoons gaining access into a home through a pet door to eat pet food, and skunks causing damage to landscaping, gardens, and golf courses from feeding activities. On average, WS-Nebraska has received reports of or verified nearly 386 damage or threat occurrences to property per year in Nebraska (see Table 1 and Table 4). Between FY 2010 and FY 2015, WS-Nebraska has received requests for assistance to manage damage or threats to property associated with striped skunks, coyotes, raccoons, bobcats, opossum, red fox, and feral cats. In total, predators have caused $193,986 in verified or reported damages to property in Nebraska from FY 2010 through FY 2015.

WS-Nebraska has received reports of or verified loss or injuries to pets and hobby animals caused by bobcats ($660), coyotes ($2,720), red fox ($2,805), badger ($400) raccoon ($1,035) and striped skunks ($1,500). Predators can kill or injure pets and hobby animals, especially in urban and suburban areas. Predators in suburban and urban areas often have adapted to human altered habitats and have the presence of people. Coyotes can be territorial and aggressive, especially during the breeding season and especially toward other canids, such as dogs. When coyotes adapt to and acclimate to the presence of people, they can act aggressive and attack pet dogs, even when people walk those dogs on a leash. Deer are a primary food source for mountain lions. Deer often thrive in urban and suburban areas due to availability of food and water. The presence of high deer densities in urban and suburban areas can attract mountain lions to those areas as the mountain lion population increases in Nebraska since the early1990's. Pets and hobby animals often are easy prey items for coyotes and mountains lions because they are confined inside an enclosure or are generally less wary than other prey. Damage to other property has also been reported to or verified by WS-Nebraska associated with raccoons ($29,300), badgers ($20,200) and striped skunks ($11,670).

1.5.4 Human Health and safety

Zoonoses (*i.e.*, wildlife diseases transmissible to people) are a major concern of cooperators when requesting PDM assistance. Disease transmission could occur from direct interactions between people and animals or from interactions with pets and livestock that have direct contact with wild predators. Pets and livestock often encounter and interact with wild mammals, which can increase the opportunity of transmission of disease to humans. These include viral, bacterial, mycotic (fungal), protozoal, and rickettsial diseases.

Individuals or property owners that request assistance with disease threats frequently are 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 human health or safety 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 human health 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 assistance from WS-Nebraska.

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. Rabies 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 *Mephitis mephitis*), and bats (Order Chiroptera) (CDC 2011).

Over the last 100 years, the vector of rabies in the United States has changed dramatically. About 90% or greater of all animal cases reported annually to CDC now occur in wildlife (Krebs et al. 2000, CDC 2011). 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 two people per year in the 1990s. 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 (CDC 2011). 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, exceeding $300 million annually. 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 (CDC 2011).

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 40,000. 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 five doses of vaccine given over a 4-week period typically exceeds $1,000 (CDC 2011) and has been reported to be as high as $3,000 or more (Meltzer 1996). 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 Massachusetts involving contact with, or drinking milk from, a single rabid cow required PEPs for 71 persons (CDC 1999). The total cost of this single incident exceeded $160,000 based on a median cost of $2,376 per PEP in Massachusetts.

The most expensive single mass exposure case on record in the United States occurred in 1994 when a kitten from a pet store in Concord, New Hampshire tested positive for rabies after a brief illness. Because of potential exposure to the kitten or to other potentially rabid animals in the store, at least 665 persons received post-exposure rabies vaccinations at a total cost of more than $1.1 million (Noah et al. 1995). The American Veterinary Medical Association (AVMA) estimated the total cost for this specific incident, including investigation, laboratory testing, and rabies immunoglobulin and vaccines was more than $1.5 million (AVMA 2004).

Rabies presents a human health 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.

In Nebraska, skunks and bats are the primary reservoir of rabies. The striped skunk (*Mephitis mephitis*) is frequently the source of rabies exposure to domestic livestock and pets and accounts for 54 percent of the Nebraska rabies cases from 2010 to 2015. 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 (Majumdar et al. 2005). The skunk variant of rabies may be found in the Midwest and California; however, skunks found throughout North America may be infected with different variants of rabies such as the raccoon variant. The distribution of rabies in skunks extends from Georgia to Maine east of the Appalachians, Texas 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 Alaska and parts of Texas. 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 human health given the close association of those animals with humans and companion animals. The topic of feral animals and their impacts on native wildlife and human health elicits a strong response in numerous professional and societal groups with an interest in the topic. Feral cats and dogs are considered by wildlife professionals to be 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 zoonoses 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. 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, cat scratch disease, and numerous parasitic diseases, including roundworms, tapeworms, and toxoplasmosis.

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 to occur. WS-Nebraska 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 abundant amount of food, water, and shelter found within those habitats.

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 (Canadian Broadcast Company 2009), 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 Nebraska. 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-Nebraska has received requests for assistance in Nebraska to reduce human health and safety concerns. Human health and safety concerns include disease threats from rabies and plague outbreaks where predators act as reservoirs, odor and noise nuisances from raccoons, opossums, and skunks under houses, and aircraft strike hazards from coyotes and fox crossing runways at airports or airbases. Typically, the biggest concern of the public is the threat of attack on people by large predators despite the rarity of those types of events. Mattson et al (2011) showed that mountain lion attacks peaked in the 1990's and then dropped and became stable after 2000. There have been no lion-caused fatalities documented in Nebraska. 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).

WS-Nebraska assists many residents, especially in urban and suburban areas, such as the Lincoln, and Omaha metropolitan areas concerned about coyote attacks on their pets and their apparent loss of fear toward people. Between FY 2010 and FY 2015, WS-Nebraska received reports of or verified damage or threat occurrences occurring to human safety associated with bobcats, coyotes, feral dogs, feral cats, red fox, mountain lions, opossum, raccoons, badgers, and striped skunks (see Table 1 and Table 4). Between FY 2010 and FY 2015, people requesting assistance reported to WS-Nebraska or WS-Nebraska verified 829 damage or threat occurrences involving human safety. Striped Skunks represented over 47% of those damage or threat occurrences, while coyotes represented only 6%. Predator attacks on people occur very rarely, but could result in requests for assistance under the current program.

1.5.5 Disease Surveillance and Monitoring

Public awareness and health 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 human safety where people encounter predators. WS-Nebraska has received requests to assist with reducing damage and threats associated with several predator species in Nebraska and could conduct or assist with disease monitoring or surveillance activities for any of the predator species addressed in this EA. Most disease sampling would occur ancillary to other wildlife damage management activities (*i.e.*, disease sampling occurs after wildlife have been captured or lethally taken for other purposes). For example, WS-Nebraska may sample predators harvested during the annual hunting season or during other damage management programs or may collect ticks from raccoons that were lethally taken to alleviate damage occurring to property.

1.5.6 Natural Resources

Natural resources may be described as those assets belonging to the public and often managed and held in trust by government agencies as representatives of the people. Such resources may be plants or animals, including T&E species, historic properties, or habitats in general. Examples of natural resources are historic structures and places; parks and recreation areas; natural areas, including unique habitats or topographic features; threatened and endangered plants or animals; and any plant or animal populations which have been identified by the public as a natural resource. From FY 2010 to FY 2015, WS-Nebraska received reports of or verified 15 damage occurrences associated with predator damage to natural resources (see Table 1).

Similarly, WS-Nebraska received reports of or verified 195 threat occurrences associated with natural resources in the State (see Table 4).

Predation is one of many mortality factors that influence wildlife populations. Predators often play critical roles in the composition and function of wildlife populations in ecosystems (Witmer et al. 1996). Normally, predation by native predators would be considered part of the function of a healthy ecosystem.

Many of the predators addressed in this EA are native to Nebraska; however, many changes have occurred in the ecosystem within State that has disrupted natural predator-prey relationships. Many of the changes that have occurred can be attributed to human influence, including habitat fragmentation, landscape alteration, and environmental contamination. In addition, human habitation alone can often alter the biological carrying capacity of a local environment. Some species such as raccoons and skunks live in high densities because of human activity. Those human-induced changes can negatively affect the viability of some native wildlife populations.

Declines in bird populations associated with habitat loss and fragmentation may be compounded by predation (Cote and Sutherland 1997). The effects of predation on birds can be detrimental to local populations; especially, when predator densities are high or when predators gain access to areas not historically occupied (Stoudt 1982, Bailey 1993). In general, ground nesting birds suffer the highest predation rates (DeVos and Smith 1995).

Under certain conditions, predators, especially coyotes and mountain lions, can adversely affect mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*), and pronghorn antelope (*Antilocapra americana*) populations, and predation may not be 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). Connolly (1978) reviewed 68 studies of predation on wild ungulate populations and concluded that in 31 cases, predation was a limiting factor.

Mackie et al. (1976) documented high winter loss of mule deer to coyote predation in north-central Montana and stated that coyotes were the cause of most overwinter deer mortalities. Teer et al. (1991) documented that coyote diets contain nearly 90% deer during May and June and concluded from work done at the Welder Wildlife Refuge, Texas that coyotes remove a large portion of the fawns each year during the first few weeks of a fawn's 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), and Litvaitis and Shaw (1980). Mule deer fawn survival increased and was more consistent inside a predator-free enclosure in Arizona (LeCount 1977, Smith and LeCount 1976). Hamlin et al. (1984) observed that a minimum of 90% summer mortality of fawns was a result of coyote predation. Trainer et al. (1981) reported that heavy mortality of mule deer fawns during early summer and late autumn and winter was limiting the ability of the population to remain stable or increase. Other authors observed that coyotes were responsible for most of fawn mortality during the first few weeks of life (Knowlton 1964, White 1967).

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 1974*a*, Beasom 1974*b*) 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 in Texas 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.

Jones (1949) believed that coyote predation was the main limiting factor of pronghorn antelope in Texas. A six-year radio telemetry study of pronghorn antelope 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 antelope to the point where antelope were once again hunt able, whereas on areas without coyote damage management this increase was not noted. A similar observation of improved pronghorn antelope fawn survival and population increase following damage management has been reported by Riter (1941), Udy (1953), and Smith et al. (1986). Major losses of pronghorn antelope fawns to predators have been reported from additional radio telemetry studies (Beale 1978, Barrett 1978, Bodie 1978, Von Gunten 1978, Hailey 1979, Tucker and Garner 1980).

Coyote damage management on Anderson Mesa, Arizona increased the pronghorn 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 local coyote population in 1981, 28% in 1982, and 29% in 1983. Pronghorn antelope 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 antelope 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 antelope 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 kill sheep. Mooring et al. (2004) found that in New Mexico, rams had the highest predation rates and thought it was mostly from mountain lions. Rams often use habitat conducive to predation by lions, have poor post-rut body condition, and have impaired vision 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 killed more by mountain lions in proportion to their population, while 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).

The above cases show that coyote predation can influence white-tailed deer (*Odocoileus virginianus*), mule deer, bighorn sheep and pronghorn antelope 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 high mortality, but managing predation may or may not result in higher populations and increased harvest levels for hunters. Ballard et al. (2001) found that managing predation benefitted big game mostly when herds were well below forage carrying capacity, predation was identified to be a limiting factor, efforts sufficiently reduced the predator population, efforts were timed correctly (prior to fawning and denning), and management was focused on a small scale (<259 mi^2). Conversely, managing predation 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 predator management to benefit deer needed to be improved because it was unclear in several studies if predator management had a sufficient effect protecting deer herds. The most convincing evidence of deer population increases as a result of predator management were from studies conducted in small enclosures (< 15 mi^2) because predator populations were much easier to regulate in smaller areas.

Clearly, under some circumstances, managing predation can be an important tool in maintaining specific wildlife management objectives. Managing game species in Nebraska is the responsibility of the NGPC and any decision to managing predation to benefit local game populations would be the responsibility of the NGPC. However, WS-Nebraska could provide assistance if requested by the NGPC. A major goal of WS-Nebraska 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).

Scientists estimate that nationwide cats kill hundreds of millions of birds and more than a billion small mammals, such as rabbits, squirrels, and chipmunks, each year. 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).

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 two-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).

Childs (1986) and Childs (1991) found that urban cats use of rats is size limiting. Few rats of reproductive size or age were preyed on by domesticated cats. In rural areas, rats were more vulnerable to cat predation for longer periods. The duration of susceptibility of rats to predation is attributed to abundance of garbage and artificial food sources in the urban environment. Artificial feeding of cats also reduces predation to non-native rodents because of size differences in urban rats. In rural setting, cats can control rat populations for longer durations but ultimate suppression of population growth is achieved via chemicals (poisons). Jackson (1951) found feral and free-ranging cats in Baltimore, Maryland urban areas were insignificant predators of Norway rats. The largest percentage of ingested food was comprised of garbage. It was estimated that a cat in the study area would consume roughly 28 rats per year.

Impacts from cat predation are not always direct, but indirect in the form of competition for food resources. George (1974) speculated that domestic cats were not a direct limiting factor on bird populations. However, the author did find evidence indicating cats indirectly could affect some birds-of-prey by competing for a limited resource (primarily microtine rodents).

WS-Nebraska may be requested to assist with preventing predation on other wildlife species. If a management agency finds that a particular species would be impacted by predation, WS-Nebraska could assist in determining if damage management efforts could help protect the species and implement necessary, if any, actions to prevent predation. In many cases, requests for assistance to manage damage to natural resources involve T&E species. For example, WS-Nebraska has assisted with the protection of the least terns (*Sternula antillarum athalassos*) and piping plovers (*Charadrius melodus*) from predators where the tern and plovers nest in the State.

1.6 NATIONAL ENVIRONMENTAL POLICY ACT AND WS DECISION-MAKING

The purpose of this Environmental Assessment (EA) is to evaluate cumulatively the individual projects conducted by WS-Nebraska in Nebraska to manage damage and threats to agricultural resources, property, natural resources, and threats to people caused by predators. This EA will assist in determining if the proposed cumulative management of damage could have a significant impact on the human environment based on previous activities conducted by WS-Nebraska and based on the anticipation of conducting additional efforts to manage damage caused by those species.

The goal of WS-Nebraska would be to conduct a coordinated program to alleviate damage caused by predators in accordance with the states plans, goals, and objectives developed to reduce damage pursuant to the MOU. WS-Nebraska is preparing this EA pursuant to the

National Environmental Policy Act (NEPA) 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 proposed activities; and 5) evaluate and determine if there would be any potentially significant or cumulative effects from the alternative approaches developed to meet the need for action. The analyses contained in this EA are based on information derived from WS' Management Information System, published documents (see Appendix A), interagency consultations, and public involvement.

The EA evaluates the need for action to manage damage associated with predators in the State, the potential issues associated with predator damage management, and the environmental consequences of conducting different alternatives to meet the need for action while addressing the identified issues. WS-Nebraska initially developed the issues and alternatives associated with predator damage management. The Nebraska Game and Parks Commission (NGPC) has regulatory authority to manage populations of most native wildlife species in the State of Nebraska. To assist with identifying additional issues and alternatives to managing damage associated with predators in Nebraska, this EA will be made available to the public for review and comment prior to the issuance of a Decision[2].

WS-Nebraska previously developed an EA that addressed activities to manage damage associated with predators in Nebraska (USDA 1999). Based on the analyses in that EA, a Decision and Finding of No Significant Impact were signed selecting the proposed No Action Alternative. The proposed No Action Alternative implemented a damage management program using a variety of methods in an integrated approach (USDA 1999). Changes in the need for action and the affected environment have prompted WS-Nebraska to initiate this new analysis to address predator damage in Nebraska. Additionally, this EA discusses the implementation of updated policies and directives that would be incorporated into all alternatives, as applicable. This EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on those changes.

This EA will: (1) assist in determining if the proposed management of damage associated with predators could have a significant impact on the environment for both people and other organisms, (2) analyze several alternatives to address the need for action and the identified issues, (3) coordinate efforts between members of WS-Nebraska, (4) inform the public, and (5) document the analyses of the environmental consequences of the alternatives to comply with the NEPA.

Since this EA will re-evaluate activities conducted under the previous EA to address the new need for action and the associated affected environment, the previous EA that addressed predator damage management in Nebraska will be superseded by this analysis and the outcome of the Decision issued for this EA.

[2]After the development of the EA by WS-Nebraska and consulting agencies and after public involvement in identifying new issues and alternatives, WS will issue a Decision. Based on the analyses in the EA after public involvement, a decision will be made to either publish a Notice of Intent to prepare an Environmental Impact Statement or a Finding of No Significant Impact will be noticed to the public in accordance to NEPA and the Council of Environmental Quality regulations.

1.7 WHAT ARE THE STATE OF NEBRASKA AUTHORITIES AND OBJECTIVES FOR MANAGING WILDLIFE DAMAGE?

The need for PDM in Nebraska was determined by WS-Nebraska, with input from the NDA, NGPC, University of Nebraska Cooperative Extension (UNCE), and USFWS, to define the objectives for the WS program in Nebraska. They are:

Livestock Protection: For cooperative agreements and agreements for control, Nebraska WS' objectives are to:

- Respond to requests for assistance with the appropriate action (technical assistance or direct control) as determined by Nebraska WS personnel, applying the Decision Model (Slate et al. 1992).

- Further develop cooperative partnerships with Federal, State, tribal and local agencies and private organizations working to reduce impacts of predators to agriculture, natural resources, property, and human health.

- Expand WS-Nebraska to protect agriculture, nature resources, property and human health.

- Monitor the implementation of nonlethal methods used by livestock producers that cooperate with the federal WS program in Nebraska.

- Respond to requests from the NGPC, USFWS, tribes and private entities for the protection of wildlife species dependent on funding.

- Involve the NGPC and USFWS in wildlife damage management planning to consider specific wildlife to be protected and public health and safety when designating a wildlife damage management program.

1.7.1 What Actions Are Outside of APHIS-WS' Authority?

It is important to remember that APHIS-WS does not have any regulatory 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/NMFS for ESA-listed species, the USFWS for migratory birds and eagles, and tribal governments on tribal lands.

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-Nebraska only conducts PDM following a request for assistance (Section 1.5 and WS Directive 2.201).

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

Each state has full authority and jurisdiction to manage the native wildlife within its boundaries, unless authority is granted to another governmental entity, such as the US Fish and Wildlife Service per the ESA, MBTA, or the Bald and Golden Eagle Protection Act (BGEPA).

In Nebraska, most native wildlife species are managed by NGPC per NSS §37. The US 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 811 as amended). The State of Nebraska has its own Endangered Species Act (NSS §37.801-811 includes the list of bird and animal species, with criteria identified in NSS §37-101-1510).

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-Nebraska has no authority for determining the appropriate management of wildlife populations that are under the jurisdiction of NGPC and NDA 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-Nebraska responds to governmental and non-governmental requesters for assistance in managing wildlife damage and threats.

For more details on the various federal and state laws regarding wildlife management and protection, see Section 1.15 and Appendix B.

1.8 HOW DOES WS-NEBRASKA COMPLY WITH NEPA?

1.8.1 How Does NEPA Apply to WS-Nebraska's PDM Activities?

WS-Nebraska 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-Nebraska implementation of PDM in Nebraska have prompted WS-Nebraska 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 NDA and NGPC regarding species under their jurisdiction; published and, when available, peer-reviewed scientific documents (Chapter 3); interagency consultations; public involvement; and other relevant sources.

This EA describes the needs for resolving predator damage problems for which WS-Nebraska 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-Nebraska involvement in PDM.

To assist with understanding applicable issues and reasonable alternatives to managing predator damage in Nebraska and to ensure that the analysis is complete for informed decision-making, WS-Nebraska 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 *Lincoln Journal Star* 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 1.10 and 1.11), WS-

Nebraska is coordinating the preparation of this EA with cooperating with agencies, including NGPC, NDA, FS, BLM, USFWS and the Nebraska extension services WS-Nebraska also recognizes the sovereign rights of Native American tribes to manage wildlife on tribal properties, and has invited all federally recognized tribes in Nebraska to cooperate or participate in the development of this EA. The WS-Nebraska program is committed to coordinating with all applicable land and resource management agencies including tribes when PDM activities are requested.

1.8.2 How Will this EA Be Used to Inform WS-Nebraska Decisions?

Based on agency relationships, MOUs, and legislative authorities, WS-Nebraska is the lead agency for this EA, and therefore, is responsible for the scope, content and decisions made. The USFWS, NGPC, NDA and UNCE provided input to the EA to ensure an interdisciplinary approach according to NEPA and agency mandates, policies, and regulations.

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

- What is the best strategy for allocating WS-Nebraska resources, and for working with cooperators to meet WS-Nebraska program objectives
- Which of WS-Nebraska methods are appropriate for inclusion in a WS-Nebraska?
- What are the environmental impacts of the alternatives for WS-Nebraska involvement in a cooperative coordinated WS-Nebraska?

1.8.3 What is the Geographic Scope of this EA and in What Areas would WS-Nebraska Action Occur?

This EA documents the need for predator damage management, the issues associated with meeting that need, and alternative approaches to address those issues and to meet the need for action. The mission of USDA APHIS Wildlife Services (WS) is to provide Federal leadership and expertise to resolve wildlife conflicts to allow people and wildlife to coexist. (See WS Directive 1.201). WS-Nebraska would only provide assistance when the appropriate property manager or property owner requested assistance. WS-Nebraska could receive a request for assistance from a property owner or manager to conduct activities on property they own or manage, which could include federal, state, tribal, municipal, and private land within Nebraska.

Chapter 2 of this EA discusses the methods available for use or recommendation under each of the alternative approaches evaluated[3]. The alternatives and Appendix B also discuss how WS-

[3]Appendix B contains a complete list of chemical and non-chemical methods available for use under the identified alternatives. However, listing methods neither implies that all methods would be used by WS-Nebraska to resolve requests for assistance nor does the listing of methods imply that all methods would be used to resolve every request for assistance.

Nebraska and other entities could recommend or employ methods to manage damage and threats associated with predators in the State. The actions evaluated in this EA are the use or recommendation of those methods available under the alternatives and the employment or recommendation of those methods by WS-Nebraska to manage 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 predator species by WS-Nebraska under the alternatives would only occur when agreed upon by the requester.

Geographical Area and Type of Land Designation

Federal, State, County, City, and Private Lands

Under four of the proposed alternatives, WS-Nebraska could continue to provide damage management activities on federal, state, county, municipal, and private land in Nebraska when WS-Nebraska receives a request for such services by the appropriate resource owner or manager. In those cases where a federal agency requests assistance from WS-Nebraska with managing damage caused by predators on property they own or manage, the requesting agency would be responsible for analyzing those activities in accordance with the NEPA. However, this EA could cover such actions if the requesting federal agency determined the analyses and scope of this EA were appropriate for those actions and the requesting federal agency adopted this EA through their own Decision based on the analyses in this EA. Therefore, scope of this EA analyzes actions that could occur on federal lands, when requested.

Private Property

Private and commercial property owners and/or managers of private property request WS-Nebraska for assistance to manage predator damage and threats. More than 90% 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.

Federal Property

WS-Nebraska responds to permittee and agency requests for predator damage management for protection of livestock on federal grazing allotments. WS-Nebraska 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 1.9). WS-Nebraska may also respond to requests for assistance with human health and safety incidents on federal lands. WS-Nebraska also responds to requests for assistance from the USFWS for protection of ESA-listed species.

State and Municipal Property

Activities are conducted on properties owned and/or managed by the state or Nebraska 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-Nebraska can also conduct PDM activities directly on state and city properties as agents for NGPC when requested, or independently.

Native American Lands and Tribes

WS-Nebraska would only conduct damage management activities on Native American lands when requested by a Native American Tribe. WS-Nebraska would only conduct activities after WS-Nebraska and the Tribe requesting assistance signed a MOU or Work Initiation Document[4]. 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-Nebraska and determining what methods would be available to alleviate damage, no conflict with traditional cultural properties or beliefs would likely occur. Those methods available to alleviate damage associated with 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 those activities that WS-Nebraska could employ on Native American lands, when requested and when agreed upon by the Tribe and WS-Nebraska.

Airports

Because habitat for small mammals, and small mammals that are prey for raptors may be found within fenced active airfields, these predators can become hazards to aircraft during are takeoffs and landings. WS-Nebraska receives requests for assistance and training from several airport authorities to address threats of aircraft strikes at some of the airports or airbases in Nebraska and may be requested for assistance at other airports in the future. WS-Nebraska currently provides services and/or training to several airports in Nebraska, including Lincoln Airport, Omaha Airport and Offutt Air Force Base.

Site Specificity

As mentioned previously, WS-Nebraska would only conduct PDM activities when requested by the appropriate resource owner or manager. This EA analyzes the potential impacts of predator damage management based on previous activities conducted on private and public lands in Nebraska where WS-Nebraska and the appropriate entities entered into a MOU, Work Initiation Document, Annual Work Plans, or other comparable document. The EA also addresses the potential impacts of PDM in areas where WS-Nebraska and a cooperating entity sign additional agreements for future work plans. Because the need for action would be to reduce damage and because the program's goals and directives would be to provide services when requested, within

[4]Prior to providing any direct operational assistance, a Work Initiation Document would be signed between WS-Nebraska and the appropriate property owner or manager that identifies the wildlife species to be addressed and the methods the cooperator has agreed to be implemented on property they own or manage.

the constraints of available funding and workforce, it is conceivable that additional PDM efforts could occur. Thus, this EA anticipates those additional efforts and analyzes the impacts of those efforts as part of the alternatives.

Many of the predator species addressed in this EA occur statewide and throughout the year; therefore, damage or threats of damage could occur wherever those predators occur. Planning for PDM must be viewed as being conceptually similar to the actions of other entities whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they would occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire departments, police departments, emergency clean-up organizations, and insurance companies. Although WS-Nebraska could predict some locations where predator damage would occur, WS-Nebraska could not predict every specific location or the specific time where such damage would occur in any given year. In addition, the threshold triggering an entity to request assistance from WS-Nebraska to manage damage associated with predators is often unique to the individual; therefore, predicting where and when WS-Nebraska would receive such a request for assistance would be difficult.

Chapter 2 of this EA identifies and discusses issues relating to PDM in Nebraska. The standard WS Decision Model (Slate et al. 1992; see WS Directive 2.201) would be the site-specific procedure for individual actions that WS-Nebraska could conduct in the State (see Chapter 2 for a description of the Decision Model and its application). Decisions made using the model would be in accordance with Policies described in this EA, as well as relevant laws and regulations.

Nebraska is the site-specific unit for which decisions are made within WS-Nebraska. The analyses in this EA would apply to any action that may occur in any locale and at any time within Nebraska by WS-Nebraska. In this way, WS-Nebraska believes it meets the intent of the NEPA with regard to site-specific analysis and that this is the only practical way for WS-Nebraska to comply with the NEPA and still be able to accomplish its mission.

1.9 AGENCIES INVOLVED IN THE EA AND THEIR ROLES AND AUTHORITIES

Below are brief discussions of the authorities of WS and other agencies, as those authorities relate to conducting wildlife damage management.

1.9.1 What if the Federal Law Authorizing Wildlife Services' Action?

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. 426) 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. 426c) 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."

1.10 HOW DOES WS-NEBRASKA WORK WITH FEDERAL AGENCIES?

U.S. Fish and Wildlife Service

The USFWS has the statutory authority to manage federally listed T&E species through the ESA of 1973 (16 U.S.C. 1531-1543, 87 Stat. 884). Authorization under Section 10 of the ESA allows WS to assist the USFWS with damage management for species such as the gray wolf (*Canis lupus*), should the need arise.

APHIS-WS has consulted with USFWS as required to comply with Section 7 of the Endangered Species Act and worked to develop and implement a Biological Assessment (BA) for the APHIS-WS program.
The USFWS has received the final BA prepared for WDM program in Nebraska including the effects determination made for the federal threated and endangered species from the program area. Based on the information in January 2017 the USFWS provided WS-Nebraska with an informal concurrence that supported WS-Nebraska's may effect, but is not likely to adversely affect, determination made for the following species:

Gray wolf, Northern long–eared bat, Whooping crane, Piping plover, Least tern, Rufa red knot, and Topeka shiner.

We acknowledge the determination that WDM activities in Nebraska would have no effect on the following species:

Black-footed ferret, Eskimo curlew, Pallid sturgeon, American burying beetle, Salt Creek tiger beetle, Scaleshell mussel, Colorado butterfly plant, Blowout penstomen, Western prairie fringed orchid, and Ute's ladies-tresses.

WS-Nebraska has standard operating procedures that benefit the conservation of federally listed species. Should any methods or the WDM Program area change, or during the term of the program, additional information on listed or proposed species or their critical habitat become available, or if new information reveals effects of the action that were not previously considered, consultation with the USFWS should be initiated to assess any potential impacts on listed species (see Appendix D).

U. S. Forest Service and Bureau of Land Management

The Forest Service and BLM have the responsibility to manage federal lands for multiple uses including livestock grazing, timber production, recreation and wildlife habitat, while recognizing the State's authority to manage wildlife populations. Both the Forest Service and BLM recognize the importance of managing wildlife damage on lands and resources under their jurisdiction, as integrated with their multiple use responsibilities. For these reasons, both agencies have entered into MOUs with WS to facilitate a cooperative relationship. BLM and National Forest System maps delineating restricted areas and areas closed to predator damage management are available at the appropriate federal office for public review.

United States Environmental Protection Agency (EPA)

The EPA is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which regulates the registration and use of pesticides.

1.11 HOW DOES WS-NEBRASKA WORK WITH STATE AGENCIES?

University of Nebraska Cooperative Extension (UNCE)

The UNCE through its Educators, Specialists and Assistants provides a wide range of information on the prevention and control of wildlife damage. The UNCE conducts educational programs pursuant to the Smith–Lever Act of 1914 (7 USC 341-349) and subsequent amendments.

WS-Nebraska would work cooperatively with local livestock associations and county governments to provide assistance for their constituents. WS-Nebraska would provide assistance with managing damage or threats associated with predators statewide in areas where funding was available. Activities could occur on both private and public lands.

Nebraska Counties

County boards may enter into cooperative agreements for the purpose of carrying on an organized wildlife damage management program within their respective counties. “For the purpose of carrying on an organized animal damage control program within their respective counties, the county boards may cooperate with the Animal and Plant Health Inspection Service of the United States Department of Agriculture, state agencies, private associations, and individuals in the control of coyotes, bobcats, foxes, badgers, opossums, raccoons, skunks, and other predatory animals in this state that are injurious to livestock, poultry, and game animals and the public health. The county boards may also undertake the control of commensal and field rodents, nuisance birds, and other nuisance wildlife if such rodents, birds, or wildlife are causing or are about to cause property damage or represent a human health threat. All control efforts shall be in accordance with the organized and systematic plans of the United States Department of

Agriculture and state agencies covering the management and control of animals, birds, and wildlife. (RSN 23-358).

“It is the intent of sections 23-358 to 23-361 and 81-2,236 that animal damage control service shall be available to every individual citizen or group of citizens of the state and that employment of such service shall be initiated by the individual or individuals desiring the control of the animals, birds, or wildlife listed in section 23-358 which are causing a problem for such individual or individuals.

In order to support the cost of managing and controlling the animals, birds, or wildlife listed in section 23-358, each county shall match funds supplied by any resident individual or group of individuals either living within the county or owning property therein, up to a maximum of one thousand dollars annually for any specific animal damage control program, and may furnish such additional money as the county board shall deem necessary for the funding of such programs. The county board of each county is authorized to make necessary expenditures from the general fund of the county, except that the portion supplied by each county shall not exceed fifty percent of the total animal damage control program cost, unless such county elects to bear the entire program cost under sections 23-358 to 23-361. The total animal damage control program portion paid by the individual user or users may include, but shall not be limited to, any funds levied under section 23-361 by each county board, but nothing in this section shall be construed to exempt any user from a general levy made by the county board under section 23-360.

A county desiring to cooperate with another county or counties for the establishment of animal damage control services as are set forth in sections 23-358 to 23-361 may enter into agreements and match funds for the establishment of an area program with the state or federal government pursuant to the terms and limitations set forth in section 81-2,236.”(RSN 23-358.01).

“In order to perform animal damage control, the county board of each county may make necessary expenditures from any funds of the county as are available for such purpose”. (RSN 23-359).

“The county board of each county in this state may levy upon every dollar of the taxable value of all the taxable property in such county, for the use of the county board in carrying out the animal damage control program, such amount as may be determined to be necessary therefor. The entire fund derived from such levy shall be set apart in a separate fund and expended only for animal damage control as defined by sections 23-358 to 23-360."(RSN 23-260).

“In order to provide additional means for carrying on an animal damage control program for the management and control of coyotes, bobcats, foxes, and other predatory animals destructive of sheep and cattle, county boards may levy in any year a tax of not to exceed twenty cents per head on sheep and cattle on the following conditions:

(1) That a petition to the county board requesting such levy, signed by sixty-seven percent of the owners of the sheep, the cattle, or the sheep and cattle in the county as of January 1 of each year, be filed with the board on or before July 1; and

(2) That a planned program for the management and control of such predatory animals be approved by the county board each year in which such levy is to be made. Such planned program may include entry in the animal damage control program authorized by section 23-358 or any other program approved by the board and designed to manage and control such predatory animals. The proceeds of such levy shall be placed in a separate fund and shall be applied exclusively to carrying out the program adopted. For each year in which such a levy is deemed necessary, a petition shall be presented to the county board for approval as provided in this section."(RSN 23-361).

Nebraska Game and Parks Commission (NGPC)

The NGPC is responsible for managing all protected and classified wildlife in Nebraska, including federally listed T&E species, despite the land class the animals inhabit (RSN 37-101, 37-204, 37-209, 37-211, 37-215, 37-301, 37-432, 37-432.01, 37-434). The NGPC is also authorized to cooperate with WS-Nebraska and NDA for controlling predatory animals. Nebraska law allows a farmer or rancher owning or operating a farm or ranch to destroy or have destroyed any predator, including raccoons and opossums, preying on livestock or poultry or causing other agricultural depredation on lands owned or controlled by him or her without a permit issued by the NGPC (RSN 37-201)

Coyotes are protected by game laws in Nebraska but and are not classified as furbearers under the RSN administered by NGPC. The NGPC is responsible for the issuance of aerial hunting permits per the Fish and Wildlife Act of 1956, as amended and for administering a program to reduce damage caused by predatory animals (RSN 37-458, 37-509).

The NGPC has responsibility for protecting endangered and threatened species under authority of the Nongame and Endangered Species Conservation Act (NESCA) (Neb. Rev. Stat. § 37-801 to 37-811). Since 2013, staff of the WS-Nebraska program, U.S. Fish and Wildlife Service, and NGPC have corresponded through emails, phone conversations and in-person meetings to develop a Biological Assessment (BA) evaluating potential impacts of Nebraska-WS activities on endangered and threatened species in Nebraska. The BA also describes WDM methods and standard operating procedures (i.e., conservation conditions) used to avoid and minimize such impacts. Staff of the NGPC have reviewed this information and provided a concurrence letter in December 2017 with the effect determinations listed in the BA for the species as follows:

May Affect, Not Likely to Adversely Affect: gray wolf, northern long-eared bat, river otter, southern flying squirrel, swift fox, Interior Least Tern, Mountain Plover, Piping Plover, *Rufa* Red Knot, Whooping Crane, Blacknose shiner, Finescale dace, Northern redbelly dace, Sturgeon chub, Topeka shiner, and western massasauga

No Effect: black-footed ferret, Eskimo Curlew, Lake sturgeon, Pallid sturgeon, American burying beetle, Salt Creek tiger beetle, scaleshell mussel, American ginseng, blowout penstemon, Colorado butterfly plant, saltwort, small white lady's slipper, Ute ladies'-tresses, and western prairie fringed orchid

This concurrence is based on a review of the material that WS-Nebraska, information exchanged via phone, email or in person, and the WS-Nebraska program's agreement and commitment to implementing the standard operating procedures (i.e., conservation conditions) as indicated in the BA. If WS-Nebraska's program activities change or if new species become listed, then we recommend further coordination with the Nebraska Game and Parks Commission Planning & Programming Division (see Appendix D).

Nebraska Department of Agriculture (NDA)

The NDA has an MOU with WS that establishes a cooperative relationship between WS and NDA outlines responsibilities and set forth objectives and goals for each agency for resolving wildlife Damage management conflicts in Nebraska. The NDA is authorized to make funds available for equipment, supplies and other expenses, including expenditures for personal services by WS, as may be necessary to execute the functions imposed upon NDA as provided by the general appropriation bill (Legislative Bill 392).

The NDA is responsible for regulating pesticide use in the State. Pesticides that would be available to manage predators would be registered and approved for use through the NDA. Personnel of WS-Nebraska that use any pesticide restricted-use pesticides must become a certified pesticide applicator by the NDA or be supervised by a certified applicator.

"The Director of Agriculture may contract and cooperate with the Animal and Plant Health Inspection Service of the United States Department of Agriculture in the management and control of (1) coyotes, bobcats, foxes, and other predatory animals listed in section 23-358 in this state that are injurious to livestock, poultry, and game animals and the public health, (2) black-tailed prairie dogs and other injurious commensal and field rodents, and (3) nuisance birds or other nuisance wildlife in accordance with organized and systematic plans of the Animal and Plant Health Inspection Service of the United States Department of Agriculture for the management and control of such animals. Supervision of the program shall be by the local representative of the Animal and Plant Health Inspection Service of the United States Department of Agriculture. Expenditure of funds appropriated by the Legislature may not be made without the approval in writing by the director. The director in cooperation with the Animal and Plant Health Inspection Service of the United States Department of Agriculture may enter into agreements with other governmental agencies and with counties, associations, corporations, or individuals when such cooperation is deemed to be necessary to promote the management and control of such predatory animals, black-tailed prairie dogs and other injurious commensal and field rodents, nuisance birds, or other nuisance wildlife. "(RSN 81-2,236)

"There is hereby created the Animal Damage Control Cash Fund. Such fund shall be administered by the Department of Agriculture. The fund shall consist of funds received from any source to carry out the animal damage control program pursuant to section 81-2,236. Any money in the fund available for investment shall be invested by the state investment officer pursuant to the Nebraska Capital Expansion Act and the Nebraska State Funds Investment Act."(RSN 81-2,237)

Nebraska Department of Human and Health Services (NDHHS)

The NDHHS is the state agencies with priorities of improving the health of Nebraskans, creating opportunities for self-sufficiency and independence, and to protect vulnerable people in the State from abuse, neglect, and exploitation. As part of those functions, the NDHHS is responsible for the monitoring, testing, and management of rabies within the State. Rabies remains a potentially serious public health problem in Nebraska and is a concern to a variety of professionals and occupational groups in Nebraska, including physicians, veterinarians, farmers and ranchers. WS-Nebraska has participated with the NDHHS in actively monitoring and testing for rabies in Nebraska.

1.12 DOCUMENTS RELATED TO THIS EA

Environmental Assessment: Predator Damage Management in Nebraska for the Protection of Livestock, Wildlife, Property and Public Health and Safety – WS-Nebraska has previously developed an EA that analyzed the need for action to manage damage associated with coyotes, feral dogs, red fox, gray fox, feral swine, bobcats, and raccoons in Nebraska (USDA 1997). The EA identified the issues associated with managing damage associated with several mammal species addressed in this EA in the State and analyzed alternative approaches to meet the specific need identified in those EAs while addressing the identified issues.

Changes in the need for action and the affected environment have prompted WS-Nebraska to initiate this new analysis to address damage management activities in the State. This EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on a new need for action, primarily a need to address damage and threats of damage associated with several additional species of mammals and to evaluate potential cumulative effects associated with those activities. Since WS-Nebraska is developing this EA to re-evaluate activities described in the previous EA to address the new need for action and the associated affected environment, the outcome of the Decision issued based on the analyses in this EA will supersede the analyses and Decision from the previous EA that addressed predators[5]. However, information in the need for action in the previous EA continues to be appropriate to the need for action associated with this EA (USDA 1997).

1.13 PUBLIC INVOLVEMENT

WS-Nebraska initially developed the issues associated with conducting predator damage management. WS-Nebraska defined the issues and identified the preliminary alternatives through the scoping process. As part of this process, and as required by the Council on

[5]The outcome of the Decision based on the analyses in this EA would only supersede those portions of the previous EA that related to coyotes, feral dogs, red fox, bobcats, striped skunks and raccoons, excluding the need for action addressed in the previous EA for those species (USDA 1997). That portion of the previous EA (USDA 1997) that evaluates the need for action and the issues associated with managing damage caused by predators remain valid and appropriate to activities conducted by WS-Nebraska.

Environmental Quality (CEQ) and APHIS implementing regulations for the NEPA, WS-Nebraska made this document available to the public for review and comment. WS-Nebraska made the document available to the public through legal notices published in local print media, through direct mailings to parties that have requested notification, or that WS-Nebraska has identified as having a potential interest in the reduction of threats and damage associated with predators in the State. In addition, WS posted this EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml for review and comment.

WS-Nebraska provided a minimum of a 30-day comment period for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS-Nebraska will clearly communicate to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. WS-Nebraska has fully consider new issues, concerns, or alternatives the public has identified during the public involvement period and determined whether WS-Nebraska should revisit the EA and, where appropriate, revised the EA prior to make any Decision.

1.14 WHY IS WS-NEBRASKA PREPARING AN EA RATHER THAN AN EIS?

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-Nebraska can make an informed decision on whether or not an EIS is required for the WS-Nebraska PDM activities included in this EA.

WS-Nebraska 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-Nebraska assistance to requesting entities in managing predator damage and threats to resources and assets, and threats to human safety and health. WS-Nebraska addresses all anticipated issues and reasonable alternatives in this EA.

This EA includes thorough and comprehensive analyses of the impacts and effectiveness of four alternative PDM programs in Nebraska, including no WS-Nebraska activities at all (Section 2.5), 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-Nebraska activities and alternatives in detail, and provides rationale for not considering other alternatives and issues in detail.

WS-Nebraska involves the public in its EA processes by providing for public comment on pre-decisional EAs, and agency involvement through providing for cooperating and commenting agency status and the opportunity to comment on an internal interagency draft prior to public release. WS-Nebraska will provide a 30-day review and comment period on the pre-decisional draft of the EA for the public and interested parties to provide comments regarding new issues, concerns, and/or alternatives. Using the guidance provided in 40 CFR §1506.6 for public involvement, WS-Nebraska will clearly communicate 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 will be identical to that used for the pre-decisional EA, with the addition of direct contact with commenters.

If WS-Nebraska 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-Nebraska 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)).

If the preparation of an Environmental Impact Statement (EIS) is not warranted based the analyses associated with this EA, WS would conduct reviews of activities conducted under the selected alternative to ensure those activities occurred within the parameters evaluated in the EA.

If WS-Nebraska determines that the analyses in this EA indicate that an EIS is not warranted (impacts are not significant per 40 CFR §1508.27; Section 1.14), this EA remains valid until WS-Nebraska 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 prepared pursuant to the NEPA.

WS-Nebraska 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.

1.14.1 How will WS-Nebraska Evaluate 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-Nebraska 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-Nebraska 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-Nebraska 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-Nebraska 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-Nebraska 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-Nebraska PDM program.

1.15 LAWS RELATED TO THIS EA

Several laws or statutes would authorize, regulate, or otherwise affect the activities of WS-Nebraska under the alternatives. WS-Nebraska would comply with applicable federal, 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 damage management activities that WS-Nebraska could conduct in the State.

National Environmental Policy Act

All federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS follows CEQ regulations implementing the 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. The 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 the NEPA (see 44 CFR 50381-50384).

Pursuant to the NEPA and the 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 the NEPA into agency actions. WS-Nebraska 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.

Endangered Species Act (ESA)

Under the ESA, all federal agencies will seek to conserve T&E species and will utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS-Nebraska conducts Section

7 consultations with the United States Fish and Wildlife Service (USFWS) 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 or threatened species . . . Each agency will use the best scientific and commercial data available*" (Sec.7 (a) (2)). Evaluation of the alternatives in regards to the ESA will occur in Chapter 3 of this EA.

Federal Insecticide, Fungicide, and Rodenticide Act

The FIFRA and its implementing regulations (Public Law 110-426, 7 USC 136 et. seq.) require the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing the FIFRA. The EPA and the Nebraska Department of Agriculture regulate chemical methods that could be available to manage damage associated with predators.

National Historic Preservation Act (NHPA) of 1966, as amended

The NHPA and its implementing regulations (see 36 CFR 800) require federal agencies to initiate the Section 106 process if an agency determines that the agency's actions are undertakings as defined in Sec. 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties. If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further obligations under Section 106. None of the methods described in this EA that would be available cause major ground disturbance, any physical destruction or damage to property, any alterations of property, wildlife habitat, or landscapes, nor would 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 available under the alternatives would not generally be the types of methods that would have the potential to affect historic properties. If WS-Nebraska planned an individual activity with the potential to affect historic resources under an alternative selected because of a decision on this EA, WS-Nebraska would conduct the site-specific consultation, as required by Section 106 of the NHPA, as necessary.

The use of noise-making methods, such as firearms, at or in close proximity to historic or cultural sites for the purposes of removing wildlife have the potential for audible effects on the use and enjoyment of historic property. However, WS-Nebraska would only use such methods at a historic site at the request of the owner or manager of the site to resolve a damage problem, which means such use, would be to the benefit of the historic property. A built-in minimization factor for this issue is that virtually all the methods involved would only have temporary effects on the audible nature of a site and could be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. WS-Nebraska would conduct site-specific consultation as required by the Section 106 of the NHPA as necessary in those types of situations.

The Native American Graves and Repatriation Act of 1990

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. Federal agencies are to discontinue work until the agency has made a reasonable effort to protect the items and notify the proper authority.

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.

Federal Food, Drug, and Cosmetic Act (21 USC 360)

This law places administration of pharmaceutical drugs, including some chemical methods used for wildlife capture and handling, under the Food and Drug Administration.

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 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-Nebraska 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.

Airborne Hunting Act

The Airborne Hunting Act, passed in 1971 (Public Law 92-159), and amended in 1972 (Public Law 92-502) added to the Fish and Wildlife Act of 1956 as a new section (16 USC 742j-l) that prohibits shooting or attempting to shoot, harassing, capturing or killing any bird, fish, or other animal from aircraft except for certain specified reasons. Under exception [16 USC 742j-l, (b)(1)], state and federal agencies are allowed to protect or aid in the protection of land, water, wildlife, livestock, domesticated animals, human life, or crops using aircraft.

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

Executive Order 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. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minority and low-income persons or populations. This EA will evaluate activities addressed in the alternatives for their potential impacts on the human environment and compliance with Executive Order 12898.

WS-Nebraska would use only legal, effective, and environmentally safe PDM methods, tools, and approaches. The EPA through the FIFRA, the Nebraska Department of Agriculture, the United States Drug Enforcement Agency, MOUs with land managing agencies, and WS' Directives would regulate chemical methods that could be available for use by WS-Nebraska pursuant to the alternatives. WS-Nebraska would properly dispose of any excess solid or hazardous waste. The NWSP 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 public health and safety and property damage.

Protection of Children from Environmental Health and Safety Risks - Executive Order 13045

Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. WS-Nebraska makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. WS-Nebraska has considered the impacts that this proposal might have on children. The proposed activities would occur by using only legally available and

approved methods where it is highly unlikely that activities conducted pursuant to the alternative would adversely affect children. For these reasons, WS-Nebraska concludes that it would not create an environmental health or safety risk to children from implementing the alternatives. Additionally, the need for action identified a need to reduce threats to human safety, including risks to children; therefore, cooperators could request assistance with reducing threats to the health and safety of children posed by predators.

Invasive Species - Executive Order 13112

Executive Order 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 Order 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.

Hunting from aircraft; unlawful; exception; violation; penalty.

Nebraska State Statutes, Chapter 37, section 509 it shall be unlawful for any person (a) while airborne in any aircraft to shoot or attempt to shoot for the purpose of killing any bird, fish, or other animal, (b) to use any aircraft to harass any bird, fish, or other animal, (c) to knowingly participate in using any aircraft for such purposes unless he or she is the holder of a currently valid permit issued under section 37-458 and engages only in activities permitted by such permit, or (d) to shoot or attempt to shoot any coyote from an aircraft under the authority of a permit issued under section 37-458 unless permission has first been obtained from the landowners or tenants over whose land the aircraft is to be used to shoot or attempt to shoot coyotes.

Shooting coyotes from aircraft; permit holder; report.

The holder of a permit issued under section 37-458 shall report to the commission, not later than fifteen days after the end of each calendar quarter, the number of coyotes taken during such quarter.

Nebraska Fur-bearing animals
Nebraska State Statutes, Chapter 37, section 226 defines fur-bearing animals to mean all beaver, martens, mink, muskrats, raccoons, opossums, otters, bobcats, gray foxes, red foxes, badgers, long-tailed weasels, Canada lynx, and skunks, except mutation minks and mutation foxes.
Destruction of predators; permit required; when; mountain lion: action authorized.
Nebraska State Statutes, Chapter 37, Section 559

(1) Any farmer or rancher owning or operating a farm or ranch may destroy or have destroyed any predator preying on livestock or poultry or causing other agricultural depredation on land owned or controlled by him or her without a permit issued by the commission. For purposes of this subsection, predator means a badger, bobcat, coyote, gray fox, long-tailed weasel, mink, opossum, raccoon, red fox, or skunk.
(2) Any farmer or rancher owning or operating a farm or ranch, or his or her agent, may kill a mountain lion immediately without prior notice to or permission from the commission if he or she encounters a mountain lion and the mountain lion is in the process of stalking, killing, or consuming livestock on the farmer's or rancher's property. The farmer or rancher or his or her agent shall be responsible for immediately notifying the commission and arranging with the commission to transfer the mountain lion to the commission.
(3) Any person shall be entitled to defend himself or herself or another person without penalty if, in the presence of such person, a mountain lion stalks, attacks, or shows unprovoked aggression toward such person or another person.
(4) This section shall not be construed to allow a farmer or rancher or his or her agent to destroy or have destroyed species which are protected by the Nongame and Endangered Species Conservation Act or rules and regulations adopted and promulgated under the act, the federal Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq., the federal Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq., the federal Bald and Golden Eagle Protection Act, as amended, 16 U.S.C. 668 et seq., the federal Migratory Bird Treaty Act, as amended, 16 U.S.C. 703 et seq., or federal regulations under such federal acts.

Nebraska State Statues, Chapter 54, Section 604 states that;

"*Any person shall have the right to kill any dog found doing any damage as mentioned in sections 54-601 and 54-602 to any sheep or domestic animal, or if he shall have just and reasonable ground to believe that such dog has been killing, wounding, chasing or worrying such sheep or animal; and no action shall be maintained for such killing."*

1.16 WHAT IS THE EFFECTIVENESS OF THE NATIONAL APHIS-WS PROGRAM?

1.16.1 What are 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 (Section 2.3.5) 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 ([reference target, non-target and trophic] Sections 3.2.1 and 3.2.2).

The use of non-lethal methods described in Appendix A, 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.

The common factor when using any PDM method is that new or the original individual predators return if the attractive conditions continue to exist at the location where damage occurred and predator densities and/or the availability of transient/juvenile animals are sufficient to reoccupy all available habitats. One of WS-Nebraska objectives is to ensure that all PDM actions cumulatively would not cause adverse effects on statewide target or non-target species populations (Sections 3.2.1 and 3.2.2). Therefore, WS-Nebraska policy is not to cause population-wide or even localized long-term adverse impacts to the target species' populations (unless to meet NGPC 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. NGPC policy is to euthanize all captured coyotes and smaller predators and to never relocate problem animals, because of the healthy size of the populations statewide and the high risk associated with

relocating wildlife. These NGPC 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.

1.16.2 How Has the US Government Evaluated 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 in conducting the mission of the agency and cost-effective.

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."

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 specialists 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.

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 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.

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 zoonoses,
- 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.

1.16.3 Are Field Studies of Effectiveness of Lethal PDM for Livestock Protection Sufficient for Informed Decision-Making?

An analysis of effectiveness of each of the WS-Nebraska alternatives considered in detail is found in Section 3.2. 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 3.3.

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 robust and effective as possible. The APHIS-WS NWRC collaborates with experts from around the world to conduct these studies and findings that 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 PDM 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."

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.

1.17 WHAT ROLE DOES COST-EFFECTIVNESS PLAY IN WDM AND NEPA?

A common concern expressed by commenters about government-supported predator damage management is whether the value of livestock or game population losses are less than the cost of using at least some public funds to provide predator damage management services. However, this concern indicates a misconception of the purpose of predator damage management, 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. Predator damage management 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 1.17.5). 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 predator damage management program is inherently difficult and very complex (Shwiff and Bodenchuk 2004). Relevant scientific literature suggests that, in the absence of predation management, predation rates on livestock would likely increase (Bodenchuk et al. 2002; Section 1.17.5).

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 1.17.5). Section 1.17.4 discusses other factors, complexities, and methods involved in evaluating the economic values of predator damage management.

1.17.1 Does APHIS-WS Authorizing Legislation Require an Economic Analysis?

No. The statute of 1931, as amended does not incorporate consideration of economic valuations and cost-effectiveness for the WDM program as part of decision-making (Section 2.3.5). In addition to authorizing the WDM services, it provides for entering into agreements for collecting funds from cooperators for the services the agency provides.

1.17.2 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-Nebraska 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.

Cost-effectiveness is not the primary goal of APHIS-WS. Additional constraints, such as 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 predator damage management 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 3 and the agency's decision based on all considerations, including non-quantifiable values, will be explained in the decision document.

1.17.3 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 need for large capital improvement projects that use or impact large quantities of natural resources are typically already approved and funded by Congress through legislation; the agency decisions remaining are specifically how to meet the approved need through the consideration of the cost-effectiveness of alternative means, as mandated by Congress through consideration of the NED at the national level. These 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.

1.17.4 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 predator damage management 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. 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.

1.17.5 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 predator damage management, 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 2.3.5 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 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 or using 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.

1.17.6 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 3.2.1 and 3.2.2), ecosystem services and biodiversity (Section 3.2.5), [sociocultural/wildlife values] and impacts to recreation (Section 3.2.4]).

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 2.6, Alternatives Not Considered in Detail.

1.17.6.1 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 1.15), 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-Nebraska 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-Nebraska is aware of beliefs that federal wildlife damage management should not be allowed until economic losses become "unacceptable," (Section 1.4.3) and that livestock losses should be considered as a cost of doing business by producers. WS-Nebraska 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-Nebraska 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 2.3.5).

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.

1.17.6.2 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). Nebraska 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 (aka the 2014 Farm Bill) 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 argues 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.

1.17.6.3 Livestock Producers Should Pay All Costs of PDM

The Act of 1931, 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 Nebraska, this funding is made up of about 31% from Congressional appropriations, 18% from federal and state interagency agreements, and 51% from private or commercial cooperators. Cooperators pay the costs of non-lethal actions taken, even when recommended by WS-Nebraska personnel, and a substantial proportion of the cost for WS-Nebraska efforts, including WS-Nebraska administrative overhead.

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

1.17.6.4 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-Nebraska may rarely loan harassment equipment on very limited circumstances. The State of Nebraska 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 1.14.5 and 2.7.24).

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

1.17.6.5 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.

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

NGPC has identified limited circumstances for which PDM for protection of native game species of mule and white-tail deer, elk, pronghorn and bighorn sheep especially related to predation, would meet Commission objectives (Section 3.2.1.1). NGPC conducts administrative removals of offending animals itself, it can hire WS-Nebraska, it can use commercial wildlife damage management companies, or it can certify, train, and use volunteer agents.

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

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

APHIS-WS address liability for pet dog's incidental killings claims to be addressed through the tort claims office. 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 Nebraska, the primary responder to damage caused by dogs is either a local animal control authority or the Nebraska State Police. However, WS-Nebraska can respond upon request for assistance with dogs to damage to agriculture, livestock, to protect human health or safety, and at airports and airfields, some of which may be caused by feral or free-ranging dogs.

WS-Nebraska 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. Nebraska NRS §54-607 provides for counties and cities to pass ordinances prohibiting dogs from running at large, including pets. NRS §§54-604 provides for liability against dog owners for dogs engaged in killing, wounding, injuring, or chasing livestock and NRS §54-601 allows for liability if the dog causes injury or property damage, as well as disposition of the offending dog.

The primary concern, however, is when WS-Nebraska 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-Nebraska 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 2.6). 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.

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

1.17.6.8 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 Nebraska, this authority does not yet exist in the state.

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

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

1.17.7.1 What is the Marin County Predator Damage Replacement Program?

In 2003, concomitant with severe fiscal issues affecting the State of California's budget, California's Vertebrate Pest Control Research Advisory Committee funded a comprehensive economic assessment of APHIS-WS operations in the state (Shwiff *et al*. 2005, Shwiff *et al*. 2006). At the time, the WS-California program had cooperative service agreements and memoranda of understanding with 40 of the 58 counties. Each cooperating county provides funds for WS-California operations. While most farmers and ranchers have long offered testimony to the savings incurred from WS-California activities related to predator control, analyses to substantiate these claims were lacking. Shwiff *et al*. (2006) summarizes the results of the study for FY 2003 and 2004, including a comparison with the livestock replacement program in Marin County, which did not include lethal predator management.

WS-California District Supervisors responded to a survey, with validation from the APHIS-WS Management Information Service (MIS) database, that the primary reasons for requests for assistance with predator damage protection for sheep, cattle, and goats; health and human safety; natural resources protection (including services to protect riparian areas, trees and timber, and rangeland; and protection of property, such as buildings, landscaping, and irrigation and dams. These services are considered to have economic values that cannot be determined using market valuations. Therefore, a value for the WS-California services that would be replaced (replacement-cost method) is inferred by finding similar market values where the price or quantity change was used to represent the missing market value, with the focus on livestock (sheep and cattle) protection replacement and human health and safety/natural resources/property replacement.

Marin County, California, near San Francisco, created an equivalent program for protection of commercial sheep enterprises, called the Ranch Improvement/Non-Lethal Control and Indemnity Plan, which estimates the costs associated with replacing PDM services and associated costs provided by WS-California with non-lethal methods only. The Plan originally involved: 1) monetary reimbursement to ranchers for their costs associated with creating protective facilities and improvements such as fencing, guard dogs, and scare devices; and 2) indemnification – compensation for livestock lost to predation, using market price/head lost.

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. The Marin County program provides an annual subsidy to enrolled landowners for the purchase or maintenance of nonlethal/exclusionary

equipment. It requires no receipts be turned in or reporting of application of methods, resource protection numbers, predation losses, or any other measure of success.

Initially, producers who qualified for the program could also receive compensation for sheep and lambs 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.

1.17.7.2 How Do the Costs of the Marin County Program Compare to WS-California Program?

Shwiff *et al*. (2005) evaluated the replacement-cost methods using predation rates of 1.5% for year 1 and 3.2% for year 2, based on the number of lambs lost to predators in each year and a hypothetical lamb crop of 1.5 lambs/ewe. Indemnification costs at these levels of predation were calculated by multiplying the number of lambs lost to predation by the market price given in the livestock protection replacement program ($70/head at year 1 and $82/head in year 2). The total cost of replacing the WS-California services in each cooperating county was evaluated as the cost of monetary reimbursement for protection improvements and indemnification for losses that each county would incur under this replacement program as experienced in Marin County.

To estimate the costs of replacing the WS-California services for capturing and removing animals that pose health or human safety threats or cause damage to natural resources or property, the costs of pest control providers across California were averaged based on telephone surveys, resulting in multiplying the number of incidents documented in the WS-California MIS database by $170.00 for most cases and by $395.00 for coyote incidents, considering a single trap setup and animal capture (costs are not directly comparable because WS-California field personnel would set multiple traps and capture multiple animals for each task). Since private commercial operators in California would not provide costs for removal of large predators such as cougar and bears, the multiplier for these species was developed using the multiplier for coyote, recognizing that the replacement cost was likely higher.

Assuming that WS-California activities prevented or suppressed wildlife-caused damages in cooperating counties, damage to agriculture, health and human safety, natural resources, and property would likely increase in the absence of a federal program. The damage-avoided cost used the value of livestock protected and jobs saved or protected that support the livestock industry in the county as a measure of the benefits provided by WS-California that would be replaced, using an input-output model. The change inputted into the model was the increase in expected predation rates for both sheep and cattle, based on the literature and predation rates in

Marin County under the livestock protection replacement program, resulting in increased predation rates for sheep at 2%, 2.5%, and 3% and for cattle at 1%, 1.5%, and 2%. The savings in damage costs avoided in the livestock sector was measured by the amount of revenue and the number of jobs affected by having the WS-California acting in each county. The benefit of human health and safety, natural resources, and property protection was determined by estimating a hypothetical increase in the amount of damage under each category (assuming increases of 25%, 50%, and 100% for projected damage).

The study found that the costs of replacing WS-California activities with private activities for WDM in the cooperating counties was almost $174,000 in year 1 and over $226,000 in year 2, while county share to WS-California for providing those services averaged almost $52,000, showing substantial savings using the federal program. Assuming that damage from wildlife would increase from 25% to 100% without WS-California activities, the counties would have incurred between $5,759,000 and $10,636,000 in additional expenses. The net value of WS-California operations was calculated to range from approximately $10,394,000 and $17, 257,000.

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 WS-California program achieves economy of scales that individual replacement programs cannot, such as the ability to use a broad spectrum of methodologies and resources to address wildlife damage problems. Therefore, it was assumed that rates of predation would be higher and resulting damages greater with only compensation for non-lethal activities and indemnification. Cooperating counties also receive indirect benefits from the WS-California program, such as federal compliance with NEPA and ESA, training and certification of field personnel in firearm and chemical use and disposal, access to research and study results and technical support on diverse pesticide registration and use issues, provided by the APHIS-WS National Wildlife Research Center, and best management practices for capture and handling of problem wildlife.

CHAPTER 2: ISSUES AND ALTERNATIVES

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impact analysis in Chapter 3 (Environmental Consequences), issues that have driven the development of Policies, and issues that WS-Nebraska did not consider in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues. Additional descriptions of the affected environment occur during the discussion of the environmental effects in Chapter 3.

2.1 ISSUES USED TO DEVELOP ALTERNATIVES

Issues are concerns regarding potential effects that might occur from a proposed action. Agencies must consider such issues during the NEPA decision-making process. Initially, WS-Nebraska developed the issues related to managing damage associated with predators in consultation with the NGPC. In addition, WS-Nebraska will invite the public to review and comment on the EA to identify additional issues.

2.1.1 Issue 1- Effects of PDM on Target Species Populations

Predators play a vital role in a healthy ecosystem; therefore, a common issue when addressing damage caused by wildlife is the potential impacts of management actions on the populations of target species. Lethal and non-lethal methods will be considered when resolving wildlife damage or threats to human safety.

Non-lethal methods are used to attempt to disperse or otherwise make an area unattractive to target species with the goal of reducing the presence of those species at the site and potentially the immediate area around the site where an entity employed those methods. Employing lethal methods would remove a predator or those predators responsible for causing damage or posing threats to human safety. Therefore, the use of lethal methods could potentially result in local population reductions in the area where damage or threats were occurring. The number of animals removed from a population of a target species using lethal methods would be dependent on the number of requests for assistance received, the number of individual predators involved with the associated damage or threat, and the efficacy of methods employed.

The analysis in Chapter 3 will examine 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. Determinations based on population trends and harvest trend data, when available, are qualitative.

Many of the predator species addressed in this EA can be harvested in the State during annual hunting and/or trapping seasons and can be addressed using available methods by other entities

in the State when those species cause damage or pose threats of damage. Damage or threats caused by predators could also be reduced during state hunting and trapping seasons. Without hunting and trapping, the International Association of Fish and Wildlife Agencies (2004) estimated that wildlife damage would increase from $20 billion to $70 billion annually in the United States. Therefore, any damage management activities conducted by WS-Nebraska under the alternatives addressed would be occurring along with other natural process and human-induced events such as natural mortality, human-induced mortality from private damage management activities, mortality from regulated harvest, and human-induced alterations of wildlife habitat.

Under certain alternatives, WS-Nebraska could employ methods available to resolve damage and reduce threats to human safety that target an individual of a predator species or a group of individuals after applying the WS' Decision Model (Slate et al. 1992). Chapter 3 analyzes the effects on the populations of target predator populations in the State from implementation of the alternatives addressed in detail, including the proposed action. Information on predator populations and trends may be obtained from several sources including the fur harvest reports, damage complaints, ground surveys, aerial surveys, and published literature.

Impacts to Populations of Target Species

The analyses of these issues are inherently a cumulative impact analysis, because many direct and indirect factors impact a species' populations, including climate change, quality of and changes to habitat (such as human development or fires), consumptive uses, and a variety of sources of mortality.

2.1.2 Issue 2- Effects of PDM on Non-target Species Populations, Including T&E Species

The issue of non-target species effects, including effects on T&E species, arises from the use of non-lethal and lethal methods identified in the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently disperse, capture, or kill non-target wildlife. Appendix B describes the methods available for use under the alternatives.

There are also concerns about the potential for adverse effects to occur to non-target wildlife from the use of chemical methods. Chemical methods that would be available for use to manage damage or threats associated with those predator species addressed in this EA include immobilizing drugs, euthanasia chemicals, sodium cyanide, fumigants, and repellents. Chemical methods available for use to manage damage and threats associated with predators in Nebraska are further discussed in Chapter 3 and Appendix B. Concerns have also been raised regarding the potential effects of aircraft overflights on non-target wildlife.

The ESA states that all federal agencies *"...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* [Sec. 7(a)(1)]. The ESA requires that federal agencies consult with the appropriate implementing agency prior to undertaking any action that may take listed endangered or threatened species or their critical habitat. Chapter 3 discusses the potential effects of the alternatives on this issue.

In 2017 WS-Nebraska submitted the Final Biological Assessment for Wildlife Damage Management Activities in Nebraska to the USFWS and NGPC. WS-Nebraska requested an informal consultation with USFWS to comply with Section 7 of the Endangered Species Act. In January 2018, both the USFWS and NGPC provided WS-Nebraska with concurrence on the determinations outlined in the WS-Nebraska 2017 BA. Attached in Appendix D is the Concurrence Letter from the USFWS and Appendix E is the Concurrence Letter from NGPC.

Impacts to Populations of Non-target Species

The analyses of these issues are inherently a cumulative impact analyses, because many direct and indirect factors impact a species' population, including climate change, quality of and changes to habitat (such as human development or fires), consumptive and non-consumptive uses, and a variety of sources of mortality.

Relationship of Removal of Apex Predators/Trophic Cascades/Maintaining Biodiversity/Mesopredator and Prey Release/Ecosystem Services

The analysis of this issue is inherently a cumulative impact analysis, because many direct and indirect effects impact the complex interrelationships among and between trophic levels, habitat, biodiversity, and the species themselves. This analysis is based on scientific literature and the impact analyses for target and non-target species in Nebraska.

2.1.3 Issue 3- Effects of PDM on Human Health and Safety

These issues mostly involve direct effects (the risk of potentially "one-off" impacts) and not cumulative impacts, except possibly for Issue 5 (as many communities are adversely impacted by a variety of factors).

1. Potential exposure of WS-Nebraska employees to disease from handling animals
2. Potential for the public, employees, and surface water to be exposed to chemical such as pesticides, hazardous materials, immobilizing/euthanasia chemicals, pyrotechnics, and mechanical tools, such as traps, snares, shooting, during field operations
    - Public exposure
    - Employee exposure
    - Water quality
3. Employee crew safety during aerial shooting operations
4. Risk of employees being attacked or bitten by captured animals
5. Potential for impacts to Environmental Justice communities (Appendix B), adverse impacts to human communities even if not a disproportionate impact, and potential impacts to children (Appendix B)

An additional issue often raised is the potential risks to human safety associated with employing methods to manage damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse effects on human safety. Employees of WS-Nebraska could

use and recommend those methods that were legally available under each of the alternatives. Still, some concerns exist regarding the safety of methods available despite their legality and selectivity. As a result, this EA will analyze the potential for proposed methods to pose a risk to members of the public. Selection of methods, under the alternatives, would include consideration for public and employee safety.

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use or recommendation of chemical methods would include immobilizing drugs, euthanasia chemicals, fumigants, sodium cyanide, and repellents. The EPA through the FIFRA and the NDA would regulate pesticide use. The United States Drug Enforcement Agency and the United States Food and Drug Administration would regulate immobilizing drugs and euthanasia chemicals. In addition, the use of all chemical methods by WS-Nebraska would be subject to Nebraska laws and WS' Directives.

Another concern would be the potential for immobilizing drugs used in animal capture and handling to cause adverse health effects in people that hunt and consume the species involved. Among the species that WS-Nebraska could capture and handle under the proposed action, this issue would be a primary concern for wildlife species that people hunt and consume as food.

Most methods available to alleviate damage and threats associated with predators would be non-chemical methods. Non-chemical methods may include cultural methods, limited habitat modification, animal behavior modification, and other mechanical methods. Changes in cultural methods could include improved animal husbandry practices, altering feeding schedules, moving pastures, or night penning. Limited habitat modification would be practices that alter specific characteristics of a localized area, such as removing bushes to eliminate shelter locations. Animal behavior modification methods would include those methods designed to disperse predators from an area through harassment or exclusion. Behavior modification methods could include pyrotechnics, propane cannons, barriers, electronic guards, effigies, and flagging. Other mechanical methods could include cage traps, foothold traps, body-gripping traps, cable restraints, cannon nets, shooting, or the recommendation that a local population of predators be reduced using hunting and/or trapping.

The primary safety risk of most non-chemical methods occurs directly to the applicator or those persons assisting the applicator. However, risks to others do exist when employing non-chemical methods, such as when using firearms, cannon nets, pyrotechnics, or body-gripping traps. Most of the non-chemical methods available to address predator damage in Nebraska would be available for use under any of the alternatives and by any entity, when permitted. Chapter 3 further discusses the risks to human safety from the use of non-chemical methods as this issue relates to the alternatives. Appendix B provides a complete list of non-chemical methods available to alleviate damage associated with predators.

Another concern is the threat to human safety from not employing methods or not employing the most effective methods to reduce the threats that predators could pose. The need for action in Chapter 1 addresses the risks to human safety from diseases associated with certain predator

populations. The low risk of disease transmission from predators does not lessen the concerns of cooperators requesting assistance to reduce threats from zoonotic diseases. Increased public awareness of zoonotic events has only heightened the concern of direct or indirect exposure to zoonosis. Not adequately addressing the threats associated with potential zoonosis could lead to an increase in incidences of injury, illness, or loss of human life.

Additional concerns occur when inadequately addressing threats to human safety associated with aircraft striking predators at airports in Nebraska. Predators have the potential to cause severe damage to aircraft, which can threaten the safety of passengers. Limiting or preventing the use of certain methods to address the potential for aircraft striking predators could lead to higher risks to passenger safety. Chapter 4 further evaluates those concerns in relationship to the alternatives.

2.1.4 Issue 4- Effects of PDM Activities on Sociocultural Resources

Another issue commonly identified is a concern that damage management activities conducted by WS-Nebraska could conflict with recreational activities, such as hunting, fishing, wildlife viewing, sightseeing, horseback riding, camping, hiking, wood gathering, skiing, snowmobiling, and boating. Those species that are addressed in this EA can also be hunted and/or trapped during regulated seasons in Nebraska.

Potential impacts could arise from the use of nonlethal or lethal damage management methods. Non-lethal methods used to alleviate damage could reduce predator densities through dispersal in areas where damage or the threat of damage was occurring. Similarly, lethal methods used to reduce damage associated with predators could lower densities in areas where damage was occurring resulting in a reduction in the number of those species in the area where lethal methods were applied.

2.1.4.1 Historic Sites/Resources, Native Americans, Traditional Cultures and Ceremonial Values

Removal and reductions of predator populations and implementation of nonlethal PDM techniques are expected to reduce predator damage to historic resources, culturally significant resources and sites, native species hunting and wildlife viewing opportunities and adverse aesthetic impacts on parks and natural areas. In areas were predators are valued for traditional or ceremonial purposes, reductions in populations or changes in movements in distribution associated with damage management activities could have adverse impacts on cultural uses of predators. However, adherence to state, territorial and tribal management objectives for predators and consultation with tribes and other native peoples should help to reduce risks of adverse impacts.

Conversely, there may also be concerns that PDM actions conducted adjacent to historic, cultural or tribal sites where PDM is not permitted due to conflicts with the spiritual value or intended use of the site, may result in predators inhabiting areas where they had not previously occurred.

Fencing, while effective in protecting sensitive sites (Engeman et al. 2012), may also have adverse impacts on historic and cultural sites because of visual impacts, impacts on movement of native wildlife or the landscape and soil disturbance associated with fence construction. Noise and site disturbance associated with PDM and some carcass disposal methods (e.g., on-site burial, leaving on site) also have the potential to adversely impact historic sites/resources, and Tribal and other traditional cultural values and site uses. Compliance with the NHPA and consultation with tribes in accordance with Executive Order 13175 and APHIS Directive 1040.3 will be needed to prevent or minimize risk of these types of adverse impacts.

2.1.4.2 Hunting

Hunters who are concerned about the impact of predators on native species populations and hunting opportunities are likely to benefit from PDM actions and associated reduction or elimination of predator populations depending on the species that the hunters pursue. Removal or reductions in predator populations can adversely impact individuals who value predator hunting. In Nebraska where license revenues for predator hunting, reductions in the predators population may adversely affect income. However, information on the net balance between revenue from hunting and overall costs of managing the hunt and addressing predator damage is not available. Reductions in predator hunting may also adversely impact associated businesses including guides/outfitters, the travel industry, meat packaging plants and other businesses. The extent of the impact will depend largely in the size of the predator population and the duration of time it has been in the area and state, territorial and tribal regulations and management goals. In Nebraska the low or newly developed predator populations and/or regulations prohibiting hunting, impacts on hunting are likely to be minimal. Impacts may be less pronounced in States, Territories, and Tribal lands that seek to retain predator population for cultural reasons and sport harvest.

2.1.4.3 Impact of PDM on Private Recreational and Commercial Fur Harvest

A concern that has arisen is the impact that PDM would have on sportsmen. Game and non-game wildlife populations are not significantly impacted by WS-Nebraska PDM take allowing hunters ample opportunities for pursuit during seasons set by NGPC. WS-Nebraska PDM is highly directed to target individual animals and species in a given area, mostly on tribal and private lands, and can be conducted in low to high density predator areas. The goal of WS-Nebraska it to work a property until the damage has ceased. The amount of time it takes to successfully complete a PDM project is often longer than hunters or private fur trappers are willing to commit. Additionally, WS- Nebraska only conducts PDM in a small portion of Nebraska (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.

2.1.4.4 Other Outdoor Activities

Removal and reductions in predator populations and implementation of nonlethal PDM techniques are expected to reduce predator damage to native species populations, natural sites, and wildlife viewing opportunities, and adverse aesthetic impacts on parks and natural areas. Removal of predators may reduce safety concerns for individuals who choose to recreate in areas where predators occur and may increase their willingness to use these locations. Conversely, individuals who enjoy seeing predators on the landscape, and those who may feel that their aesthetic enjoyment of a site is impaired because of the knowledge that lethal methods may be adversely impacted by predator removal.

Some PDM methods have the potential to impact outdoor activities through disturbance (noise associated with aerial shooting, ground shooting, or frightening devices), or temporary reductions in access for the protection of human safety during damage management operations (e.g., temporary site closures when shooting or hunting with dogs are used). There may be aesthetic concerns regarding some on site methods of carcass disposal including odor and ground disturbance. Nonlethal methods such as fencing may also have impacts (visual, movement through site) on other outdoor activities.

Some individuals believe their recreational experiences on public lands would be impaired just by knowing that damage management activities could be occurring on those lands. Similarly, being deprived of the aesthetic experience of viewing or hearing coyotes or other predators because of activities conducted by WS-Nebraska could also diminish recreational experiences. Most of the land area in Nebraska is privately owned. However, WS-Nebraska could be requested to provide assistance on federal, state, county, and municipal properties within the State. Activities under the alternatives would only occur when the appropriate property owner or manager requested assistance from WS-Nebraska.

2.1.5 Issue 5 Humaneness and Ethical Perspectives of PDM

Ethical Concerns

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 wildlife damage management 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 also often contain an emotional component that can be variable 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 for 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).

Humaneness Concerns

The issue of humaneness, as it relates to killing or capturing of wildlife is an important but 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. Few premises are more obvious than that an animal can feel pain. Determining whether an animal is experiencing pain or suffering is difficult. Despite this difficulty, many manifestations of pain are shared by many animal species (AVMA 2013). The intensity of pain perceived by animals could be judged by the same criteria that apply to its recognition in human beings. If a condition causes pain in a human being, it probably causes pain in other animals. Suffering is a much abused and colloquial term that is not defined in most medical dictionaries. Neither medical nor veterinary curricula explicitly address suffering or its relief. Therefore, there are many problems in attempting a definition. Nevertheless, suffering may be defined as a highly unpleasant emotional response usually associated with pain and distress. Suffering is not a modality, such as pain or temperature. Thus, suffering can occur without pain; and although it might seem counter-intuitive, pain can occur without suffering (AVMA 2013). The degree of pain experienced by animals that are shot probably ranges from little to no pain to significant pain depending on the nature of the shot and the time until death. Since the connotation of suffering carries with it the connotation of time, it would seem that there is little or no suffering where death comes immediately.

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). Humaneness, as perceived by livestock and pet owners, requires that domestic animals be protected from predators because humans have bred the natural defense capabilities out of domestic animals. 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 Bowens 1982). The suffering apparently endured by livestock damaged in this manner is unacceptable to many people. 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.

Ethics and humaneness issues relating to each of the alternatives in this EA are discussed in Chapter 3 of this document (see 3.2.4.3: Effect of Socio-cultural Resources; Humaneness and Ethics).

2.1.6 Issue 6 Effects of PDM on Ecosystem Function

This issue concerns the impacts on the ecosystem due to the removal of predators during PDM. This issue addresses complex interrelationships among trophic levels, habitat, biodiversity, and wildlife populations. These are inherently indirect and cumulative impacts. The analysis of this issue is limited to the larger picture of the ecosystem effects, as opposed to effects on any particular species' population; however, impacts on wildlife populations are included in this analysis to the extent that they may affect the ecosystem. Effects on species' populations are analyzed under issues 1 and 2, described above.

2.2 WHAT ISSUES ARE NOT CONSIDERED IN DETAIL AND WHY?

WS-Nebraska identified additional issues during the scoping process of this EA. Discussion of those additional issues and the reasons for not further analyzing those issues is provided below.

2.2.1 A Loss Threshold Should Be Established Before Allowing Lethal Methods.

Concerns have been expressed that WS-Nebraska or other entities should establish a threshold of loss before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. In some cases, cooperators likely tolerate some damage and economic loss until the damage reaches a threshold where the damage becomes an economic burden. The appropriate level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and damage situations. In addition, establishing a threshold would be difficult or inappropriate to apply to human health and safety situations. For example, aircraft striking predators can lead to property damage and can threaten passenger safety if a catastrophic failure of the aircraft occurs because of the strike. Therefore, addressing the threats of aircraft strikes prior to an actual strike occurring would be appropriate.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah determined that a forest supervisor could establish a need for wildlife damage management if the supervisor could show that damage from wildlife was threatened (Civil No. 92-C-0052A January 20, 1993). Thus, there is judicial precedence indicating that it is not necessary to establish a criterion such as a percentage of loss of a particular resource to justify the need for damage management actions.

2.2.2 Appropriateness of Preparing an EA (Instead of an EIS) For Such a Large Area.

The appropriateness of preparing an EA instead of an EIS was a concern WS-Nebraska identified during the scoping process. Wildlife damage management falls within the category of actions in which the exact timing or location of individual activities can be difficult to predict well enough ahead of time to describe accurately such locations or times in an EA or even an EIS. Although WS could predict some of the possible locations or types of situations and sites where predator damage would occur, the program cannot predict the specific locations or times at which affected resource owners would determine a damage problem had become intolerable to the point that they request assistance from WS. In addition, WS-Nebraska would not be able to prevent such damage in all areas where it might occur without resorting to destruction of predator populations over broad areas at a much more intensive level than would be desired by most people, including WS-Nebraska and other agencies. Such broad scale population management would also be impractical or impossible to achieve within the policies and professional philosophies of WS-Nebraska.

Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (Kleppe v. Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, WS individual damage management actions could be categorically excluded (7 CFR 372.5(c)). WS intent in developing this EA has been to determine if the proposed action or the other alternatives could potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS. This EA addresses impacts for managing damage and threats to human safety associated with predators in Nebraska, to analyze individual and cumulative impacts, and to provide a thorough analysis.

In terms of considering cumulative effects, one EA analyzing impacts for the entire State would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If WS-Nebraska made 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-Nebraska would publish a notice of intent to prepare an EIS and this EA would be the foundation for developing the EIS. Based on previous requests for assistance, WS-Nebraska would continue to conduct PDM in a very small area of the State where damage was occurring or likely to occur.

2.2.3 A Site Specific Analysis should be made for Every Location Where Predator Damage Management Would Occur.

The underlying intent for preparing an EA is to determine if a proposed action might have a significant impact on the human environment. The EA development process is issue driven, meaning issues that were raised during the interdisciplinary process and through public involvement that were substantive, would be used to drive the analysis and determine the significance of the environmental impacts of the proposed action and the alternatives. Therefore, the level of site specificity must be appropriate to the issues listed.

The analysis in this EA was driven by the issues raised during the scoping process during the development of the EA. In addition to the analysis contained in this EA, personnel in WS-Nebraska would use the WS Decision Model (Slate et al. 1992) described in Chapter 3 as a site-specific tool to develop the most appropriate strategy for alleviating damage or threats of damage at each location. The WS Decision Model is an analytical thought process used by personnel of WS-Nebraska for evaluating and responding to requests for assistance.

As discussed previously, one EA analyzing impacts for Nebraska would provide a more comprehensive and less redundant analysis that allows for a better cumulative impact analysis. If a determination were made through this EA that the alternatives developed to meet the need for action could result in a significant impact on the quality of the human environment, then an EIS would be prepared.

2.2.4 Effects of Activities on Unique Characteristics of Geographic Areas.

A number of different types of federal and state lands occur within Nebraska, such as National Wildlife Refuges, Wildlife Management Areas, and National Grasslands. WS-Nebraska recognizes that some persons interested in those areas may feel that any activities, if conducted in those areas, would adversely affect the aesthetic value and natural qualities of the area. If WS-Nebraska were requested to conduct activities in those types of areas, WS-Nebraska would abide by federal and state laws, regulations, and policies to minimize any effect on the public and would abide by any restrictions imposed by the land management agency requesting WS-Nebraska PDM assistance.

2.2.5 Cumulative Effects on Wildlife Populations from Oil and Gas Development, Timber Harvesting, Land Development, and Grazing.

A concern identified is the potential effects of PDM activities on wildlife species when considered with past, present, and future effects from other activities, such as oil and gas development, timber harvesting, other land development actions such as residential subdivision development, and grazing. WS-Nebraska has no authority to affect decisions of other entities that engage in or approve such actions. Thus, they are not related or connected to activities that could be conducted by WS-Nebraska. The effects of such actions by other agencies and entities are part of the existing *environmental status quo* and would neither increase nor decrease because of activities that could be conducted by WS-Nebraska.

The following discussion is provided to give an example of what potential, if any, PDM activities conducted by WS-Nebraska could contribute to cumulative effects on wildlife species in Nebraska and the environment that have resulted from oil and gas development, timber harvest, land development, and grazing (the environmental baseline). Information related to those activities in Nebraska is not currently available.

Adverse effects on some wildlife could result from land management and development activities. Housing developments in rural areas have been recognized as having the potential to adversely affect wildlife by diminishing habitat (Gill 1999). Oil and gas development can adversely affect

certain wildlife species by reducing the amount of available habitat. Road building and establishment of well pads (sites where wells are drilled to pump oil or gas out of the ground) reduce habitat directly by removing vegetation that animals use for food and cover. Timber harvest can benefit some wildlife species while negatively affecting others (United States Forest Service 1998). For example, deer and elk generally benefit from the creation of openings in large expanses of mature forest. Roads established to support oil and gas development and timber harvest further indirectly reduce the amount of habitat effectively available to certain species because many of those species fear using areas where humans are traveling, which is considered a displacement effect caused by roads.

In an EIS covering oil and gas leasing and development in five Resource Areas in Colorado, the Bureau of Land Management stated that indirect impacts on some wildlife species would be from the loss of 17,900 acres of habitat over a 20-year period because of ground surface disturbance, which was considered minor compared to the 5.1 million acres of federal oil and gas mineral estate in the five Resource Areas evaluated (Bureau of Land Management 1991). Other impacts were qualitatively discussed but no quantitative measures of such effects were described in the EIS (Bureau of Land Management 1991). The Records of Decision issued by the Bureau of Land Management for oil and gas leasing and development in the five Resource Areas adopted a number of mitigation measures described in the EIS to protect wildlife habitat for the purposes of preventing substantial adverse effects on wildlife populations. The mitigation measures included habitat improvement efforts and stipulations or conditions on leases such as conditions of approval, no surface occupancy, and timing limitations, each designed specifically to protect important wildlife habitat. The Bureau of Land Management concluded that cumulative impacts on wildlife from implementing their proposed oil and gas development proposed action would be insignificant (Bureau of Land Management 1991).

WS-Nebraska reviewed all species considered sensitive in Nebraska (see Appendix B) and determined that PDM would have no or minimal effect on any of the species listed. WS-Nebraska also reviewed the alternatives for any potential for contributing to or causing significant adverse effects on any of those wildlife species identified in the affected environment components. WS-Nebraska evaluated the potential impacts on wildlife resources associated with mining, oil and gas development, timber harvest, and grazing and analyzed whether those actions had effects on the same wildlife resources as those wildlife resources affected by PDM that could be conducted by WS-Nebraska. Based on those evaluations, WS-Nebraska would not cumulatively add to potential impacts from land management activities (including mining, oil and gas development, and livestock grazing).

2.2.6 Effects of Livestock Grazing on Riparian Areas and Wildlife Habitat as a Connected Action to Damage Management Activities.

Based on other scoping process, some members of the public have expressed that livestock grazing is a *connected action* to PDM activities. However, a connected action implies that grazing is an *interdependent part* of damage management activities that depends on such activities for its justification, that it is *automatically triggered* by PDM activities, or that grazing *cannot and will not proceed* unless PDM occurs (40 CFR 1508.25).

Livestock grazing in Nebraska occurs on private property at the discretion of the property owner without involvement from WS-Nebraska or any activities conducted by WS-Nebraska. Therefore, livestock grazing is not automatically triggered by PDM conducted by WS-Nebraska, and it clearly can and does proceed in the absence of PDM assistance provided by WS-Nebraska.

Some public commenters have asserted that PDM activities to protect livestock cannot or would not proceed unless livestock grazing was occurring. If no livestock production occurred, there would be no need to protect livestock from predation and there would be no reason for the WS-Nebraska to conduct PDM for livestock protection if there were no livestock. Conversely, there would be no PDM actions to protect livestock if there were no predators. Damage management activities associated with predators could and do occur by other entities in Nebraska, whether the WS-Nebraska provides such assistance or not. 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.

As long as livestock producers experience economic losses from predators, activities to prevent or reduce losses would continue to occur whether assistance was provided by WS-Nebraska or not. In the absence of any involvement by WS-Nebraska, livestock owners and managers or authorized state agencies would continue to conduct damage management activities on their own. Even if some livestock producers went out of business due to economically severe predation in the absence of any assistance that does not mean livestock grazing would not continue. Some of those producers would be expected to sell their properties to other producers that may have a better economic ability to withstand predation losses.

Livestock grazing and its impacts on the environment and PDM activities conducted by non-federal entities does not have to comply with the requirements and provisions of the NEPA and would represent the *environmental status quo* for the human environment. PDM by private or non-federal entities would not be governed or restricted by the environmental laws that govern federal agencies, such as the NEPA and the preventive measures consultation requirements of Section 7 of the ESA. The only livestock grazing activities that are subject to the requirements of the NEPA would be those that were authorized by federal land management agencies to occur on federal lands, such as the Bureau of Land Management or United States Forest Service. Those federal agencies would prepare documents pursuant to the NEPA covering their authorization of livestock grazing on federal public lands and the potential environmental effects of livestock grazing.

2.2.7 Predator Damage Management Should Not Occur at Taxpayer Expense.

An issue identified is the concern that WS-Nebraska should not provide assistance at the expense of the taxpayer or that activities should be fee-based. Funding for activities could occur from federal appropriations, through state funding, county funds and through cooperative funding. Funding for activities of WS-Nebraska would occur through Work Initiation Documents with individual property owners or managers. Thirty three counties in Nebraska have made the decision to provide funding for PDM activities and have allocated funds for such activities. Currently, livestock producers and private resource owners with in these counties that request

assistance from WS-Nebraska must pay for about 50 percent of the costs associated with the assistance that would be provided by the WS-Nebraska. Additionally, PDM activities are an appropriate sphere of activity for government programs, since managing wildlife is a government responsibility.

2.2.8 Predator Damage Should Be Managed by Private Businesses.

Wildlife control agents and private entities could be contacted to reduce predator damage when deemed appropriate by the resource owner. In addition, the WS-Nebraska could refer persons requesting assistance to agents and/or private individuals under all of the alternatives fully evaluated in the EA.

WS Directive 3.101 provides guidance on establishing cooperative projects and interfacing with private businesses. WS-Nebraska would only provide assistance after receiving a request from the appropriate property owner or manager. When responding to requests for assistance, WS-Nebraska would inform requesters that other service providers, including private entities, might be available to provide assistance.

2.2.9 Effectiveness of Predator Damage Management Methods

Defining the effectiveness of PDM often occurs in terms of losses or risks potentially reduced or prevented. Effectiveness can also be dependent upon how accurately practitioners diagnose the problem, the species responsible for the damage, and how people implement actions to correct or mitigate risks or damages. To determine that effectiveness, WS must be able to complete PDM to minimize harm to non-target animals and the environment, while at the same time, using methods as humanely as possible. The most effective approach to resolving any wildlife damage problem would be to use an adaptive integrated approach, which may call for the use of several management methods simultaneously or sequentially (Courchamp et al. 2003).

The purpose behind integrated 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[6]. Efficacy is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS personnel, the guidance provided by WS directives and policies.

WS-Nebraska's PDM mission is to reduce conflicts with wildlife as requested and not to reduce/eliminate populations. Localized population reduction could be short-term with new individuals immigrating into the area or born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to return to pre-management levels eventually does not mean individual management actions were unsuccessful, but that periodic PDM may be necessary. The return of wildlife to pre-

[6]The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

management levels also demonstrates that limited, localized PDM methods have minimal impacts on species' populations.

WS-Nebraska often receives comments that lethal methods would be ineffective because additional predators would likely return to the area. Comments also claim that because predators return to an area after initial removal efforts were complete, the use of lethal methods gives the impression of creating a financial incentive to continue the use of only lethal methods. Those statements assume predators only return to an area where damage was occurring if WS-Nebraska or other entities used lethal methods. However, the effectiveness of non-lethal methods is often temporary and the time for which predator damage reoccurs following non-lethal or lethal PDM is site specific. The common factor when employing any method would be that predators would return if suitable conditions continued to exist at the location where damage was occurring and predator densities were sufficient to occupy all available habitats to the extent that damage occurs. Therefore, any reduction or prevention of damage from the use of methods addressed in Appendix B would be temporary if habitat conditions continue to exist that attract predators to an area where damage was occurring.

Therefore, any method that disperses or removes predators from areas would only be temporary if habitat containing preferred habitat characteristics continued to exist. Dispersing predators using non-lethal methods addressed in Appendix B often requires repeated application to discourage those animals from returning to locations, which increases costs, moves animals to other areas where they could cause damage, and would be temporary if habitat conditions that attracted those predators to damage areas remained unchanged. Some people could view dispersing and translocating predators as moving a problem from one area to another, which would require addressing damage caused by those predators at another location, which increases costs and could be perceived as creating a financial incentive to continue the use of those methods since predators would have to be addressed annually and at multiple locations. WS recommendation of or use of techniques to modify existing habitat or making areas unattractive to predators is discussed in Appendix B. The objective of WS-Nebraska would be to respond to requests for assistance with the most effective methods and to provide for the long-term solution to the problem using WS Decision Model.

PDM can be divided into short-term redistribution approaches and long-term population and habitat management approaches. Short-term approaches focus on dispersal of predators to limit use of an area where damage or threats were occurring. Short-term redistribution approaches may include prohibiting feeding, the use of pyrotechnics, propane cannons, effigies, and other adverse noise, erecting access barriers such as fencing, and repellents. Population reduction by limiting survival or reproduction, removing animals, and habitat modification would be considered long-term PDM solutions.

Dispersal methods would often be employed to provide immediate resolution to damage occurring until long-term approaches can be implemented or have had time to reach the desired result. Dispersing predators can often be a short-term solution that moves those predators to other areas where damages or threats could occur. Some short-term methods may become less effective in resolving damage as a predator population increases, as predators become more acclimated to human activity, and as predators become habituated to harassment techniques.

Non-lethal methods often require a constant presence at locations when predators were present and must be repeated every day or night until the desired results are achieved, which can increase the costs associated with those activities. Non-lethal methods may also require constant monitoring and maintenance to insure proper results. For example, fencing could be used to prevent access to a resource; however, constant monitoring of the fencing would be required and necessary repairs completed to ensure the use of fencing would be successful in preventing access to resources. Long-term solutions to resolving predator damage often require management of the population and identifying the habitat characteristics that attract predators to a particular location.

Research has shown that in areas without some level of damage management, losses of adult sheep and lambs to predators can be as high as 8.4 percent and 29.3 percent of the total number of sheep, respectively (Henne 1975, Munoz 1977, O'Gara et al. 1983). Additional research has indicated that sheep and lamb losses are generally lower where PDM was applied (Nass 1977, Tigner and Larson 1977, Howard and Shaw 1978, Howard and Booth 1981). The effectiveness of damage management activities can also be measured by public satisfaction. In a survey conducted by the Policy and Program Development program of APHIS, respondents indicated a high level of satisfaction with damage management activities conducted by the WS program nationwide (APHIS 1994).

Shwiff and Merrell (2004) reported a 5.4 percent increases in the numbers of calves brought to market when coyotes were removed by aerial operations. Bodenchuk et al. (2002) reported benefit-cost ratios of 3:1 to 27:1 for agricultural resource protection from predators. Wagner and Conover (1999) found that total lamb losses declined 25 percent on grazing allotments in which coyotes were removed by winter aerial operations five to six months ahead of summer sheep grazing. On allotments where no aerial operations occurred, total lamb losses only declined 6 percent. Confirmed losses to coyotes declined by 7 percent on allotments where aerial operation occurred, but increased 35 percent on allotments where no aerial operations occurred (Wagner and Conover 1999).

A recent study by Treves et al. (2016) criticizes certain research on lethal PDM methods and recommends suspension of these tools until more rigorous scientific studies prove their efficacy (Treves et al. 2016). The authors in this paper call for new study designs that use the same standards as those in controlled laboratory settings for biomedical research. NWRC research scientists have evaluated this paper and do not agree with the authors' assessment that existing research is flawed. There are important differences between research studies conducted in a field environment and studies in biomedical laboratory settings. Field research inherently brings in variables such as weather, varying habitat quality, and movement of wildlife that cannot be controlled. Assumptions must be made when trying to answer complex ecological questions in field settings. Scientists address and acknowledge these variability's using well-established and recognized field study designs, such as the switch-back and paired block designs. Additionally, Treves et al.'s (2016) critique of at least two studies by scientists currently working for WS did not accurately interpret or represent the studies' designs or results and raises questions regarding additional misrepresentations and errors in the paper.

APHIS Wildlife Services agrees that PDM tools and techniques must be based on rigorous, scientifically-sound principles. Researchers at NWRC are dedicated to gathering information, testing new ideas and methods, and using experiments (versus observational studies) as much as possible. APHIS Wildlife Services scientists at NWRC's Utah Field Station are leaders in the design and implementation of controlled studies to evaluate predation and predator control methods. They collaborate with experts from around the world to conduct these studies and findings are published in peer-reviewed literature.

In conclusion, we believe that this EA uses the best available information regarding the efficacy of PDM methods. No one method or group of method (nonlethal or lethal) will be effective under all conditions. Consequently, this EA analyzes alternatives that provide access to groups of methods which may be employed using an adaptive integrated PDM process. Because of site-specific variations in efficacy of methods, this process includes continuous evaluation of activities at each project site and adjustment of methods as needed to achieve management objectives while also minimizing environmental impacts. Therefore, the effectiveness of methods would be considered as part of the decision making-process under the use of the Decision Model described in Chapter 1 for each damage management request based on the continual evaluation of methods and results and does not need to be addressed as a separate issue in detail.

2.2.10 The following list of 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-Nebraska coordination with NGPC, 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 the development of Work Plans.
- ***Accuracy of reporting take of target and non-target animals:*** Commenters have questioned the accuracy of APHIS-WS recording 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 predator damage management 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.

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-Nebraska operations, based on previous PDM EAs prepared in the Western United States and in Nebraska. They will not be discussed further in this EA.

- ***Floodplain:*** WS-Nebraska 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-Nebraska 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-Nebraska and therefore not under the agency's jurisdiction.
- ***General soils*** (except for Issue E.1: the environmental fate of lead in soils): WS-Nebraska 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-Nebraska 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-Nebraska operations do not involve permanently converting the land use of any kind of farmlands.
- ***Air quality:*** WS-Nebraska'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).
- ***Vegetation***, including timber and range plant communities: WS-Nebraska 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-Nebraska PDM activities. All WS-Nebraska PDM activities are conducted under the authorization of and in compliance with federal and state laws and in coordination with the NGPC or the USFWS, as appropriate. Although we recognize that some individuals could find this loss distressing, analysis in Chapter 3 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-Nebraska's operations, including ESA-listed species

2.3 DAMAGE MANAGEMENT STRATEGIES AVAILABLE FOR INCLUSION IN THE ALTERNATIVES INTEGRATED WILDLIFE DAMAGE MANAGEMENT (IWDM)

For more than 80 years, WS has considered, developed, and used numerous methods of managing wildlife damage problems (USDA 1994:3). WS' efforts have included the research and development of new methods and the implementation of effective strategies to resolve and prevent wildlife damage. Usually, the most effective approach to resolving 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 manner4 while minimizing the potentially harmful effects to humans, target and nontarget species, and the environment. IWDM draws from the largest possible array of options to create a combination of appropriate techniques for the specific circumstances.

2.3.1 Integrated Predator Damage Management Strategies

Under alternative 1, the no action alternative, which is to continue the current operations of the WS-Nebraska PDM program, WS-Nebraska could respond to requests for assistance by: 1) taking no action, if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by predators, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage.

Property owners or managers requesting assistance from WS-Nebraska would be provided with information regarding the use of effective and practical non-lethal and lethal techniques. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Property owners or managers may choose to implement recommendations of WS-Nebraska on their own (*i.e.*, technical assistance), use contractual services of private businesses, use the services of private people, use the services of the NGPC (*i.e.*, direct operational assistance), take the management action themselves, or take no further action.

WS-Nebraska would work with those people experiencing predator damage as expeditiously as possible to address those predators responsible for causing damage. The WS' Decision Model would be the implementing mechanism for a damage management program under the no action alternative that could be adapted to an individual damage situation that allows for the broadest range of methods to be used to address damage or the threat of damage in the most effective, most efficient, and most environmentally conscious way available. An adaptive integrated approach allows for the largest possible array of options to create a combination of techniques appropriate for the specific circumstances. An integrated approach that adapts to each request for assistance may incorporate cultural practices (*e.g.*, animal husbandry), limited habitat modification (*e.g.*, removing brush piles), altering animal behavior (*e.g.*, propane cannons), local

population reduction (*e.g.*, removing a raccoon using a cage trap), or any combination of these, depending on the characteristics of the specific damage problems.

When WS-Nebraska receives a request for direct operational assistance, WS-Nebraska could conduct site visits to assess the damage or threats, would identify the cause of the damage, and would apply the Decision Model described by Slate et al. (1992) and WS Directive 2.201 to determine the appropriate methods to resolve or prevent damage based on the informed judgment of trained personnel. The use of the Decision model by employees of WS-Nebraska is further discussed below. Using the Decision Model and based on site visits or reported information, consideration would be given to several factors before selecting or recommending methods and techniques. Those factors could include 1) the species responsible for damage, 2) the magnitude, geographic extent, frequency, and duration of the problem, 3) the status of target and non-target species, including T&E species, 4) local environmental conditions, 5) the potential biological, physical, economic, and social impacts, 6) potential legal restrictions, 7) the cost of control options, and 8) prevention of future damage. Those factors would be incorporated into the Decision Model to determine the methods that would be appropriate to resolving a particular request for assistance. Both non-lethal and lethal methods would be available for use under this alternative.

Non-lethal methods that would be available for use by WS-Nebraska under this alternative include, but are not limited to minor habitat modification, behavior modification, visual deterrents, live traps, translocation, exclusionary devices, frightening devices, decoy dogs, tracking dogs, hand-capture, immobilizing drugs, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods that would be available to WS-Nebraska under this alternative would include body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, euthanasia chemicals, sodium cyanide, and shooting, including the use of firearms from aircraft. In addition, target predator species live-captured using non-lethal methods (*e.g.*, live-traps, immobilizing drugs) could be euthanized. The lethal control of target predators would comply with WS Directive 2.505.

Discussing methods does not imply that all methods would be used or recommended by WS-Nebraska to resolve requests for assistance and does not imply that all methods would be used to resolve every request for assistance. The most appropriate response would often be a combination of non-lethal and lethal methods. There could be instances where application of lethal methods alone would be the most appropriate strategy. For example, if an entity requesting assistance had already attempted to alleviate damage using non-lethal methods, WS-Nebraska would not necessarily employ those same non-lethal methods, since those methods were proven ineffective at reducing damage or threats to an acceptable level to the requester. As part of an integrated approach, WS-Nebraska may provide technical assistance and direct operational assistance to those people experiencing damage to agricultural resources, property, and threats to human safety associated with predators.

The National Wildlife Research Center (NWRC) functions as the research unit of WS by providing scientific information and the development of methods for wildlife damage management, which are effective and environmentally responsible. Research biologists with the

NWRC work closely with wildlife managers, researchers, and others to develop and evaluate methods and techniques for managing wildlife damage. Research biologists with the NWRC have authored hundreds of scientific publications and reports based on research conducted involving wildlife and methods.

2.3.2 Operational Assistance

Operational damage management assistance would include damage management activities that were directly conducted by or supervised by personnel of WS-Nebraska. Operational damage management assistance could be initiated when the problem could not be effectively resolved through technical assistance alone and there was a written MOU, Work Initiation Document, Annual Work Plans, or other comparable document signed between WS-Nebraska and the entity requesting assistance. The initial investigation by personnel of WS-Nebraska would define the nature, history, and extent of the problem, species responsible for the damage, and methods available to resolve the problem. The professional skills of personnel from WS-Nebraska could be required to effectively resolve problems, especially if chemical methods were necessary or if the problems were complex. Depending on the assistance request received, activities conducted by WS-Nebraska could be categorized as preventative or corrective.

Preventative activities would be associated with employing methods before damage occurs based on damage that has occurred historically at a location. For example, Wagner and Conover (1999) found that removing coyotes from lambing grounds in Utah three to six months prior to the arrival of adult sheep could reduce future predation rates of lambs. When requested, personnel of WS-Nebraska could provide information and conduct demonstrations, or take action to prevent damage from recurring. Most non-lethal methods, whether applied by WS-Nebraska or the resource owner, would be employed to prevent future damage from occurring. For example, fencing is often used to keep wildlife, such as predators, out of livestock pastures and to prevent future livestock predation from occurring. On lambing grounds with historically high predation rates of lambs, WS-Nebraska may provide information about livestock guarding animals, fencing, or other husbandry techniques, or if requested and appropriate, WS-Nebraska could conduct damage management activities before lambing begins to reduce the probability of predation for cooperators who have had a history of predation issues.

Corrective activities would be associated with stopping or reducing damage that was currently occurring. For example, if a mountain lion was verified as killing several calves, WS-Nebraska, upon request, could conduct damage management activities to remove the mountain lion to prevent further predation. The United States General Accounting Office (GAO) concluded that, according to available research, localized lethal damage management was effective at reducing predator damage (GAO 1990). Corrective actions would often be employed to provide immediate resolution to damage occurring until long-term approaches could be implemented (*e.g.*, building a fence) or have had time to reach the desired result (*e.g.*, acquiring and raising guard animals).

2.3.3 Technical Assistance /Education and Outreach

Under the proposed action, WS-Nebraska would provide technical assistance to those persons requesting assistance with managing damage as part of an integrated approach. Technical assistance provided by WS-Nebraska would occur as described in Alternative 4 of this EA.

Education is an important element of technical assistance because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations, WS-Nebraska provides lectures, courses, and demonstrations to producers, homeowners, state and county agents, colleges and universities, and other interested groups. WS-Nebraska frequently cooperates with other entities in education and public information efforts. Additionally, technical papers have been and would continue to be presented at professional meetings and conferences so that other wildlife professionals and the public were periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies.

2.3.4 Research and Development/NWRC

The APHIS-WS National Research Center (NWRC) currently conducts research projects on array of issues related to predator damage management. NWRC regularly collaborates with other government agencies, universities, and private organizations to conduct research activities. WS-Nebraska has and will continue to assist NWRC and universities with research projects that will help better understand new and improved way to manage and reduce damage caused by predator.

2.3.5 Decision Model Discussion and Decision Making

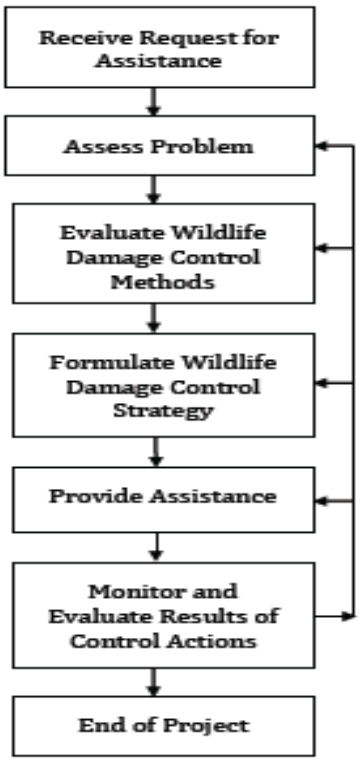


Figure 2 Decision Model

WS-Nebraska personnel use an adaptive management thought process for evaluating and responding to damage complaints that is depicted by the APHIS-WS Decision Model described figure 2-1; WS Directive 2.201. The Decision Model is not a written documented process, but a mental problem-solving process similar to adaptive management strategies used by all wildlife management professionals, including the cooperating agencies for this EA when addressing a wildlife damage problem. WS-Nebraska personnel assess the problem, and evaluate the appropriateness and availability (legal and administrative) of damage management strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a management strategy. After this strategy has been implemented, monitoring is conducted, and evaluation continues to assess the effectiveness of the strategy. Management strategies are then adjusted, modified, or discontinued, depending on the results of the evaluation.

WS-Nebraska program applies an Integrated Wildlife Damage Management (IWDM) approach to reduce wildlife damage (APHIS-WS Directive 2.105). As used and recommended by the APHIS-WS program, IWDM encompasses the integrated application of approved methods simultaneously or sequentially as appropriate to reduce or prevent wildlife damage. The philosophy behind IWDM is to implement the best combination of effective management methods in the most cost-effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (e.g., animal husbandry), habitat modification (e.g., exclusion), animal behavior modification (e.g., scaring), removal of individual offending animals, local population reduction,

elimination of invasive species (e.g., feral hogs) or any combination of these, depending on the circumstances of the specific damage problem.

2.3.5.1 Community-based Decision Making

WS-Nebraska could receive requests for assistance from community leaders and/or representatives. In those situations, WS-Nebraska under this alternative would follow the "*co-managerial approach*" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS-Nebraska could provide technical assistance regarding the biology and ecology of predators and effective, practical, and reasonable methods available to the local decision-maker(s) to reduce damage or threats. This could include non-lethal and lethal methods. WS-Nebraska and other state and federal wildlife management agencies may facilitate discussions at local community meetings when resources were available. Under this approach, resource owners and others directly affected by predator damage or conflicts would be involved in the decision making process. They may implement management recommendations provided by WS-Nebraska or others, or may request direct operational assistance from WS-Nebraska, local animal control agencies, private individuals, or private businesses.

Under a community based decision-making process, WS-Nebraska would provide information, demonstration, and discussion on available methods to the appropriate representatives of the community for which services were requested to ensure a community-based decision was made. By involving decision-makers in the process, damage management actions could be presented to allow decisions on damage management to involve those individuals that the decision-maker(s) represents. As addressed in this EA, WS-Nebraska could provide technical assistance to the appropriate decision-maker(s) to allow for information on damage management activities to be presented to those persons represented by the decision-maker(s), including demonstrations and presentation by WS-Nebraska at public meetings to allow for involvement of the community. Requests for assistance to manage damage caused by predators often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives of the community, the decision-maker(s) would be able to provide the information to local interests either through technical assistance provided by WS-Nebraska or through demonstrations and presentation by WS-Nebraska on damage management activities. This process would allow decisions on damage management activities to be made based on local input. The community leaders could implement management recommendations provided by WS-Nebraska or others, or may request management assistance from WS-Nebraska, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

2.3.5.2 Private Property Decision-Makers

In the case of private property owners, the decision-maker is the individual that owns or manages the affected property. The decision-maker has the discretion to involve others as to what occurs

or does not occur on property they own or manage. Due to privacy concerns, WS-Nebraska cannot disclose cooperator information to others. Therefore, in the case of an individual property owner or manager, the involvement of others and to what degree others were involved in the decision-making process would be a decision made by that individual. Direct operational assistance could be provided by WS-Nebraska if requested, funding was provided, and the requested actions were in accordance with recommendations made by WS-Nebraska.

2.3.5.3 Public Property Decision-Makers

The decision-maker for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals, and legal mandates for the property. WS-Nebraska could provide technical assistance to this person and recommendations to reduce damage. Direct operational assistance could be provided by WS-Nebraska if requested, funding was provided, and the requested actions were within the recommendations made by WS-Nebraska.

Activities conducted by WS-Nebraska on federal, state, county, or municipal properties would follow all laws and regulations that have been determined to apply to damage management activities on those properties, such as the limited use of traps, snares, or toxicants. When a request was received from a federal, state, county, or municipal entity to conduct activities on properties they own or manage, WS-Nebraska would provide information on proposed activities. Those entities would be responsible for reviewing proposed activities to assess their compatibility with established practices and procedures for compliance on their properties. For public land, the land management agency would be responsibility for clearly showing where a proposed activity would likely conflict with land use plans. In most cases, maps would be used to delineate areas where restrictions or limitations were needed to avoid conflicts with land uses. Those Work Plans and the WS Decision Model (Slate et al. 1992) would provide further site-specific planning mechanisms to evaluate and monitor activities for a given area.

2.3.5.4 Tribal Decision-Makers

The NHPA 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 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 result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted with appropriate American Indian Tribes to determine whether they have concerns for cultural properties in areas of federal undertakings.

The NAGPRA of 1990 provides for protection of American Indian burials and establishes procedures for notifying tribes of any new discoveries. Senate Bill 61, signed 1992, set similar requirements for burial protection and tribal notification with respect to American Indian burials discovered on state and private land. If a burial site is located by WS employee, 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. In consideration of American Indian cultural and archeological interests, WS-Nebraska solicited input from the following tribes:

- Omaha Tribe
- Ponca Tribe of Nebraska
- Santee Sioux Tribe
- Winnebago Tribe
- Sac and Fox Tribe of Missouri
- Iowa Tribe of Kansas and Nebraska

Each tribe was asked to identify concerns relating to the proposed WS program through an *invitation for public comment* letter sent January 25, 2016. No tribe responded with concerns.

Other Cultural and Historical Resources Concurrence of no impact to properties on or eligible for the National Registry of Historical Places relative to the current program and the proposed action has been received from the Nebraska State Historical Preservation Office (Puschendorf 1997). In most cases, predator damage management has little potential to cause adverse effects to sensitive cultural resources. The areas where predator damage management would be conducted are small and damage management activities cause minimal ground disturbance. Mitigation measures developed to avoid impacts to these sites are listed in Chapter 3.

2.3.5.5 Planned Control Areas

If activities were requested on by the appropriate entity, planned control areas would be established where WS-Nebraska would actively work or would have plans to work to limit predator damage. Planned activities would be those activities that would be anticipated to occur based on historical needs. However, actual activities may or may not be conducted in those areas because the need to manage damage would likely vary from year to year and site to site. Generally, WS-Nebraska cannot predict where damage would occur at any given time; however, based on historic information, some locations where damage is likely to occur can be predicted. For example, damage management activities could be concentrated in areas where livestock were most abundant and during times when they were most vulnerable to predators, such as during calving and lambing. Requests for assistance in reducing property damage and threats to human health and safety would be by their nature, intermittent and, thus, far less predictable.

2.3.5.6 Unplanned/Emergency Control Areas

On occasion, unplanned and emergency activities could be provided when requested in areas where activities were not scheduled to occur, except in areas designated as restricted. The restricted zones would be identified by appropriate management agency, cooperators, or WS-Nebraska. Where unanticipated local damage or threats arise, WS-Nebraska could take immediate action to alleviate damage or the threat of damage provided the proposed activities did not occur within a designated restricted activity zone. Emergency or unplanned activities would be handled on a case-by-case basis, as the need arises and would only occur if the

appropriate entity allowed unplanned or emergency activities. WS-Nebraska would notify the cooperating agency as soon as practicable after the emergency action commences or the work was performed.

2.4 WS-NEBRASKA OPERATING POLICIES

Operating Policies improve the safety, selectivity, and efficacy of activities intended to resolve wildlife damage. Policies would be incorporated into activities conducted by WS-Nebraska under the appropriate alternatives when addressing predator damage and threats in the State.

Some key policies pertinent to resolving predator damage in Nebraska include the following:

APHIS-WS in Operational Policies

- The APHIS-WS Decision Model WS Directive 2.201 (Figure 2-1) is used to identify the most appropriate strategies for WS-Nebraska on a case-by-case basis. WS employees consider multiple variables specific to the project site before selecting the appropriate techniques. Legal and practical restrictions on the use of methods, considerations for human safety and risks to non-target animals, weather, vegetation density, and terrain are just some of the variables that would be considered in this model.

1. Program Monitoring and Compliance

- WS-Nebraska monitors and reports PDM lethal removal and other activities through its Management Information System (MIS) database. This information can be used to help evaluate population trends and the magnitude of take in Nebraska.

- WS-Nebraska activities are evaluated prior to the start of work and monitored annually to ensure that they fall within the scope and limits of NEPA analyses and associated decisions including state and local level analyses. NEPA analyses will be updated or supplemented as necessary.

- WS-Nebraska complies with all applicable laws and regulations that pertain to conducting predator management on federal, state, tribal, local, and private lands.

- WS-Nebraska personnel adhere to all label requirements for use, storage, and disposal of chemical toxicants, repellents, and immobilization, euthanasia, and contraceptive drugs. EPA/FDA-approved labels provide information on preventing exposure to people, pets, and T&E species, along with environmental considerations that must be followed. WS-Nebraska personnel abide by these. These restrictions preclude or reduce to non-target species, the public, pets, and the environment.

- WS-Nebraska employees who use firearms and pyrotechnics are trained and certified by experts in the safe and effective use of these methods according to WS' Directives.

- Training and certification is required of pilots and crew members for aerial shooting projects. This training includes training in the use of personal protective equipment, emergency procedures in the event of an aerial accident, target identification, and additional firearms training specific to aircraft. Commercial-rated pilots must pass a Class II physical exam, as defined by the Federal Aviation Administration, and are subjected to recurrent APHIS-WS safety training for low-level aircraft. Aircraft are inspected to meet or exceed Part 135 Federal Aviation Administration aircraft standards.

2. Minimize Harm to Non-Target Species

- WS-Nebraska monitors the impacts of program actions on non-target species (e.g., dispersed, captured and released, killed) to determine if program impacts are within parameters anticipated and analyzed in applicable national, state, or local NEPA analyses. This information is available to applicable wildlife management agencies and can be used to help evaluate impacts of program actions on non-target species.

- WS-Nebraska employees use specific trap types, trap door systems and trigger devices, baits, lures and device placement that are most conducive for capturing the targeted animals and minimizing the potential capture of non-target animals.

- WS-Nebraska employees confirm identification of the target animal prior to shooting.

- Where appropriate, suppressed firearms would be used to minimize noise and disturbance.

- When conducting nighttime activities, potential impacts associated with spotlights may be minimized by the use of night vision equipment, infrared devices, or red filtered spotlights.

- Non-target animals captured in cage traps or any other restraining device would be released whenever it is possible and safe to do so.

- Traps would be checked, in accordance with applicable State laws, to ensure non-target species would be released in a timely manner, and to minimize unnecessary stress or injury to target or non-target species.

- Human presence at sites would be kept to the minimal time needed to accomplish the management action.

- Trap monitoring devices may be employed where applicable to facilitate monitoring of the status of traps in remote locations, reduce risks to non-target species, and to ensure any captured wildlife was removed promptly to minimize stress and injury.

- WS-Nebraska personnel work with research programs, such as NWRC, to continually improve and refine the selectivity of management devices, thereby reducing non-target take.

- WS-Nebraska will use non-toxic ammunition on National Parks and FWS wildlife refuges, as required by land management policies, and as required by State law.

3 Minimize Harm to T&E Species

In addition to policies that minimize harm to non-target species, WS-Nebraska would implement specific SOPs that are outlined in the September 2017 Biological Assessment for Wildlife Damage Management in Nebraska as requested by the USFWS during the consultation process, to comply with Section 7 of the Endangered Species Act:

- Before any WS-Nebraska actions that may affect federally listed T&E species could be implemented, a formal or informal consultation with FWS, as appropriate, would be completed.

- Reasonable and prudent Alternatives, Measures, and Terms and Conditions associated with formal ESA Section 7 consultations are incorporated into local program planning.

- Minimization measures identified in specific informal ESA consultations with FWS, as applicable, are incorporated into State and local programs for predator management.

- WS-Nebraska will use non-toxic ammunition when and where required by ESA Section 7 consultations.

- WS-Nebraska would not proceed with any action that the FWS has determined could jeopardize the continued existence of any federally listed threatened or endangered species, or that would adversely modify or destroy designated critical habitat.

4. Minimize the Potential for Non-purposeful Take of Eagles

- All projects proposed for implementation at the State, Territory, Tribal or local level will be reviewed for potential to takeeagles in accordance with the provisions of the Bald and Golden Eagle Protection Act (BGEPA). If potential risk of take is identified, WS-Nebraska will work with the FWS on measures to reduce risks and the need for a non-purposeful take permit.

- Eagles are known to scavenge on carcasses. WS-Nebraska would not intentionally use carcasses to draw predators to foot-hold traps or snares, but carcasses (e.g., road kill, predation, wildlife damage management) could be near project sites. To reduce risks of unintentional capture of an eagle in a snare or foot-hold trap, WS Directive 2.45 states that no foot-hold traps or snares (cable devices) will be set closer than 30 feet from any exposed animal carcass or part thereof, having meat or viscera attached 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.

5. Carcass Disposal

- Carcasses of predators retrieved by WS-Nebraska after damage management activities would be disposed of in accordance with APHIS-WS Directive 2.515.

- If WS-Nebraska is directly involved in carcass burial, burial site remediation should include soil conservation measures to minimize runoff and soil erosion, loss of topsoil and effects on vegetation.

- On non-federal lands, when WS-Nebraska is directly involved in carcass burial, siting decisions would be made after consulting with State Historic Preservation Officers (SHPOs), affected tribal authorities, and land managers to avoid adverse effects on cultural/historic resources.

- Disposal of all carcasses will be done in accordance with WS Directive 2.515

6. Minimize Risks to Human Safety

- Warning signs, alerting people to the presence of foot-hold traps or snares will be posted on main entrances or commonly used access points to areas where foot-hold traps snares are in use. Signs will be routinely checked to assure they are present, obvious, and readable.

- Whenever possible, WS-Nebraska activities would be conducted away from areas of high human activity. If this is not possible, WS-Nebraska personnel would work to schedule activities during periods when human activity was low (e.g., early morning or late at night) or may work with the landowner/manager to temporarily close areas during predator management. Signs would be placed to warn the public of any potential hazards as appropriate.

- Shooting would be conducted during times and in locations where risks to the public may be eliminated (e.g., site is closed to public).

- Personnel involved in shooting operations would be fully trained in the proper and safe application of this method in accordance with APHIS-WS Directive 2.615.

- Aviation safety and the operation of aircraft would adhere to standards for the use of aircraft in APHIS-WS' activities under APHIS-WS Directive 2.620.

- All pilots, crewmembers, ground crews, and aircraft maintenance personnel would adhere to the APHIS-WS Aviation Operations and Safety Manual, as amended, as well as, Title 14 CFR, and FAR, Part 43, 61, 91, 119, 133, 135, and 137.

- Personnel employing chemical methods would be properly trained and certified in the use of those chemicals. All chemicals used by WS-Nebraska would be securely stored and properly monitored to ensure the safety of the public. WS-Nebraska use of chemicals and training requirements to use those chemicals are outlined in APHIS-WS Directive 2.401 and APHIS-WS Directive 2.430.

- All chemical methods used by WS-Nebraska or recommended by WS-Nebraska would be registered with the FDA, DEA, EPA, and the appropriate State or Tribal regulatory agency(ies).

- In most cases, captured predators would be killed. In cases where predators would be chemically immobilized, fitted with radio telemetry equipment, and released for research or operational purposes, released animals would be identified with ear tags or other similar devices that provide WS-Nebraska contact information and a warning to the public not to capture, kill, or eat the marked animal.

7. Minimize Harm to Cultural Resources

- Before any WS-Nebraska actions that may affect cultural resources protected by the NHPA could be implemented, consultations with federal, state, territorial, and tribal historic preservation offices, as appropriate, would be conducted to prevent, minimize, or mitigate potential impacts to cultural resources.

- If an individual activity with the potential to affect archaeological resources is planned under the alternative selected in this EA, WS-Nebraska will comply with the provisions set forth in the Archaeological Resources Protection Act (ARPA) of 1979.

- On public lands and on other federal lands, the land management agency requesting predator control could be designated as the lead agency for compliance with Section 106, and APHIS would cooperate in that effort.

8. Address Animal Welfare Concerns

- Personnel would be well trained in the latest and most humane devices/methods for removing predator. WS-Nebraska personnel would attempt to kill captured predators as quickly and humanely as possible, in accordance with APHIS-WS' directives (APHIS-WS Directive 2.430, APHIS-WS Directive 2.505), and applicable AVMA euthanasia guidelines for use on wildlife under field conditions (AVMA 2013).

- NWRC is continually conducting research to improve the selectivity and humaneness of wildlife damage management devices used by personnel in the field. WS-Nebraska incorporates advances in the research into PDM methods as they become available.

9. Address Coordination with Tribes

- Tribes would be included in the planning and prioritization of WS-Nebraska activities that occur in areas under their jurisdiction to ensure that all actions are conducted in accordance with Tribal objectives for the species.

- No PDM would be conducted on tribal lands without the written consent of the Tribe.

- All PDM activities conducted on tribal lands would be conducted in accordance with applicable Tribal regulations.

- APHIS will consult with tribes regarding the impacts of proposed methods on tribally-listed T&E species. APHIS will work with tribes on methods to ensure that PDM actions do not jeopardize tribally listed T&E species.

- APHIS will remain open to consultation with tribes regarding FSDM in accordance with APHIS Directive 1040.3.

10. Address Actions Conducted on Federal Lands

- Except as otherwise provided under Memoranda of Understanding, PDM conducted on lands administered by the National Park Service, U.S. Fish and Wildlife Service, Department of Defense agencies, and other federal lands would be at the request of the federal land management agency and in accordance with agreed upon conditions for minimizing adverse effects on land uses and other resources (e.g., requirements for lead-free ammunition, trap placement).

- The federal land management agency would be consulted prior to conducting PDM to ensure consistency with applicable land and resource management plans, Congressional direction regarding the intended purpose of the site, and existing site uses.

- All PDM conducted on federal lands must be reviewed for consistency with applicable land and resource management plans, Congressional direction regarding the intended purpose of the site, and existing site uses.

2.5 ALTERNATIVES CONSIDERED IN DETAIL

The following alternatives were developed to meet the need for action and address the identified issues associated with managing damage caused by predators in Nebraska:

2.5.1 Alternative 1 – Continue the Current Adaptive Integrated Predator Damage Management Program (Proposed Action)

The proposed action alternative would continue the current program of implementing methods in an adaptive integrated approach to alleviate damage or threats of damage associated with predators. WS-Nebraska could respond to requests for assistance from the NGPC, the USFWS, and/or other entities to enhance survival of native wildlife populations in areas where WS-Nebraska has been requested to alleviate damage to other resources, when requested by the appropriate entity and when approved by the property owner. For example, WS-Nebraska could be requested to prevent coyote predation on calves by a livestock producer. If the area also served as critical pronghorn habitat and pronghorn were below population objectives established by the NGPC due, in part, to coyote predation, WS-Nebraska could also conduct damage management activities at the request of the NGPC on the property to enhance survival of antelope fawns by managing predators. Activities to manage predation could extend beyond the calving season if needed to prevent predation on pronghorn fawns. WS-Nebraska would only conduct those activities when the property owner had agreed to allowing WS-Nebraska to conduct those activities.

In another example, WS-Nebraska could integrate the activities associated with threats to human safety into decisions regarding managing damage to other resources. Rabies management projects include active surveillance of potential wildlife vectors/reservoirs of the rabies virus. Red fox, coyotes, bobcats, and striped skunks addressed during damage management efforts could be sampled to determine the presence and extent of rabies outbreaks. Similarly, if surveillance of those species is determined to be a key component for rabies management purposes, WS-Nebraska could target those species using available methods for sampling during efforts targeting other predators even if those animals pose little risk to other resources (*e.g.*, skunks could be targeted during projects addressing coyote predation), when allowed by the cooperator requesting assistance.

When using the WS Decision Model under this alternative, WS-Nebraska would consider the use of methods to alleviate damage or threats of damage on meeting population objectives of local wildlife when such management assistance is requested by the NGPC, the USFWS, and or other entities and when agreed upon by the property owner requesting assistance from WS-Nebraska. In some instances, management methods and timing could be adjusted to prevent predation on native wildlife to enhance survival as well as too reduce damage to other resources.

WS-Nebraska would coordinate with land managing agencies and the NGPC to prevent predators from negatively affecting other resources. For example, WS-Nebraska could be requested to disperse or removing mountains lions in areas to alleviate predation on livestock. In those situations, WS-Nebraska could manage predation associated with mountain lions in that area using cultural or limited habitat modification methods (*e.g.*, regulating the availability of water, if feasible). The need for action associated with managing predator damage to natural resources was addressed in Section 3.2.4 of this EA.

When managing damage or threats of damage to natural resources, some methods would be unavailable. For instance, M-44 devices can't be used to alleviate damage or threats of damage occurring to natural resources, except to prevent coyote, red fox, grey fox, and feral dogs from predating on wildlife species listed pursuant to the ESA by the USFWS as threatened or endangered.

The goal of the PDM program would be to resolve and prevent damage associated with predators and to reduce threats to human safety. To meet this goal, WS-Nebraska would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding was available, operational damage management. Funding could occur through federal appropriations, from state funding, or from cooperative funding. The adaptive approach to managing damage associated with predators would integrate the use of the most practical and effective methods to resolve a request for assistance as determined by a site-specific evaluation to reduce damage or threats to human safety for each request. City/town managers, agricultural producers, property owners, and others requesting assistance would be provided information regarding the use of appropriate non-lethal and lethal methods.

Under this alternative, WS-Nebraska could respond to requests for assistance by: 1) taking no action, if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by predators, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage.

Property owners or managers requesting assistance from WS-Nebraska would be provided with information regarding the use of effective and practical non-lethal and lethal techniques. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Property owners or managers may choose to implement recommendations of WS-Nebraska on their own (*i.e.*, technical assistance), use contractual services of private businesses, use the services of private people, use the services of WS-Nebraska (*i.e.*, direct operational assistance), take the management action themselves, or take no further action.

In most situations, a cooperating entity has already tried reasonable non-lethal methods to resolve damage prior to contacting WS-Nebraska 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.

WS-Nebraska would work with those people experiencing predator damage as expeditiously as possible to address the predators responsible for causing damage. WS' Decision Model would be the implementing mechanism for the PDM program under the no action alternative that could be adapted to an individual damage situation that allows for the broadest range of methods to be used to address damage or the threat of damage in the most effective, most efficient, and most environmentally conscious way available. An adaptive integrated approach allows for the largest possible array of options to create a combination of techniques appropriate for the specific circumstances. An integrated approach that adapts to each request for assistance may incorporate cultural practices (*e.g.*, animal husbandry), limited habitat modification (*e.g.*, removing brush piles), altering animal behavior (*e.g.*, propane cannons), local population reduction (*e.g.*, removing a raccoon using a cage trap), or any combination of these, depending on the characteristics of the specific damage problems.

When WS-Nebraska receives a request for direct operational assistance, WS-Nebraska could conduct site visits to assess the damage or threats, would identify the cause of the damage, and would apply the Decision Model described by Slate et al. (1992) and WS Directive 2.201 to determine the appropriate methods to resolve or prevent damage based on the informed judgment of trained personnel. The use of the Decision model by employees of WS-Nebraska is further discussed below. Using the Decision Model and based on site visits or reported information, consideration would be given to several factors before selecting or recommending methods and techniques. Those factors could include 1) the species responsible for damage, 2) the magnitude, geographic extent, frequency, and duration of the problem, 3) the status of target and non-target species, including T&E species, 4) local environmental conditions, 5) the potential biological, physical, economic, and social impacts, 6) potential legal restrictions, 7) the cost of control options, and 8) prevention of future damage. Those factors would be incorporated into the Decision Model to determine the methods that would be appropriate to resolving a particular request for assistance. Both non-lethal and lethal methods would be available for use under this alternative.

WS-Nebraska, NGPC and/or its agents, commercial companies, NGPC permitted aerial operators, 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 2.[?]), which provides for the consideration of lethal and non-lethal methods, allows WS-Nebraska 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.

What Types of Methods Are Used in Alternative 1?

As detailed in Appendix B, WS-Nebraska can use and/or recommend many methods, including combinations of methods for IPDM strategies.

WS-Nebraska, NGPC and/or its agents, and will certified commercial companies, NGPC-permitted aerial operators, 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 2.3.5), which provides for the consideration of lethal and non-lethal methods, allows WS-Nebraska 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-Nebraska 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-Nebraska's personnel under the APHIS-WS Decision Model within the practices of IPDM (Section 2.3.5, Figure 2). WS-Nebraska 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-Nebraska may include habitat management, husbandry, hazing, fencing, and aversive/harassment devices, herding, and livestock guard animals (Appendix A). WS-Nebraska 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 resolving the issue.

In most situations, a cooperating entity has already tried reasonable non-lethal methods to resolve damage prior to contacting WS-Nebraska 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-Nebraska could use other non-lethal methods, attempt to continue the use of the same non-lethal methods, and/or recommend or use lethal methods.

- **Lethal methods**

After receiving a request for assistance and conducting a field review, trained and certified WS-Nebraska 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-Nebraska 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. These methods are described in detail in Appendix A. WS-Nebraska 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 2.4 and 3.2.5), and use the most humane and rapid methods available under the circumstances and per the APHIS-WS Decision Model (Sections 2.3.5, Appendix A, and Section 3.2.5).

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, are also used in combination with aerial shooting in these areas. During spring, coyotes inflict the greatest predation losses coinciding with lambing and calving. Therefore, PDM is intensified with all necessary methods including traps, snares, M-44s, and shooting being utilized.

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.

Aerial shooting occurs only on lands where it is authorized and when under agreement, primarily on private lands. During late fall and winter (November through March), requests for PDM assistance on lambing and calving grounds on private property.

Aerial shooting can also be conducted by other entities under permit from the NGPC to remove coyotes for livestock protection (Section 3.2.1.1).

Any strategy involving reducing the number of predators in a particular area during a regulated hunting/trapping season is the responsibility of NGPC as authorized by state law.

The current WS-Nebraska PDM program is or may be conducted on private, public, tribal, and other lands where a request has been made, the WS-Nebraska 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 2.5).

- **Methods that May Be both Lethal and Non-Lethal**

Some methods may be part of 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. As described in Section 1.15, NGPC policy prohibits relocating certain species of predators, such as coyotes, skunks and raccoons, and predators that has a risk of continuing the problem in their new location, spread of disease, territorial issues well due to intraspecies competition. APHIS-WS policy also discourages relocation of captured offending animals for the same reason (APHIS-WS Directive 2.501; Section 2.15). 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.

Non-lethal methods that would be available for use by WS-Nebraska under this alternative include, but are not limited to minor habitat modification, behavior modification, visual deterrents, live traps, translocation, exclusionary devices, frightening devices, decoy dogs, tracking dogs, hand-capture, immobilizing drugs, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods that would be available to WS-Nebraska under this alternative would include body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, euthanasia chemicals, sodium cyanide, and shooting, including the use of firearms from aircraft. In addition, target predator species live-captured using non-lethal methods (*e.g*., live-traps, immobilizing drugs) could be euthanized. The lethal control of target predators would comply with WS Directive 2.505.

Discussing methods does not imply that all methods would be used or recommended by WS-Nebraska to resolve requests for assistance and does not imply that all methods would be used to resolve every request for assistance. The most appropriate response would often be a combination of non-lethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. For example, if an entity requesting assistance had already attempted to alleviate damage using non-lethal methods, WS-Nebraska would not necessarily employ those same non-lethal methods, since those methods were proven ineffective at reducing damage or threats to an acceptable level to the requester. As part of an integrated approach, WS-Nebraska may provide technical assistance and direct operational assistance to those people experiencing damage to agricultural resources, property, and threats to human safety associated with predators.

The National Wildlife Research Center (NWRC) functions as the research unit of WS by providing scientific information and the development of methods for wildlife damage management, which are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate methods and techniques for managing wildlife damage. Research biologists with the NWRC

have authored hundreds of scientific publications and reports based on research conducted involving PDM methods.

What other Entities Conduct PDM in the Absence of WS-Nebraska Action?

As defined by the 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). The Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations" (Question 3; https://ceq.doe.gov/nepa/regs/40/40p3.htm), states:

> "Where a choice of "no action" by the agency would result in predictable actions by others, this consequence of the "no action" alternative should be included in the analysis."

Therefore, WS-Nebraska will analyze not only the effects of its actions, but also the potential impacts that would occur when another entity takes the same or similar action in the absence of the APHIS-WS action.

Worldwide, humans have been removing large carnivorous predators for millennia, resulting in complete eradication or severe range reductions. This direct control may occur for many reasons, including fear, active threats to health and safety, and competition for food, land, or resources of human value, while indirect control may occur through habitat and ecosystem losses and fragmentation, climate change, accelerating resource extraction, and poverty (for example, Sacks et al. 1999, Prugh et al. 2009, McShane et al. 2010). Chronic conflicts with humans and human activity often results in direct taking of large carnivores.

In Marin County, California, under the county-managed cost-share program that replaced WS-California activities, individual producers and others working on their behalf routinely practice snaring, calling and shooting, and denning in an effort to kill damage-causing coyotes, most intensely in winter and spring. When incidences of "hot spots" occur with multiple losses on adjacent ranches, ranchers collaborate on hunting parties in an effort to eliminate the depredating coyote(s). It is likely that some ranchers themselves are taking more coyotes than when APHIS-WS activities were taking place. There are no data on current take of target or non-target species by landowners or their agents (Larson 2006).

State agencies also have legal authority to respond to and manage wildlife conflicts. As discussed in Chapter 1 (Section 1.15), NGPC has legal wildlife damage management authority, and issue depredation permits and permits for aerial shooting, respectively. NGPC can also certify volunteers, particularly those with trained pursuit dogs, for predator damage management for cougar and bears, and certify commercial wildlife damage management companies, typically for addressing human conflicts with smaller predators. For many predators not managed as game or furbearer mammals in Nebraska, property owners can also remove such animals causing depredation or damage with a permit issued by NGPC or without a permit, depending on the species. In addition, NGPC can set take limits for game and furbearer predators during hunting and trapping seasons to manage population levels to meet state objectives (Section 1.15).

Private and commercial property owners can also request assistance from companies that have a permit from the NGPC (found on the NGPC website) to provide those services, or those private and commercial property owners may authorize another person(s) as their agent to remove

damaging species. However, for most species a permit to remove the animal is needed. No permit is required for a landowner to take depredating or threatening predators. Coyotes may be taken by aerial gunning on private land with a permit from NGPC and permission from the landowner.

Given that federal, state, commercial, and private entities receive authorization to conduct PDM from the NGPC, and that most methods for resolving predator damage are available to both WS-Nebraska and to non-federal entities (except for M-44s), it is clear that, even under all the alternatives, including those in which WS-Nebraska is not involved with direct (lethal) PDM, other entities will be conducting PDM (Section 3.2.1.1).

All non-lethal methods and most lethal methods are available to non-WS-Nebraska entities. Only WS-Nebraska has authority to use M-44s in Nebraska per the FIFRA label. M-44s are commonly used by WS-Nebraska staff (average 700 coyotes per year, with approximately 30% of total annual coyote take by WS FY 2011 through FY 2015 (MIS 2016). WS-Nebraska generally uses M-44s in situations where coyotes have proven difficult to remove using other methods.

2.5.2 Alternative 2 - No WS-Nebraska PDM Program

Under this alternative, The WS program would not be involved with any aspect of managing damage caused by predators in Nebraska. All requests for assistance received by the WS program to resolve damage caused by predators would be referred to the NGPC, other governmental agencies, and/or private entities. WS-Nebraska, consisting of the NGPC and the NDA, could continue to provide assistance as described in Alternative 1 or Alternative 2.

Despite no involvement by the WS program in resolving damage and threats associated with predators in Nebraska, those people experiencing damage caused by predators could continue to employ those methods legally available to address predator damage on their own since predators could be addressed to alleviate damage or threats without a the need for a permit from the NGPC. All methods described in Appendix B could be available for use by those people experiencing damage or threats under this alternative except for the use of immobilizing drugs and euthanasia chemicals. Immobilizing drugs and euthanasia chemicals could only be used by WS-Nebraska or appropriately licensed veterinarians.

Under this alternative, those people experiencing damage or threats of damage could contact the WS program; however, WS would immediately refer the requester to NGPC and/or to other entities. The requester could contact other entities for information and assistance with managing damage, could take actions to alleviate damage without contacting any entity, or could take no further action.

2.5.3 Alternative 3 – WS-Nebraska Provides Technical Assistance Only

Under this alternative, the federal WS program would provide those people seeking assistance with PDM technical assistance only. WS could also provide technical assistance to the NGPC

and the NDA and refer people requesting assistance to the NGPC and the NDA. The NGPC and the NDA could continue to provide assistance as described in Alternative 1 or Alternative 2.

Similar to the other alternatives, WS-Nebraska could receive requests for assistance from community representatives, private individuals/businesses, or from public entities. Technical assistance provided by the WS program would provide those people experiencing damage or threats caused by predators with information, demonstrations, and recommendations on available and appropriate methods. The implementation of methods and techniques to resolve or prevent damage would be the responsibility of the requester with no direct involvement by the WS program. WS may provide supplies or materials that were of limited availability for use by private entities (*e.g.*, loaning of propane cannons). Technical assistance could be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies would be described by WS to the requester for short and long-term solutions to managing damage. Those strategies would be based on the level of risk, need, and the practicality of their application. The WS program would use the Decision Model to recommend those methods and techniques available to the requester to manage damage and threats of damage. Those people receiving technical assistance from the WS program could implement those methods recommended by WS, could employ other methods not recommended by WS, could seek assistance from other entities, or take no further action.

Under a technical assistance only alternative, the WS program would recommend an integrated approach similar to Alternative 1 and Alternative 2 when receiving a request for assistance; however, the WS program would not provide direct operational assistance under this alternative. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Recommendation of methods and techniques by WS to resolve damage would be based on information provided by the individual seeking assistance using the WS Decision Model. In some instances, wildlife-related information provided to the requestor by the WS program would result in tolerance/acceptance of the situation. In other instances, damage management options would be discussed and recommended. Only those methods legally available for use by the appropriate individual would be recommended or loaned by the WS program. Similar to the other alternatives, those methods described in Appendix B would be available to those people experiencing damage or threats associated with predators in the Canyon District, except for immobilizing drugs and euthanasia chemicals.

Immobilizing drugs and euthanasia chemicals would only be available to employees of the WS program, appropriately licensed veterinarians, or people under the supervision of a veterinarian. WS-Nebraska regularly provides technical assistance to individuals, organizations, and other federal, state, and local government agencies for managing predator damage. Technical assistance would include collecting information about the species involved, the extent of the damage, and previous methods that the cooperator had attempted to resolve the problem. The WS program would then provide information on appropriate methods that the cooperator could consider to resolve the damage themselves. Types of technical assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups, such as homeowner associations or civic leagues.

This alternative would place the immediate burden of operational damage management work on the resource owner. Those persons experiencing damage or were concerned with threats posed by predators could seek assistance from WS-Nebraska, other governmental agencies, private entities, or conduct damage management on their own. Those people experiencing damage or threats could take action using those methods legally available to resolve or prevent predator damage as permitted by federal, state, and local laws and regulations or those persons could take no action.

2.5.4 Alternative 4 – Use of Only Non-lethal PDM Methods by WS-Nebraska

Under this alternative, Nebraska-WS would be restricted to implement only non-lethal methods to resolve damage or threats of damage associated with predators. Only those methods discussed in Appendix B that are considered non-lethal would be employed or recommended by WS. No lethal removal of predators would occur by employees of the WS program. The use of lethal methods to manage damage could continue under this alternative by landowners or resource managers, and by other entities. The non-lethal methods used or recommended by WS under this alternative would be identical to those identified in any of the alternatives.

In situations where non-lethal methods were impractical or ineffective to alleviate damage or threats of damage, WS could refer requests for information regarding lethal methods to the NGPC, the NDA other governmental agencies, and/or private businesses.

Under this alternative, non-lethal methods would include fencing, deterrents/repellents, pyrotechnics, visual deterrents, exclusion, harassment, minor habitat alteration, cage traps, foothold traps, cable restraints, and translocation. If WS were to conduct operational assistance, predators live-captured would be translocated because lethal methods would be unavailable. Chemical repellents would also be available for use by WS under this alternative. Appendix B describes a number of non-lethal methods available for recommendation and use by WS under this alternative. WS would recommend an integrated approach to resolving requests for assistance under this alternative using those non-lethal methods available. WS would continue to provide technical assistance and direct operational assistance, when requested. Those activities described in Alternative 1 and Alternative 2, except for the recommendation and/or use of lethal methods, would continue to be available under this alternative. Property owners or managers could still resort to lethal methods or other methods not recommended by WS. In addition, those people experiencing damage or threats of damage could request assistance from the NGPC, the NDA, take actions themselves, use the services of other entities that were available to them, or take no action.

Under this alternative, only those methods discussed in Section 3.2 that are considered nonlethal would be employed or recommended by WS-Nebraska. . The use of lethal methods could continue under this alternative by producers, state agency personnel, landowners or resource managers of areas where predation is occurring. The nonlethal methods used or recommended by WS-Nebraska under this alternative would be identical to those identified in any of the alternatives.

2.6 ALTERNATIVES AND STRATEGIES NOT ANALYZED IN DETAIL

In addition to those alternatives analyzed in detail, several additional alternatives were identified by WS-Nebraska. However, those alternatives will not receive detailed analyses for the reasons provided. Many of the alternatives identified would only be applicable to the WS program, since the NGPC and the NDA are not part of the WS program and WS has no authority to govern their activities. The alternatives considered but not further analyzed include:

2.6.1 Compensation for Predator Damage Losses

The compensation alternative would require the WS program to establish a system to reimburse persons impacted by predator damage and to seek funding for the program. 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 1.17.6. This issue is better addressed through the political process at the county or state level.

Under such an alternative, the WS program would continue to provide technical assistance to those persons seeking assistance with managing damage. In addition, WS would conduct site visits to verify damage. WS-Nebraska, through the NGPC and the NDA, could continue to provide direct operational assistance when requested under this alternative. Evaluation of this alternative indicates that a compensation only alternative has many drawbacks. A compensation program implemented by WS would: 1) require large expenditures of money and labor to investigate and validate all damage claims, and to determine and administer appropriate compensation, 2) compensation most likely would be below full market value, 3) give little incentive to resource owners to limit damage through improved cultural or other practices and management strategies, and 4) not be practical for reducing threats to human health and safety.

Therefore, this alternative will not be considered in detail.

2.6.2 Establish a Bounty System for Predators

This alternative would require the WS program to establish a system that paid people for each predator killed. Payment of funds (bounties) for killing some mammals suspected of causing economic losses does not currently exist in Nebraska. Bounties are generally not effective in abating damage, especially over a wide area, such as a county or State, but may provide some benefits by removing surplus animals. A standard problem with bounties is that the circumstances surrounding the lethal removal of animals are typically arbitrary and completely unregulated. Abuse is often common with bounty systems and many animals could come from places outside the bounty area. The WS program does not have the authority to establish a bounty program.

2.6.3 A Short Term Eradication and Long Term Population Suppression of Predator Populations

An eradication alternative would direct all WS' program efforts toward total long-term elimination of predator populations wherever a cooperative program was initiated in The State. Some landowners would prefer that some species of predators be eradicated, especially those that have become abundant and caused damage without intervention from wildlife agencies (International Association of Fish and Wildlife Agencies 2004). Eradication of native species is not a desired population management goal of WS-Nebraska, the NGPC, the NDA, and the USFWS. Eradication as a general strategy for managing predator damage was not considered in detail because state and federal agencies with interest in, or jurisdiction over, wildlife oppose eradication of any native wildlife species and eradication is not acceptable to most people.

Suppression would direct the efforts of WS toward managed reduction of certain problem populations or groups. In areas where damage could be attributed to localized populations of predators, WS-Nebraska could decide to implement local population suppression using the WS' Decision Model. However, large-scale population suppression would not be realistic or practical to consider as the basis of WS-Nebraska. Problems with the concept of suppression would be similar to those described above for eradication. Typically, WS' activities in the State would be conducted on a very small portion of the sites or areas inhabited or frequented by problem species.

2.6.4 Management Activities would only be Conducted after Damage Had Occurred

Managing damage proactively and reactively are the general approaches to alleviating damage cause by predators (Baker et al. 2008). Proactive damage management would be the application of methods to target predators prior to damage occurrences based on historical damage that has occurred (*i.e.*, based on a threat of damage). As requested and appropriate, the WS program, the NGPC, and the NDA provide information, conduct demonstrations or take action to prevent damage from recurring. For example, in areas where substantial lamb depredation has occurred on lambing grounds, WS-Nebraska could provide information about guard dogs, fences, or other husbandry techniques, or be requested to provide direct operational assistance to remove predators prior to lambing. Reactive damage management would be the application of methods targeting predators in response to an incurred loss with the intent of abating or reducing further losses (*i.e.*, after damage has already occurred). Under this alternative, the WS program would only provide reactive assistance and only conduct activities after damage has occurred. No proactive assistance would be provided by the WS program; however, the NGPC and the NDA could continue to provide proactive assistance by conducing activities based on a threat of damage similar to Alternative 1 and Alternative 2. WS-Nebraska would only conduct activities based on a request for assistance. In some cases, proactive damage management is prohibited or not agreed to (*e.g.*, proactive management cannot occur on the Wilderness Study Areas managed by the Bureau of Land Management).

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah determined that a forest supervisor could establish a need for wildlife damage management if the supervisor could

show that damage from wildlife was threatened (Civil No. 92-C-0052A January 20, 1993). The Court stated that, *"The agency need not show that a certain level of damage is occurring before it implements a [*WS*] Program… Hence, to establish need for* [WS]*, the forest supervisors need only show that damage from predators is threatened."* Thus, there is judicial precedence indicating that it is not necessary to establish a criterion such as a percentage of loss of a particular resource to justify the need for damage management actions.

2.6.5 All Available Non-lethal Methods Implemented Before Lethal Methods

This alternative would require that non-lethal methods or techniques described in Appendix B be applied by the WS program to all requests for assistance to reduce damage and threats to safety from predators in the State. If the use of non-lethal methods failed to resolve the damage situation or reduce threats to human safety at each damage situation, lethal methods could then be employed to resolve the request. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of the damage or threat until deemed inadequate to resolve the request. This alternative would not prevent the use of lethal methods by other members of WS-Nebraska or by those persons experiencing predator damage but would only prevent the use of those methods by the WS program until non-lethal methods had been employed. The WS program could recommend the use of lethal methods through technical assistance under this alternative; however, the operational use of lethal methods would only occur after non-lethal methods had been proven ineffective.

Few non-lethal methods available to alleviate damage or threats associated with predators, such as livestock management practices (*e.g*., night-penning, herding, carcass removal) and physical exclusion (*e.g*., predator-proof fencing), are practical for implementation by WS' personnel. Those persons experiencing damage often employ non-lethal methods to reduce damage or threats prior to contacting the WS program. Most non-lethal methods are put into use by the resource owner (Knowlton et al. 1999). Many of those non-lethal methods (*e.g*., fencing and guard dogs) require a large investment in time to implement and have a high initial cost (Mitchell et al. 2004). Even with the additional effort and costs, those methods are not always effective at reducing damage and potentially have side effects (*e.g*., concentrating livestock can cause unwanted damage to particular pasture areas) (Knowlton et al. 1999).

Verification of the methods used would be the responsibility of WS. No standard exists to determine requester diligence in applying those methods, nor are there any standards to determine how many non-lethal applications are necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods could be evaluated. The no action alternative (Alternative 1), the proposed action alternative (Alternative 2), and the technical assistance only alternative (Alternative 3) would be similar to a non-lethal before lethal alternative because in most situations WS would use or recommend non-lethal methods before lethal methods (see WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not contribute additional information to the analyses in the EA.

2.6.6 Use of Lethal Methods Only by WS

This alternative would require the use of lethal methods only to reduce threats and damage associated with predators. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. Predator damage could be effectively reduced using non-lethal methods. For example, the use of guard dogs can be effective at reducing predation rates or installing proper fencing can exclude some predators from areas. In those situations where damage could be alleviated using non-lethal methods deemed effective, those methods would be employed or recommended as determined by the WS Decision Model. Therefore, this alternative was not considered in detail.

2.6.7 Live-capture and Translocate Predators Only

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 primarily immobilizing drugs, cage traps, foothold traps, and restraining cables. All predators live-captured through direct operational assistance by the WS program would be translocated. Translocation sites would be identified and have to be approved by the property owner where the translocated predators would be placed prior to live-capture and translocation. Live-capture and translocation could be conducted as part of the alternatives analyzed in detail. WS could translocate predators or recommend translocation under any of the alternatives analyzed in detail, except under the no involvement by WS alternative (Alternative 3). However, other entities could translocate predators under Alternative 3. The NGPC and the NDA could continue to provide assistance similar to Alternative 1 and Alternative 2 under this alternative.

Generally, translocating predators that have caused damage to other areas following live-capture would not be effective or cost-effective. Translocation is generally ineffective because predators are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and translocation would most likely result in damage problems at the new location. In addition, several animals would need to be captured and translocated to solve some damage problems; therefore, translocation is unrealistic. Translocation of wildlife is also discouraged by WS policy (see WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, threat of spreading diseases, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988). Based on those factors and the availability of additional methods that could be used to effectively resolve damage or threats of damage, this alternative was not evaluated in detail. In addition, the WS program could translocate or recommend translocation under any of the alternatives analyzed in detail, except for the no involvement by WS alternative (Alternative 2).

2.6.8 Reducing Damage by Managing Predator Populations through the Use of Reproductive Inhibitors

Under this alternative, the only method that would be available to resolve requests for assistance by WS would be the recommendation and the use of reproductive inhibitors to reduce or prevent reproduction in predators responsible for causing damage. Reproductive inhibitors are often considered for use where wildlife populations are overabundant and where traditional hunting or lethal control programs are not publicly acceptable (Muller et al. 1997). Use and effectiveness of

reproductive control as a population management tool is limited by population dynamic characteristics (*e.g.*, longevity, age at onset of reproduction, population size, and biological/cultural carrying capacity), habitat and environmental factors (*e.g.*, isolation of target population, cover types, and access to target individuals), socioeconomic, and other factors.

Reproductive control for predators could be accomplished through sterilization (permanent) or contraception (reversible). Sterilization could be accomplished through: 1) surgical sterilization (vasectomy, castration, and tubal ligation), 2) chemo sterilization, and 3) through gene therapy. Bromley and Gese (2001*a*, 2001*b*) conducted studies to determine if surgically sterilized coyotes would maintain territories and pair bond behavior characteristics of unsterilized coyotes, and if predation rates by sterilized coyote pairs would decrease. The results indicated that behaviorally, sterile coyote pairs appeared to be no different from unsterilized pairs, except for predation rates on lambs. Unsterilized coyote packs were six times more likely to prey on sheep than were sterilized packs (Bromley and Gese 2001*b*). Bromley and Gese (2001*b*) 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 coyote breeding pairs could be captured and sterilized. Bromley and Gese (2001*a*, 2001*b*) captured as many coyotes as possible from all packs on their study area and controlled coyote exploitation (mortality) on their study area. During their studies, Bromley and Gese (2001*a*, 2001*b*) found survival rates for coyotes in the unexploited study area were similar to those survival rates reported for mostly unexploited wild coyote populations. Bromley and Gese (2001*b*) concluded a more effective and economical method of sterilizing resident coyotes was needed to make sterilization a practical management tool on a larger scale.

As alternative methods of delivering chemosterilants are developed, sterilization may prove to be a practical tool in some circumstances (DeLiberto et al. 1998). Reduction of local populations could conceivably be achieved through natural mortality combined with reduced fecundity. However, no predators would be killed directly with this method and predators could continue to cause damage.

Sterilization methods were not analyzed in detail in the EA because: (1) surgical sterilization would require that each animal be captured and sterilization conducted by licensed veterinarians, which would be labor intensive and expensive; and (2) currently no federal or state approved chemosterilants are available for operational use to manage local predator populations.

Contraception could be accomplished through: 1) hormone implantation (synthetic steroids such as progestin's), 2) immunocontraception (contraceptive vaccines), and 3) oral contraception (progestin administered daily).

Population modeling indicates that reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates (Dolbeer 1998). Additionally, the need to treat a sufficiently large number of target animals, multiple treatments, and population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproduction control technologies as a wildlife management tool for some species.

Currently, chemical reproductive inhibitors are not available for use to manage most predator populations. Given the costs associated with live-capturing and performing sterilization procedures on predators and the lack of availability of chemical reproductive inhibitors for the management of most predator populations, this alternative was not evaluated in detail. If reproductive inhibitors become available to manage a predator population and if an inhibitor had been proven effective in reducing localized predator populations, the use of the inhibitor could be evaluated as a method available that could be used to managing damage.

2.6.9 Use of Lithium Chloride as an Aversive Agent

This alternative would require WS to use lithium chloride to prevent predation on livestock. 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 (Conover et al. 1977, Sterner and Shumake 1978, Burns 1980, Burns and Connolly 1980, Burns 1983, Horn 1983, Johnson 1984, Burns and Connolly 1985). Results of studies evaluating lithium chloride as a taste aversion agent to prevent coyote predation have reported varying results. Some studies report success using lithium chloride (Gustavson et al. 1974, Ellins and Martin 1981, Gustavson et al. 1982, Forthman-Quick et al. 1985*a*, Forthman-Quick et al. 1985*b*), while other studies have shown lithium chloride to be ineffective, especially in field situations (Conover et al. 1977, Burns 1980, Bourne and Dorrance 1982, Burns 1983, Burns and Connolly 1985). The GAO (2001) reported "…*while the coyotes learned not to eat lambs, they still killed them*". In addition, lithium chloride is currently not registered for use with the EPA and the TDA. Therefore, at the time this EA was developed, lithium chloride could not be used to prevent predation. If a product containing lithium chloride becomes available to manage damage and if the product has been proven effective in reducing predation rates, the use of the lithium chloride could be evaluated as a method available that could be used to managing damage.

2.6.10 Livestock Producers Should Exceed a Threshold of Loss before PDM Actions are taken

As explained in Section 1.16.2, 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 predator damage management 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 1.16.4). 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-Nebraska 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-Nebraska policy is to respond regardless of the requestor's threshold of loss.

Therefore, this alternative is not considered in detail.

2.6.11 Use Regulated Hunting and/or Trapping to Reduce Predator Damage

NGPC can and has used regulated sport 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 NGPC. State-sponsored sport 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 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 human 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).

WS-Nebraska may certainly recommend to NGPC 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.

2.6.12 Use Only Non-lead Ammunition

Effects on various resources from the use of lead ammunition are discussed in Section 3.2 of the EA. APHIS-WS' use of lead ammunition is a small fraction of total lead contamination from many sources. WS-Nebraka and many other state programs have investigated the availability of effective and accurate non-lead ammunition, and have found that such ammunition is not readily available for the wide variety of firearm types used in Nebraska and elsewhere, in the appropriate calibers. It is also more expensive at this point.

WS-Nebraska will follow Department of Interior USFWS policy for eliminating the use of lead ammunition for management and research activities on lands and waters within the National Wildlife Refuge System under their jurisdiction. This policy requires non-lead ammunition to be used by employees of the USFWS, USDA APHIS, other federal agencies, state agencies, universities or private contractors for study and research, dispatch of feral or trespass animals when authorized, and dispatch of injured animals. It does not apply to public hunting on refuges or taking of free-ranging animals that threaten human safety or welfare of wildlife, especially if using lead-free ammunition would result in prolonged unrelieved pain and suffering of the animal. The memo also provides exception for special circumstances for wildlife management

when non-lead ammunition is unavailable or not practice for the specific circumstances (Memorandum, Director USFWS, dated October 3, 2016, FWS/ANRS-NRCP/063775).

WS-Nebraska 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 3.2 this EA would still be valid if WS-Nebraska began using more non-lead ammunition.

2.6.13 Conduct Supplemental or Diversionary Feeding

Supplemental feeding involves providing supplemental acceptable food plots or bait stations either during certain annual periods when damage is occurring or on a year-round basis to lure the animal away from the locations of protected resources. This alternative is inefficient at best, and would most likely lead indirectly to increased damage. Supplemental feeding of carnivores would require a ready and consistent supply of meat, including animal carcasses, and placing those carcasses in areas that predators may be using. These sites could become a public nuisance, inappropriately attract large numbers of predators to a small area, increase intra- and inter-species competition, and require a large and continuous effort.

Supplemental feeding may increase predator populations and alter their natural diets (Fedriani et al. 2000, Newsome et al. 2015); decrease survival rates of targeted populations when food subsidy is removed (Bino et al. 2010, Newsome et al. 2015); predator populations no longer cycle with prey populations, changing life history parameters such as reproduction and social structure, size of home ranges, activity, and movements (Newsome et al. 2015); change interactions with other predator species, and create long-term changes in disease transmission (Newsome et al. 2015).

However, several studies have indicated that providing supplementary feeding for bears damaging trees may reduce actual damage in commercial timber stands (Nolte and Dykzeul 2002, Ziegltrum 1994). Despite the supplemental feeding, some of those bears may still damage trees, and some stands can suffer substantial damage. There, lethal removal of individual bears may be needed to complement supplemental feeding. Those implementing a supplemental feeding method for bears in commercial timber stands must be committed to long-term use of the method, which for some cost may be prohibitive. This method is included in Alternatives 1, 2, and 3, as described in Sections 2.5 and may be recommended to a cooperator.

Therefore, this alternative, other than for bears in commercial timber operations, is not considered in detail.

2.6.14 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-Nebraska 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.

2.6.15 All Losses Confirmed by an Independent Entity (Not WS-Nebraska)

Some commenters request that all livestock losses be confirmed by an entity independent of WS-Nebraska prior to WS-Nebraska 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 Nebraska, other than commercial enterprises that focus on predators less than or equal to the size of coyotes.

In addition as coyotes are regulated in Nebraska as "predators," private landowners or managers may take predators in protection of property on private land. This requirement is also outside the scope of this EA as WS-Nebraska has no authority to implement an independent process for verifying livestock losses.

Requiring entities other than WS-Nebraska 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.

2.6.16 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-Nebraska 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-Nebraska 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-Nebraska 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 (Parks and Messmer 2016) s 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-Nebraska under alternatives that involve some level of WS-Nebraska involvement in PDM.

2.6.17 Livestock Producers Pay 100% of WS-Nebraska Assistance Involving Lethal Removal

This is discussed in Section 2.5 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-Nebraska 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-Nebraska 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-Nebraska already provides technical support to all requesters and operational support (Alternative 1), including lethal assistance to some degree under all alternatives as determined appropriate, except Alternative 4.

Therefore, this alternative is contrary to agency policy and will not be considered in detail.

2.6.18 WS-Nebraska Contracts PDM Activities to the Commercial Sector or Defers All PDM Activities to NGPC

This alternative requires WS-Nebraska to award and oversee contracts for predator damage management activities to the commercial/private sector; WS-Nebraska would not conduct any technical or direct lethal or non-lethal assistance. All legally authorized methods would also be authorized in such contracts. WS-Nebraska 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-Nebraska would continue to be responsible for environmental and NEPA compliance. Private contractors would not be contracted to use M-44s.

WS-Nebraska does not contract its authorized activities to other entities, including commercial entities. NGPC and its agents may already be hired directly by requesters to conduct PDM activities. WS-Nebraska would not assume any responsibility or liability for actions conducted by any other entity.

Therefore, this alternative will not be considered in detail.

2.6.19 Modify Habitats to Reduce Predation

WS-Nebraska may recommend habitat modification as part of its technical assistance activities (WS-Nebraska does not conduct this type of activity itself) in all alternatives having WS-Nebraska 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 4), this alternative will not be considered further as an independent alternative

CHAPTER 3: ENVIRONMENTAL CONSEQUENCES

Chapter 3 provides information needed for making informed decisions when selecting the appropriate alternative to address the need for action described in Chapter 1 and the issues described in Chapter 2. This chapter analyzes the environmental consequences of each alternative as that alternative relates to the issues identified.

3.1 ENVIRONMENTAL IMPACTS ANALYZED

The environmental consequences of each alternative are compared with the environmental baseline (no action alternative/Alternative 1) to determine if the real or potential impacts are greater, lesser or the same. Cumulative and unavoidable impacts, and direct and indirect effects are discussed in relation to the issues for each of the alternatives and the potentially affected species in this Chapter, as appropriate.

- *Direct effects* are caused by the proposed action and occur at the same time and place.
- *Indirect effects* are caused by the proposed action and are later in time or further removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate and related effects on air and water and other natural systems, including ecosystems.

"Results from the incremental impact of the action when added to other past, present, and reasonably future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR §1508.7)

The consideration of past actions may be considered in a cumulative impact analysis as the baseline to which the impact associated with the proposed action or alternative is compared and contrasted. It may also provide a context of the trends over time related to direct or indirect effects associated with the proposed action or alternatives or may illuminate or predict future direct or indirect effects of the proposed action based on past experience with similar types of proposed actions (CEQ 2005).

WS-Nebraska PDM activities have been evaluated for their impacts on several natural environmental factors. However, there are some natural resources that are not discussed in this EA because the impacts on them are considered negligible.

3.1.1 Non-significant Impacts

The actions discussed in this EA do not involve major ground disturbance, construction, or habitat alteration. They would not cause changes in the flow, quantity or storage of water resources. All chemicals used for PDM are used, stored and disposed of in accordance with EPA

and State requirements for the protection of the environment. Consequently, the following resources within Nebraska are not expected to be significantly impacted by any of the alternatives analyzed: soils; geology; minerals; water quality and quantity; floodplains; wetlands; other aquatic resources; visual resources; air quality; prime and unique farmlands; timber; and range. These resources will not be further analyzed.

3.1.2 Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitments of resources are expected, other than the minor use of fuels for motor vehicles and other equipment and similar materials. These will not be discussed further.

3.1.3 Other Environmental Resources

All WS-Nebraska actions would meet the requirements of applicable federal laws, regulations and Executive Orders for the protection of the environment, including the Clean Air Act and Executive Order 13693. WS-Nebraska activities are evaluated for their impact on the human environment and compliance with Executive Order 12898 to ensure Environmental Justice. WS-Nebraska personnel use wildlife damage management methods as selectively and environmentally conscientiously as possible. All chemicals used by WS-Nebraska are regulated by the EPA through FIFRA, NDA, by MOUs with federal land management agencies and by WS Directives. The WS-Nebraska operational program properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. Similarly, because WS makes it a high priority to identify and assess environmental health and safety risks, WS-Nebraska has considered the impacts that alternatives analyzed in this EA might have on children as per Executive Order 13045. All WS-Nebraska PDM is conducted using only legally available and approved damage management methods where it is highly unlikely that children would be adversely affected.

Activities described under the proposed action do not cause major ground disturbance and are not undertakings as defined by the NHPA. In most cases, PDM has little potential to cause adverse effects to sensitive cultural resources because construction and earth moving activities are not conducted. WS-Nebraska has also reached out to Native American Tribes in the State and offered to consult regarding potential impacts of PDM activities, and is establishing systems of regular consultation with tribes when requested.

3.2 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each alternative in comparison to determine the extent of actual or potential impacts on the issues. Therefore, the proposed action alternative (Alternative 1) serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of the WS-Nebraska.

Cumulative and Indirect Impacts on Target Species and Nontarget Species

Cumulative impacts, as defined by the CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time.

Under Alternatives 1 and 4 the WS program, as part of the WS-Nebraska, would address damage associated with predators either by providing technical assistance only (Alternative 4) or by providing technical assistance and direct operational assistance (Alternatives 1, 3 and 4) in Nebraska. The WS-Nebraska program would be the primary federal agency conducting direct operational predator damage management in the State under Alternatives 1, 3 and 4. However, other federal, state, and private entities could also be conducting predator damage management in Nebraska

The WS-Nebraska does not normally conduct direct damage management activities concurrent with other agencies or other entities in the same area, but may conduct damage management activities at adjacent sites within the same period. In addition, commercial companies may conduct damage management activities in the same area. Potential cumulative impacts could occur from either damage management activities over time by the WS-Nebraska or from the aggregate effects of those activities combined with the activities of other agencies and private entities. Wildlife damage management activities in Nebraska would be monitored to evaluate and analyze activities to ensure they were within the scope of analysis of this EA.

The activities proposed in all alternatives would have a negligible effect on atmospheric conditions including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur because of any of the proposed alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

3.2.1 Analysis of the Effects of Alternative 1 on Target and Nontarget Species

Under this alternative, methods used for PDM would be similar to those used under the current program, with restrictions on resources protected only applicable to registered pesticides. PDM may be implemented for the protection of livestock or wildlife. PDM assistance may be requested by private landowners, Tribes, the NGPC, or the USFWS, depending on land ownership and management authority.

In making decisions based on multiple resources, the WS-Nebraska would consider the potential impacts of PDM methods on wildlife populations. In some instances, PDM methods and timing may be adjusted to protect wildlife as well as livestock. As an example, WS-Nebraska may be requested to protect calves from coyote predation. If the area also serves as critical pronghorn

antelope habitat and pronghorn are significantly below population objectives established by the NGPC, PDM might extend beyond cattle producer boundaries to adjacent cooperators to provide reduce predation rates on pronghorn. WS-Nebraska would only conduct activities on adjacent cooperator properties with permission from the appropriate landowner or manager. Similarly, PDM may extend beyond calving season if needed to protect pronghorn fawns. WS-Nebraska would coordinate with land managing agencies and the NGPC to prevent PDM from negatively affecting other natural resources.

WS-Nebraska would not have impacts on wildlife species unless WS-Nebraska is requested to suppress a predator population in a targeted area, such as at fawning/lambing grounds at the request of or in concert with the NGPC or USFWS. For example, if the NGPC or another entity requested coyote removal to enhance localized antelope or deer herds, an increase in local populations would be desired and considered as providing some benefit to the human environment. In this situation, the removal of coyotes could be beneficial to deer and antelope by reducing predation rates, but mostly in fawning and wintering areas. Removing coyotes to prevent predation on deer and antelope would end when herd management goals were met. The decision to manage predators and prey in this manner would be made NGPC, and not by WS-Nebraska

Restrictions exist on the use of pesticides to protect wildlife. M-44 devices may not be used to protect wildlife species that are not federally listed under the ESA as threatened or endangered species. WS-Nebraska could continue to use M-44s to prevent predation on livestock under this alternative; however, those methods would not be used during times when activities were conducted to prevent predation on other wildlife species, except for M-44s to prevent predation on T&E species. All other methods, lethal and non-lethal, may be used in an integrated program to protect both livestock and wildlife under this alternative.

WS-Nebraska may also integrate the protection of human health or safety into decisions regarding PDM. For example, rabies management projects include active surveillance of potential vectors/reservoirs of the rabies virus. Red fox, coyotes, bobcats, raccoons, and striped skunks removed during PDM efforts may be sampled to assess the intensity and extent of enzootic or epizootic wildlife rabies. Similarly, if surveillance in those species was critical for rabies management purposes, they may be removed during PDM programs even if they pose little risk to livestock (*e.g.*, skunks could be targeted during activities to prevent coyote predation on livestock).

WS-Nebraska has been given the authority to manage damage caused by predatory wildlife under the State's system of representative government. The NGPC has management authority over resident wildlife via the State's system of representative government. That system was established to represent the collective desires of the people of the State of Nebraska 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 resident wildlife species. WS-Nebraska recognizes and honors the right of the State of Nebraska to manage resident wildlife species. WS-Nebraska therefore has a policy of abiding by applicable state laws and works cooperatively with the State's wildlife management agencies to assure potential effects

associated with PDM activities conducted by WS-Nebraska on resident wildlife species occur within those desired by the State.

Potential cumulative effects of PDM activities and other actions are analyzed to determine the relative significance of impacts. In addition, management direction from the responsible agency is a determining factor. For example, the NGPC may want to reduce a specific predator population. A declining population of a resident wildlife species does not necessarily equate to a significant impact as defined by the NEPA if the decline was condoned or desired by the state management agency representing the people that live in the affected human population. It is reasonable and proper to rely on the representative form of government within a state as the established mechanism for determining the collective desires or endorsements of the people of a state. WS-Nebraska abides by this philosophy and defers to the collective desires of the people of the State of Nebraska by complying with applicable state laws and regulations that govern the take or removal of resident wildlife.

A viable population can exist at many levels between one that is at carrying capacity (*i.e.*, 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 are generally 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. History has born this out by the fact that efforts in the early half of the 20th century to eradicate some of the predator species being discussed (*i.e.*, coyotes and mountain lions) failed to do so. However, the larger predators' numbers were most likely reduced substantially (Evans 1983). Density dependent rates of increase are a built-in mechanism of most wildlife populations that serve to reduce effects of population reductions whether by harvest, localized control, or non-man-induced mortality. This provides additional assurance that a viable population would be maintained in Nebraska, even if a sustainable harvest rate were exceeded in the short term in areas where the objective is to maintain the population.

3.2.1.1 Effects on Target Species

A common issue is whether damage management actions would adversely affect the populations of target predator species, especially when lethal methods were employed. The analysis for the magnitude of impact from lethal take can be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest trend data. Information on predator populations and trends are often derived from several sources, including published literature and harvest data.

Methods available to address predator damage or threats of damage in Nebraska that would be available for use or recommendation under Alternative 1 (proposed action alternative), and Alternative 3 (technical assistance only alternative) would either be lethal methods or non-lethal methods. Those same methods would also be available to other entities under Alternative 2 (no involvement by WS alternative) and Alternative 4 (use of non-lethal methods only by WS). Under Alternative 3, the WS program could recommend lethal and non-lethal methods as part of an integrated approach to resolving requests for assistance. Alternative 1 would address requests

for assistance received by the WS-Nebraska through technical and/or operational assistance where an integrated approach to methods would be employed and/or recommended. Non-lethal methods that would be available would include, but would not be limited to, habitat behavior modification, pyrotechnics, visual deterrents, cage traps, foothold traps, padded foothold traps, foot snares, translocation, exclusionary devices, tracking dogs, decoy dogs, frightening devices, net guns, immobilizing drugs, reproductive inhibitors, and chemical repellents (see Appendix B for a complete list and description of potential methods).

Non-lethal methods that would be available under all of the alternatives can disperse or otherwise make an area unattractive to predators causing damage and thereby reduce the presence of those predators at the site and potentially the immediate area around the site where non-lethal methods were employed. Non-lethal methods would be given priority by the WS-Nebraska when addressing requests for assistance under Alternative 1, Alternative 3, and Alternative 4 (see WS Directive 2.101). However, non-lethal methods would not necessarily be employed or recommended to resolve every request for assistance if deemed inappropriate by personnel using the WS Decision Model. For example, if a cooperator requesting assistance had already used non-lethal methods, the WS-Nebraska would not likely recommend or continue to employ those particular methods since their use had already been proven ineffective in adequately resolving the damage or threat.

Many non-lethal methods would be used to exclude, harass, and disperse target wildlife from areas where damage or threats were occurring. When effective, non-lethal methods would disperse or exclude predators from the area resulting in a reduction in the presence of those predators at the site where those methods were employed. However, predators responsible for causing damage or threats could be dispersed to other areas with minimal impact on those species' populations. Non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal methods would generally be regarded as having minimal impacts on overall populations of wildlife since individuals of those species were unharmed. The use of non-lethal methods would not have adverse impacts on predator populations in Nebraska under any of the alternatives.

The continued use of many non-lethal methods can often lead to the habituation of predators to those methods, which can decrease the effectiveness of those methods. Proper timing is essential in effectively dispersing predators causing damage. Employing methods soon after damage begins or soon after threats were identified would increase the likelihood that those damage management activities would achieve success in addressing damage. Therefore, the coordination and timing of methods is necessary to effectively resolve predator damage issues.

Lethal methods would also be available for use under all the alternatives by the WS-Nebraska and/or by other entities. Lethal methods that would be available to address predator damage include live-capture followed by euthanasia, firearms, shooting from aircraft, calling and shooting, neck snares, body-gripping traps, gas cartridges, cable restraints, M-44s (sodium cyanide), and the recommendation of harvest during hunting and/or trapping, where appropriate.

When live-captured target animals were to be euthanized under Alternative 1 euthanasia would occur pursuant to WS Directive 2.505 and WS Directive 2.430. Under alternative 3, the WS program would recommend the use of methods to euthanize live-captured or restrained target animals in accordance with WS Directive 2.505. No assistance would be provided by the WS program under Alternative 2 and only non-lethal methods would be recommended or employed by WS under Alternative 4; however, many of those methods available to euthanize live-captured or restrained animals would continue to be available for use by other entities under Alternative 2 and Alternative 4.

The use of lethal methods by any entity could result in local population reductions in the area where damage or threats were occurring since target individuals would be removed from the population. Lethal methods could be employed or recommended to remove predators that have been identified as causing damage or posing a threat to human safety. Therefore, the use of lethal methods could result in local reductions of predators in the area where damage or threats were occurring. The number of predators removed from the population annually by the WS-Nebraska using lethal methods under Alternative 1 would be dependent on the number of requests for assistance received, the number of predators involved with the associated damage or threat, and the efficacy of methods employed. The number of predators removed by the WS-Nebraska without involvement by the WS program and other entities under Alternative 2 would be unknown but would likely be similar to the removal that could occur under Alternative 1. Other entities could continue to use all available methods to manage predator damage under Alternatives 2, 3 and 4.

Most lethal methods would be employed temporarily at a location in order to remove the animals causing the damage, which would be applicable whether using lethal or non-lethal methods. The intent of non-lethal methods would be to harass, exclude, or otherwise make an area unattractive to predators, which disperses those predators to other areas leading to a reduction in damage at the location where those predators were dispersed. The intent of using lethal methods is to remove the offending predators in a given location there by reducing the damage occurring at that location.

Often of concern with the use of lethal methods is that predators that were lethally removed would only be replaced by other predators either during the application of those methods (*e.g.*, predators that relocate into the area) or by predators the following year (*e.g.*, increase in reproduction and survivability that could result from less competition). As stated previously, the WS-Nebraska would not use lethal methods during direct operational assistance as population management tools over broad areas. Lethal methods would be employed under Alternative 1 to reduce the number of target animals present at a location where damage was occurring by targeting those animals causing damage or posing threats. The return of predators to areas where methods were previously employed does not indicate previous use of those methods was ineffective since the intent of those methods were to reduce the number of predators present at a site where predation was occurring or could occur at the time those methods were employed.

To adequately determine the magnitude of impacts in relation to predators and their populations, data and known cumulative take of predators will be analyzed. The management of resident wildlife species is under the authority of state governments. The NGPC is the state agency that

manages damage caused by resident predatory wildlife. The NGPC is the state agency with hunting and sport trapping management responsibility for animals classified by state law as protected game or furbearers. The NGPC provided statistics on harvest for many species and population estimates of some species for Nebraska. Since population estimates are not available for all species and may not have included all of the range for a species, the WS-Nebraska used the best available information to produce reasonable, but conservative population estimates to determine the relative impacts of the alternatives on a species population.

When considering the potential effects on a wildlife population, analyses must consider the *status quo* for the environment. The states have the authority to manage populations of resident wildlife species with the exception of migratory birds 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 compliance with the NEPA. 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 people. Therefore, the *status quo* for wildlife populations is fluctuation, both within and among years, which may affect perceptions of the significance of the human impact on such populations.

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-Nebraska. The GAO (1990) analyzed the effects of damage management activities conducted by the WS program on predators in the western United States and determined that WS activities had no overall adverse effect on predator populations. Several species' populations have steadily increased over the past several years due to the adaptability of those wildlife species to human-made environments, and damage from those species has increased accordingly (International Association of Fish and Wildlife Agencies 2004). To address those 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 to occur. Full accounts of life histories for these species can be found in mammal reference books. The species are discussed in order of efforts directed toward them, their subsequent take, and the occurrence and value of damage that the species cause in Nebraska. Finally, it should be noted that jurisdiction and management of these species mostly lies with the NGPC, which was discussed in Section 1.1 and Section 1.5. Additionally, most of the predators addressed in this EA may be harvested in Nebraska by hunters and trappers for recreation and fur harvest.

Previously, the WS-Nebraska data was matched with harvest data from the NGPC to determine statewide population levels. However, the NGPC discontinued their furbearing animal report that provided harvest data, citing that the long-term sustained decline in trapping and fur dealer licenses, low rate of survey return, and resulting high degree of variance in confidence intervals, did not allow enough precision to make accurate harvest estimates. Therefore, it should be noted that while WS-Nebraska makes every effort to determine a realistic population estimate for each species, these are only estimates because data are unavailable or incomplete for precise

estimates. The population estimates used are for the breeding populations and are thought to be very conservative by NGPC.

Evaluation of activities relative to target species indicated that program activities would likely have no cumulative adverse effects on predator populations when targeting those species responsible for damage at the levels addressed in this EA. Actions of the WS-Nebraska would be occurring simultaneously, over time, with other natural processes and human generated changes that are currently taking place. These activities include, but would not be limited to:

- Natural mortality of predators
- Mortality through vehicle strikes, aircraft strikes, and illegal harvest
- Human-induced mortality of predators through annual hunting and trapping seasons
- Human-induced mortality of predators through private damage management activities
- Human and naturally induced alterations of wildlife habitat
- Annual and perennial cycles in wildlife population densities

The actions taken to minimize or eliminate damage would be constrained as to the scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the environment. WS-Nebraska would use the WS Decision Model to evaluate damage occurring, including other affected elements and dynamics of the damaging species to determine appropriate strategies to minimize adverse effects on the environment (Slate et al. 1992). This process would allow the WS-Nebraska to take into consideration other influences in the environment in order to avoid cumulative adverse impacts on target species.

The lethal removal of predators by the WS-Nebraska to alleviate damage or threats of damage from FY 2010 through FY 2015 was of a low magnitude when compared to the total known take of those species and the populations of those species within the state of Nebraska. The analysis herein indicates predator populations are not being impacted to the point of causing a substantial decline. If, at some point in the future, wildlife populations decline due to harvest or PDM activities, then such a decline would not necessarily constitute a significant impact as defined in the NEPA. Such a decline would not constitute a significant effect so long as the actions that caused the decline were in accordance with the responsible management agency's goals and objectives, with applicable state law, and concomitantly, with the collective desires of the people of the State.

From the standpoint of the NEPA, justification for a Finding of No Significant Impact on the quality of the human environment with respect to the lethal removal of predators in Nebraska is that WS involvement has no adverse effect on the environmental status quo. If the WS program provided no assistance, under state authority, virtually the same predators that could have been lethally removed by the WS program could also be removed by other agencies or private actions. Other agency personnel believe the involvement of WS in the WS-Nebraska actually benefits their ability to manage most predator mortality by encouraging livestock owners to rely on assistance in resolving depredation problems instead of just killing predators themselves as allowed is allowed under state law. This suggests that, if the WS program stopped its involvement in PDM in the State, there would be virtually no change in the number of predators killed or in cumulative environmental effects. Additionally, landowners that are given assistance with damage problems

are much more likely to have a favorable view of wildlife (International Association of Fish and Wildlife Agencies 2004).

No cumulative adverse effects on target and non-target wildlife would be expected from PDM activities based on the following considerations:

The WS-Nebraska would conduct PDM activities only at the request of a cooperator to reduce damage that was occurring or to prevent damage from occurring and only after methods to be used were agreed upon by all parties involved. The WS-Nebraska would monitor activities to ensure any potential impacts were identified and addressed. The WS-Nebraska would work closely with resource agencies to ensure PDM activities would not adversely affect predator populations and that activities were considered as part of management goals established by those agencies.

Historically, the activities of the WS-Nebraska to manage damage or threats of damage associated with predators have not reached levels that would cause adverse effects to predator populations in the State. WS policies are designed to reduce the potential negative effects of actions on predators, and have been tailored to respond to changes in wildlife populations that could result from unforeseen environmental changes. This would include those changes occurring from sources other than the WS-Nebraska. Alterations in programs would be defined through WS policies, and implementation would be insured through monitoring, in accordance with the WS Decision Model (see WS Directive 2.201; Slate et al. 1992).

The methods used by the WS-Nebraska to take target predators under the current PDM program are the same as those that have been used in recent years and were described in Appendix B. The methods used in each damage situation depend on the species causing the damage and other factors, including location (public versus private lands), weather, and time of year. The WS-Nebraska has previously received requests for assistance primarily associated with 9 predator species in the Nebraska (see Table 1 and Table 3 in Chapter 1). The primary target species addressed yearly in Nebraska are badgers, coyotes, feral dogs, feral cats, striped skunks, raccoons, bobcats, red fox, and opossums. Most of the other target predators are addressed by the WS-Nebraska infrequently.

The target predators addressed from FY 2010 to FY 2015 in Nebraska by WS-Nebraska pursuant to the current PDM program alternative are presented in Table 4. Most requests for assistance have been associated with coyote predation on livestock. From FY 2010 through FY 2015, over 57 percent of the target animals addressed by WS-Nebraska in the Nebraska were coyotes. WS-Nebraska also received requests for operational assistance to manage damage or threats of damage associated with badgers, bobcats, red fox, feral dogs, feral cats, raccoons, striped skunks, and opossums in Nebraska. Although WS-Nebraska did not receive requests for direct operational assistance associated with mountain lions, in the state from FY 2010 through FY 2015, WS-Nebraska could receive requests to provide direct assistance associated with that species.

Table 8- WS-Nebraska Lethal Removal of Predator Species in Nebraska FY2010 - FY2015

Species	Fiscal Year and Fate of Target Animal												TOTAL
	FY2010		FY2011		FY2012		FY2013		FY2014		FY2015		
	Killed	Freed	Killed	Freed	Killed	Freed	Killed	Freed	Killed	Freed	Killed	Freed	
Badger	41	0	43	0	49	0	57	0	57	0	84	0	331
Bobcat	1	0	2	0	4	0	5	0	0	0	0	0	12
Feral Cat	45	0	44	0	55	2	30	0	30	0	41	0	247
Coyote	1558	0	2063	0	1983	0	1750	0	1623	0	1625	0	10602
Feral Dog	1	0	2	0	1	0	0	0	0	0	0	0	4
Red Fox	109	0	57	0	45	0	48	0	56	0	87	0	402
Mink	3	0	15	0	6	0	8	0	6	0	2	0	40
Opossums, Virginia	126	0	100	0	218	3	241	0	182	0	94	1	965
Raccoon	464	1	700	0	799	0	820	0	815	0	897	0	4496
Striped Skunk	235	0	233	0	279	0	304	0	106	0	139	0	1296
TOTAL	2583	1	3259	0	3439	5	3263	0	2875	0	2969	1	18395

Table 9 – NGPC Fur Harvest Survey FY 2015 – FY 2016

Species	Estimated Harvest				5-yr Average 2009-2013
	Hunt	Trap	Total Harvest	Previous Season	
Raccoon	26,100	65,035	**93,135**	172,486	**201,718**
Opossum	5,365	15,663	**31,544**	33,285	**32,396**
Coyote[1]	15,881	21,796	**36,268**	46,230	**26,513**
Striped Skunk	2,024	8,082	**10,106**	14,250	**14,674**
Badger	912	2,126	**3,039**	4,915	**4,360**
Mink	64	1,285	**1,349**	1,583	**2,873**
Red Fox	842	2,011	**2,852**	3,416	**3,519**
Bobcat[2]	245	598	**843**	994	**1,565**
Wood Chuck	366	720	**1,086**	1,374	**974**

1 includes only harvest numbers provided by harvesters

2 Total harvest based on pelt tagging, hunt column includes harvest road kill. The potential impacts on the populations of target predator species from the implementation of the current PDM program are analyzed for each species listed below.

Impacts on Coyote Populations

Coyotes are classified as a predator by the NGPC in Nebraska and can be taken year-round. In Nebraska, coyotes are one of the primary species that kill the majority of livestock that are reported to or verified by WS-Nebraska and the NASS (2001, 2005). Therefore, managing damage caused by coyotes is a major focus of efforts by WS-Nebraska. In Nebraska, coyotes

were responsible for an average of about $155,024 in damages to livestock, property, pets, and crops reported to or verified by the WS-Nebraska, which is an average of 502 complaints received annually from FY 2010 to FY 2015. Of all the requests for assistance associated with predators in Nebraska, coyotes averaged 45 percent of all mammalian predator complaints from FY 2010 to FY 2015. The resources protected, in order of reported economic losses included livestock, primarily calves, goats (all), lambs, adult cattle, property (*e.g.*, aircraft, drip irrigation lines, pets), adult sheep, exotic game and poultry, crops, and human health and safety (*e.g.*, injuries to people). Coyotes killed or injured an average of 441 livestock annually from FY 2010 to FY 2015.

Coyotes were once found only in western states, but have expanded their range in recent history to much of North America because 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). 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. Coyotes are characterized by wildlife biologists as very resilient. Habitat changes that have occurred over the last two hundred years have often favored coyotes.

Coyote density estimation is frequently limited to educated guesses (Knowlton 1972). Coyotes are highly mobile animals with home ranges (territories) that vary seasonally and with sex, age, and breeding status (Todd and Keith 1976, Although 1978, Pyrah 1984). Literature on coyote spatial organization varies (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)[7]. However, Ozoga and Harger (1966), Edwards (1975), and Danner (1976 observed wide overlap between coyote home range and did not consider coyotes territorial. Each occupied coyote territory may have several nonbreeding members 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 percent 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 percent, 37 percent, 10 percent and 6 percent of the resident population, respectively. The presence of unusual food concentrations and nonbreeding coyotes at dens can influence coyote densities, and complicate efforts to estimate abundance (Danner and Smith 1980). A positive relationship between coyote densities in mid-late winter and the availability of dead livestock has been reported (Roy and Dorrance 1985).

Many authors have estimated coyote populations throughout the west and elsewhere (Clark 1972, Knowlton 1972, Camenzind 1978, USFWS 1979, Pyrah 1984, Andelt 1985). Coyote population densities can 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 were low (just prior to the annual period of pup birth) and a high of 3.6 to 5.0 coyotes/mi^2 when populations were high (just after the period of pup birth) (Pyrah 1984, Knowlton 1972). Nebraska has relatively high densities of coyotes. In general, coyote populations decrease from south to 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

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

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 across the west to be an average of 0.5 to 1.0 per square mile over much of the coyote's range.

Currently "Total Harvest" estimates derived by combining WS-Nebraska's take with "Other Harvest" figures represent some of the best information available on the viability of coyote population in Nebraska (Table 9.1) even though "Total Harvest" is affected by factor such as snow cover, prey base, and the number of sport trappers. In Nebraska, the coyote population appears to fluctuate in a cyclical pattern. Nebraska coyote densities (Table 9.1) appear higher today than in the late 1990's, suggesting that coyote numbers are stable or increasing. From 2010 to 2015, WS-Nebraska took an average of 1,767 coyotes annually, while private individuals killed on average 26,513 (NGPC unpubl. data) coyotes over a slightly shorter period (2010-2014) (Table 9.1). Additional coyotes were undoubtedly taken by the public, but were not reported and could not be included in this analysis. Harvest information suggests that the coyote population in Nebraska is viable and healthy (Table 9.1) and WS-Nebraska take of coyote has remained relatively consistent from 2010 to 2015.

The unique resilience of the coyote, its ability to adapt, and its perseverance under adverse conditions is commonly recognized among biologist and rangeland managers. Despite intensive historical production areas and despite sport hunting and trapping for fur, coyotes continue to thrive and expand their range, occurring widely across North and Central America. Population estimates made by field observations, when based on experience, knowledge of the species being estimated, and intuition, may provide estimates as accurate as those based on more scientific methods (Fritzell 1987). The opinions of personnel from WS-Nebraska that conduct PDM activities in Nebraska generally agree that coyote numbers are at a relatively high density, especially compared to other western states.

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 percent of the population was removed. The population recovered within 5 years when 60 to 90 percent 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 were not allowed to move in from surrounding areas (no immigration), which all would occur in the natural environment. 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 less than 60 percent 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 percent removal had fewer transient animals, a younger age structure, and higher reproduction. Sustained removal rates of more than 70 percent of the population resulted in removal of the entire population after 7 years, but the authors acknowledged that annual removal of 70 percent 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) that indicated coyote populations could withstand an annual removal of up to 70 percent of their numbers and still maintain a viable population. This conclusion is consistent with the GAO (1990) assessment that impacts on coyote populations in the western United States by the WS program could 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 from predation, immigration of coyotes from the surrounding area can quickly replace 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.

In Nebraska, WS-Nebraska lethally removed an average of 1,767 coyotes annually from FY 2010 to FY2015 with a high of 2,063 coyotes removed in FY 2011, which represented about 8 percent of the estimated coyote "Total Harvest" in Nebraska (see Table 9.1). On average, harvest in Nebraska could increase by 12,000 additional coyotes removed or 52 percent of the coyote "Total Harvest" before a sustainable harvest threshold would be met. Harvest levels would have to increase even higher before a decline in the population would be seen.

Table 9.1 - Coyotes taken in Nebraska by the WS-Nebraska from FY 2010 to FY 2015

	Fiscal Year						
	FY 2010	FY2011	FY2012	FY 2013	FY 2014	FY 2015	Average
Est. State wide Harvest	26,513	26,513	26,513	26,513	26,513	26,513	26,513
WS-Nebraska Statewide Take	1,558	2,063	1,983	1,750	1,623	1,625	1,767
WS-Nebraska Statewide Take - % of Statewide Harvest Est.	6%	8%	7.5%	7%	6%	6%	7%
Long-term Sustainable Harvest	60%	60%	60%	60%	60%	60%	60%

Based on this information, the potential impact on the coyote population in Nebraska by WS-Nebraska would not affect the coyote population because the total take of coyotes in the area is currently far less than 60 percent of the estimated population. The analysis further suggests annual coyote removal could conservatively be increased substantially before the short-term 70 percent allowable harvest level would be reached. Therefore, it is reasonable to conclude that impacts on the coyote population within Nebraska, are not substantial and would remain so even if lethal take of coyotes by the WS-Nebraska increased by 12,000 coyotes. WS-Nebraska expects the annual lethal removal of coyotes to exceed 3000 coyotes in the State to remain similar to

previous years. Even if WS-Nebraska were to increase to a yearly take of 3000 coyotes this would not cause an adverse effect on the population base and the long term sustainable harvest would still be far less than 60 percent of the estimated statewide harvest.

Impacts on Feral Dog Populations

Feral (wild) and free-roaming dogs are somewhat common in Nebraska and damage associated with dogs can be extensive. Domestic dogs kill or injure livestock and poultry, and present a problem for human health and safety (*e.g.*, attacks and disease threats). The WS-Nebraska responded to an average of seven requests for assistance annually from FY 2010 to FY 2015 in the State. Most of the damage, averaging almost $1,191 annually (0.7 percent of the total value of all predation losses), was to livestock and almost all of the requests for assistance were to protect livestock resources. Less than 8.5 percent of complaints were to protect human health and safety. Free-roaming dogs are also known to prey on native wildlife such as deer and upland game. An average of one request per year for assistance associated with natural resources was received by the WS-Nebraska in Nebraska. Primary responsibility for dog control rests with county and municipal authorities or the resource owner/manager. Efforts to address damage associated with feral and free-roaming dogs would be conducted in accordance with WS-Nebraska Policy 2.325 for controlling dogs. Feral dogs are not part of the native environment, and when left abandoned in the wild are often considered ecological concerns because they can prey on native wildlife. The estimated dog population in the United States is 74.8 million in 44.8 million homes (American Pet Products Manufacturers Association 2008). However, an unknown percentage of those animals have become wild (Bergman 2009).

Requests for help with feral dogs are approved by the appropriate state or local agency as regulated by Nebraska state and local laws. Most State, local or tribal laws and regulations require that dog owners comply with leash laws and trespassing ordinances. Generally, owners must maintain direct control of their pets so that they do not pose health and safety threats to humans, other animals, or themselves. In urban areas where local control offices or authorities exist, WS-Nebraska shall collaborate with them to determine if WS action is necessary. If WS action is necessary and requested by local authority, WS-Nebraska must first achieve written approval of the WS Reginal Office and notify the WS Deputy Administrator before action my take place (see WS Directive; 2.340) In response to a yearly average of seven requests for assistance involving dogs, the WS-Nebraska removed an average of 1 feral dogs per year from FY 2010 to FY 2013 with no feral dogs taken in the last three years (see Table 4). The WS-Nebraska also unintentionally live-capture or removed five feral dogs as non-targets during other PDM activities. The lethal removal of feral or free-ranging dogs by the WS-Nebraska is considered to have little impact on the human environment since dogs are not an indigenous to Nebraska. In addition, the annual take of dogs by WS-Nebraska is minor in comparison to the thousands killed by animal control and humane organizations in Nebraska each year. The WS-Nebraska addresses feral and free-roaming dogs at the request of the local authority for animal control and, thus, this action would likely occur in the absence of involvement by WS-Nebraska.WS-Nebraska expects the annual lethal removal of feral and free-roaming dogs in Nebraska to remain similar to previous years and not to exceed to more than ten dogs removed per year.

Impacts on Mountain Lion Populations

The majority of mountain lion complaints involve predation of livestock, pets, and rarely, threats to people. WS-Nebraska responded to complaints in which Mountain lions were responsible for over $1,200 in damages (less than 1 percent of all predator damage) between FY 2010 and FY 2015 in Nebraska. Most requests for assistance were associated with livestock predation, with an average of 5 requests received annually from FY 2010 to FY 2015. Mountain lions were also responsible for an average of eight requests to WS-Nebraska annually for assistance involving human health and safety concerns..

Mountain lions are extensively distributed across western North America including portions of Nebraska. Mountain lions inhabit many habitat types from desert to mountain environments, indicating a wide range of adaptability, and are closely associated with deer, elk, collared peccaries (*Pecari tajacu*) and other large mammals (Young 2009). For example, 159 mountain lion scats from southwestern Arizona (1987-1990) contained remains from mule deer; 39 percent), collared peccaries (25 percent), cattle (13 percent), mountain sheep (*Ovis canadensis mexicana*; 7 percent), small rodents (8 percent), lagomorphs (8 percent), badgers (5 percent), skunks (4 percent), raccoons (2 percent), porcupines (*Erethizon dorsatum*) (2 percent), beetles (2 percent), mountain lions (1 percent), bobcats (1 percent), canids (1 percent), gila monsters (*Heloderma suspectum*) (1 percent), and chuckwalla (*Sauromalus obesus*; trace)(Cashman et al. 1992). In Nebraska, the mountain lion is managed as a game animal and currently there is no hunting or harvest being conducted.

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 (Robinette et al. 1961, Seidernsticker et al. 1973, Ashman et al. 1983). 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 competition (*i.e*., competition between or among members of the same species) with other mountain lions. Prey availability is directly related to the habitat quality 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 (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 area.

Mountain lion densities, based on a variety of population estimating techniques, range from approximately 1/100 mi^2 (McBride 1976, Hemker et al. 1984) to as high as 24/100 mi^2, and

average 7.5/100 mi^2 in western states (Johnson and Strickland 1992). Cunningham et al. (1995) determined that mountain lion densities were about 75 percent higher in the portion of their study area subject to greater depredation control and sport hunting, with an estimated density of from 4 to 7/100 mi^2. However, studies that followed mountain lions for at least 12 months found that densities ranged from 0.13 to 0.013/mi^2 (Lindzey 1999).

Although mountain lions were part of Nebraska's native fauna, they were extirpated by the end of the 19th century. Despite annual reports since the 1950s, no confirmed sightings occurred in the state until the 1990s. In 1991 a deer was found killed by a mountain lion and shortly after an adult mountain lion was shot by a hunter near Harrison, in Sioux County. Mountain lions in Nebraska are part of the larger population that spans all western states, particularly South Dakota and Wyoming. In 2017, Nebraska currently has three mountain lion populations. The largest is in the Pine Ridge area (population size estimated at 59) where mountain lions were hunted as part of the state's inaugural mountain lion hunting season in 2014. Combined with the take during the 2014 hunt and other human caused mortality, 16 mountain lions mortalities were documented from the estimated population. In January 2015 NGPC suspended mountain lion hunting during the 2015 and 2016 primarily due to the unusual number of documented mortalities (particularly to females) in 2014. The Niobrara Valley and Wildcat Hills also have populations, and mountain lions do occur in other parts of the state.

Studies of mountain lion population dynamics provide insight into sustainable harvest levels. Ashman et al. (1983) found that a Nevada mountain lion population was capable of recruitment sufficient to rapidly replace annual losses of from 30-50 percent. Logan et al. (1996) determined the rate of increase in a New Mexico study varied from 8 to 11% in an un-hunted, uncontrolled population to 21 to 28% in a population where harvest and control was simulated by removing half of the lions from the study area. Those studies concluded that rates of increase in mountain lion populations were density dependent and 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 percent of the adults should be harvested annually, but that in a population managed for control, harvest levels in excess of 28 percent per year may be needed. In a more recent research Robinson et al (2014) has shown that mountain lion populations are affected by human harvest through additive effects on survival of all age class and resultant disruption of juvenile and mountain lions do not possess the ability to respond to harvest through increased reproduction.

From FY 2010 through FY 2015, WS-Nebraska received 22 requests for assistance associated with mountain lions in which represented 5 requests per year. WS-Nebraska killed one mountain lion in Nebraska during FY 2010 to FY 2015. No other mountain lions were live-captured or lethally removed during this time period, WS-Nebraska expects the annual lethal removal of mountain lions to remain static. Based on Ashman et al. (1983) and Logan et al. (1996), the number of mountain lions lethally removed by the WS-Nebraska is unlikely to reach a magnitude where adverse effects would be expected.

Under State law, any farmer of rancher owning or operating a farm or ranch, or his or her agent, may kill a mountain lion immediately without prior notice or permission from NGPC if he or she encounters a mountain lion and the mountain lion is in the process of stalking, killing, or consuming livestock on the farmers' or rancher's property. In addition any person shall be entitled to defend himself or another person without penalty if, in the presence of such person, a mountain lion stalks, attacks or shows unprovoked aggression toward such person or another person. The type of harvest allowed provides an indication the population of mountain lions is not likely to decline from overharvest. The NGPC monitors statewide mountain lion mortality. WS-Nebraska involvement could enhance the ability of the NGPC to monitor mountain lion mortality through reporting.

Impacts on Skunk Populations

Striped skunks (*Mephitis mephitis*) and eastern spotted skunks (*Spilogale putorius*) are present in Nebraska, with striped skunks being more abundant. Striped skunks are mostly associated with farmland and urban areas while spotted skunks prefer mountainous areas. 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. Although primarily solitary, skunks may den communally near winter. Skunk home ranges are on average 0.85-1.9/mi^2 for striped skunks in rural areas (Houseknecht 1971, Storm 1972, Bjorge et al. 1981, Rosatte and Gunson 1984). Skunk population densities vary by habitat type, food availability, disease, and season (Storm and Tzilkowski 1982).

Skunks cause odor problems around homes, are potential rabies reservoirs, and prey on livestock and agricultural products. WS-Nebraska could conduct skunk damage management and disease control and research activities on behalf of landowners, agencies, and institutions. Striped skunks are consistently responsible for a high number of requests for assistance in Nebraska (mean = 116 requests per year; FY2010-FY2014). During the same period, an average of less than1 request/year is made for assistance with spotted skunk damage. Despite this, skunks are responsible for only about 12 percent of the value of damage reported to or verified by the WS-Nebraska.

The majority of requests to WS-Nebraska for assistance with skunks are related to concerns about property damage and human health and safety. WS-Nebraska killed an average of 216 striped skunks in Nebraska from FY 2010 through FY 2015 (see Table 4). The highest annual lethal removal occurred in FY 2013 when 304 striped skunks were lethally removed by WS-Nebraska. The lethal removal of just over 200 striped skunks annually WS-Nebraska program represents a very small percentage of the statewide population, and WS-Nebraska expects the annual lethal removal of striped skunks to remain below 500 animals.

Spotted skunks occur infrequently in the southeastern part of Nebraska (Adams 1961). They prefer open lowlands but are equally at home in mountainous country and in a variety of habitats including farmyards, wastelands and chaparral. Few studies have been published on the home range, population density and mortality of spotted skunks

WS-Nebraska received one request for assistance associated with spotted skunks related to human health and safety concerns during FY 2010 - FY 2015. However, no lethal control of spotted skunks occurred by WS-Nebraska during that time, and none is anticipated. Consequently, WS-Nebraska impacts to spotted skunks will be negligible.

Impacts to Feral Cat Populations

Feral cats are common in many parts of Nebraska, especially close to human habitation. Feral cats are not part of the native environment, and left abandoned in the wild are considered an ecological pest and very efficient predators responsible for killing millions of native wildlife annually (ABC 2011) and competing with native predators. Feral cats have been cited as having a negative effect on several wildlife species (ABC 2011). Primary responsibility for addressing damage or threats of damage caused by feral cats lies with county agencies, local authorities, or the resource owner/manager. There are an estimated 30 million invasive (feral) cats (Luoma 1997) and an estimated 63 million invasive (captive) cats (Nassar and Mosier 1991) in the continental United States (Pimentel et al. 2000).

WS-Nebraska has received 14 requests for assistance with damage or threats of damage to agricultural resources caused by feral cats and 18 requests for assistance associated with property damage between FY 2010 through FY 2015. During other damage management activities, the WS-Nebraska unintentionally caught and freed four feral cats, and lethally removed an average of 41 feral cats per year between FY 2010 and FY 2015. WS-Nebraska does not anticipate the lethal removal of feral cats to increase substantially. Based on the limited and infrequency of lethal removal that could occur, impacts would be nonexistent or of very low magnitude. The limited removal of feral cats by the WS-Nebraska would normally have minimal effects on local populations in the State, although in some instances temporary population reductions may occur and provide relief from predation on native species. Some local populations may be temporarily reduced at a local site if cats were removed using non-lethal or lethal methods. In those cases where feral cats were causing damage or were creating a nuisance and complete removal of the local population could be achieved, this could be considered as providing some benefit to the natural environment since feral cats are not considered part of the native ecosystem. The lethal removal of cats that could occur by the WS-Nebraska would be minor and not exceed more than 100 feral cats per year.

Impacts to Raccoon Populations

Raccoons are considered a furbearer in Nebraska and the NGPC is responsible managing their population. Raccoons are abundant throughout North America, except for 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 Nebraska, 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 distance from water in a variety of habitat combinations of grain crops and water. Raccoon densities are reported to range from 9.3/mi^2 to 80/mi^2 (Yeager and Rennels 1943, Urban 1970, Sonenshine and Winslow 1972, Hoffman and Gottschang 1977, Rivest and Bergerson 1981). Raccoons are an omnivore, feeding on carrion, garbage, birds, mammals,

insects, crayfish, mussels, other invertebrates, a wide variety of grains, various fruits, other plant materials, and foods prepared for human or animal consumption (Sanderson 1987). Raccoon damage problems, including predation, property damage, and human health and safety concerns, were reported an average of 27 times annually from FY 2010 to FY 2015 causing 3 percent of the value of all predator damage recorded by the WS-Nebraska during that period. The raccoon population in Nebraska has increased largely due to an increase in manmade habitat where raccoons often thrive (Rivest and Bergerson 1981).

Between FY 2010 and FY 2015, WS-Nebraska lethally removed an average of 749 raccoons each year. Additionally, WS-Nebraska unintentionally lethally removed an average of 1 raccoons as non-targets from FY 2010 to FY 2015. The highest annual lethal removal by the WS-Nebraska between FY 2010 and FY 2015 occurred in FY 2015 when 897 raccoons were removed, which represents less than 0.5 percent of the estimated total fur harvest in the State (NGPC unpublished. data). WS-Nebraska expects the annual lethal removal of raccoons to be similar to the FY 2010-FY 2015 average and not to exceed 1,000 raccoons per year.

Impacts on Fox Population

The NGPC manages red, grey and swift fox population with the red and grey fox classified as fur-bearers/predators in Nebraska while swift fox are classified as state endangered with no harvest of take allowed. Red fox are found throughout much of North America, and they can be found throughout Nebraska. Much debate has occurred about the distribution of native versus non-native red fox in the United States (Voigt 1987, 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 live in close association with people. Those fox were brought from Europe for fox hunting because the native gray fox were not as good for fox chasing (they often climb trees to escape) and not as desirable in the fur market. However, the population that inhabits Nebraska is within the native range of the red fox (Kamler and Ballard 2002). Red foxes prefer mixed woodlands, farm and open country, but can be found in close association with human activities, such as in suburban developments. Red fox prey mostly on small mammals, birds, insects and mast, and will feed on small livestock and poultry. Red fox have a home range of 1 to 2 mi^2, but often travel outside this area. Red fox usually den on slopes in porous soils and have one litter per year of four to nine pups. Red fox densities are reported to range from 0.3 per mi^2 in tundra habitat to 80 per mi^2 in urban habitats (Voigt 1987).

Published estimates of population densities for red fox range from more than 50/mi^2 (Harris 1977, Harris and Rayner 1986, MacDonald and Newdick 1982) where food was abundant to 2.6/ mi^2 in Ontario (Voigt 1987), and to 1 fox den/3 mi^2 in Nebraska. WS-Nebraska received an annual average of 53 request for assistance associated with red fox from FY 2010 to FY 2015. WS-Nebraska lethally removed an average of 67 red foxes in Nebraska during that time, and the highest annual take occurred during FY 2010 when 109 red foxes were removed, representing 2.9 percent of the estimated total harvest. The annual allowable harvest level for red fox would be 70 percent (Davis 1974) for the long-range maintenance of those species. WS-Nebraska expects the annual lethal removal of red fox to not exceed 150 red for in a given year, including non-target removal, and consequently, the number of red foxes lethally removed by the WS-Nebraska is unlikely to reach a magnitude where adverse population-level effects occur.

Swift fox (*Vulpes velox velox*) live primarily in short-grass prairies and deserts. Like most canids, the swift fox is an omnivore, and its diet includes grasses and fruits, as well as small mammals, carrion, and insects. Swift foxes occur in western part of Nebraska along the Wyoming and Colorado border. Two swift fox were lethally removed unintentionally as non-targets during FY 2008 but no other take has occurred since then.

While WS-Nebraska did receive 3 requests for assistance associated with swift fox during FY 2010 - FY 2015, no lethal removal of swift foxes occurred. WS-Nebraska does not anticipate the lethal removal of those fox species to exceed more than two per year. Based on the limited lethal removal that could occur impacts would be nonexistent or of very low magnitude.

No requests for assistance were received associated with grey fox.

Impacts to Bobcat Populations

Bobcats were responsible for an average of $2,353 damage to livestock and pets based on an average of 10 complaints per year reported to or verified by WS-Nebraska. Annual population estimates are not maintained by the NGPC. However, NGPC keeps track of bobcats harvested and kill by vehicle each year (NGPC unpubl. data). The bobcat harvest density per square mile was highest in the southern and central counties in Nebraska, followed by the northeast harvest densities were Franklin (11 bobcats per 100 miles^2), Boyd (9 bobcats per 100 miles^2) and Gosper (8 bobcats per 100 miles^2). The sustainable harvest level for bobcats has been estimated at 20% of a given total population (Rolley 1985), which is close to the allowable harvest level of 19% indicated by Bluett and Tewes (1988).

Bobcats generated the sixth most requests annually for assistance with damage and threats in Nebraska from FY 2010 through FY 2015. To alleviate requests for assistance, WS-Nebraska lethally removed an average of 3bobcats annually in the State from FY 2010 through FY 2015, and no non-target bobcats. The highest annual removal occurred in FY 2012 when 4 bobcats were removed. WS-Nebraska expects the annual lethal removal of bobcats to remain similar to FY 2010 – FY 2015 and not exceed 10 bobcats per year, and consequently the number of bobcats lethally removed by WS-Nebraska is unlikely to cause negative population-level effects. While at this time there is no indication that the harvest negatively impacts bobcat populations in Nebraska, an implementation of bag limit will be considered by NGPC if a substantial and persistent drop in total harvest occurs in coming years (NGPC unpublished data).

Impacts to Opossum Populations

The NGPC manages the opossum as a fur bearer, however, at any time of the year, farmer and ranchers may take, or have their “agent” take, opossums that are causing agriculture depredation. Opossums are associated with riparian areas, deciduous woodlands, cottonwood forests, pinyon-juniper woodlands, farmlands, old fields, grasslands, marshlands, agricultural and forested edges, and desert plains.

On average, during FY 2010 – FY 2015, opossums were responsible for an average of 40 requests for assistance associated with threats of damage to WS-Nebraska, and causing an average of $110 in damage per request annually to poultry, other livestock, property, and human health and safety. In response to requests for assistance, the WS-Nebraska intentionally removed an average of 161 opossums annually during the same period with the highest annual removal occurring in FY 2013 when 241 opossum were removed; no non-target opossums were removed. WS-Nebraska expects the annual lethal removal of opossums to remain similar to FY 2010 – FY 2015 and not to exceed 250 in a given year, and consequently the number of opossums lethally removed is unlikely to cause negative population-level effects.

Impacts to Mink Populations

The NGPC manages mink as furbearers. Mink are associated with semi-permanent and permanent wetlands, streams, and rivers.

During FY 2010 to FY 2015, mink were a damage threat to endangered least terns and threatened piping plovers. Also, during FY 2010 to FY 2015, WS-Nebraska verified and had reported one agricultural and one property damage threat due to mink. However, since WS-Nebraska took 40 mink during this period compared with >3,000 taken annually by fur harvesters, the magnitude of the WS-Nebraska take is low. WS-Nebraska does not anticipate taking more than 50 mink per year.

Impacts to Badger Populations.

In Nebraska, badgers typically damage cemeteries, pastures, croplands, shrubs, property, and livestock, and occasionally represent threats to public health and safety. From FY2010 to FY2015, badgers caused 43 incidents of agricultural damage and 79 incidents of property damage costing an average of $1,231 per request.

Badgers are members of the *Mustelidae* family. The badger is a large, broad-bodied animal with strong legs and long claws adapted for digging. Male badgers average 19 lbs. and females average 14 lbs. Badgers are inhabitants of grassland communities, but can also be found inhabiting forest edges. Badgers are opportunistic feeders preying on a wide variety of birds, mammals, eggs, reptiles, amphibians, invertebrates, and even plant material.

Little is known about badger densities. Messick and Hornocker (1981) believed that the Snake River Birds of Prey Natural Area and adjacent lands in southwestern Idaho supported badger densities of up to 13/mi2. Badger Population Impact Analysis Badger populations are reported to be able to sustain harvest rates of about 30-40% annually (Boddicker 1980). The NGPC reported 6,337 badgers taken by fur harvesters statewide during the 2012/2013 season (NGPC unpublished data). Nebraska WS removed 331 badgers during FY2010 to FY2015 (Table 4). Nebraska WS primarily takes badgers as a target species, but they are also occasionally captured as a non-target species in foot-hold traps set to capture coyotes. In FY 2015, WS-Nebraska removed 84 badgers, representing approximately 0.9 percent of the reported total harvest for this species. Consequently, the potential impact from WS-Nebraska take. There is no expectation that

WS-Nebraska badger take will increase substantially in future and WS-Nebraska does not anticipate taking more than 400 badgers per year.

Impacts to Weasel Populations

Three species of weasels potentially occur in Nebraska; the long-tailed weasel (*Mustela frenata*), the ermine, stoat or short-tailed weasel (*M. erminea*), and the least weasel (*M. nivalis*). However, WS has not always distinguished between these in MIS data. The long-tailed weasel is found throughout Nebraska and the least weasel is found in the eastern two-thirds of the state (Jones et al. 1983). Population densities of long-tailed weasels vary due to a variety of factors including habitat and prey availability.

In Nebraska, weasels infrequently kill poultry. In FY2010, twenty chickens worth $500 were killed by weasels. Weasels caused a damage threat to domestic turkeys and endangered least terns in FY 2012. It was also reported in FY 2014 that 6 peafowl where threatened by long-tailed weasels. Despite this, WS-Nebraska removed no weasels during FY 2010 – FY 2015. WS-Nebraska does not anticipate taking more than 10 weasel in a given year.

3.2.1.2 Effects on Non-target Species and Sensitive Species

Potential effects to non-target species from PDM arise from the use of non-lethal and lethal methods to alleviate or prevent damage. The use of non-lethal methods during activities to reduce or prevent damage caused by predators has the potential to exclude, disperse, or capture non-target wildlife. However, the effects of non-lethal methods are often also temporary and often do not involve the take of non-target wildlife species. When using exclusion devices and/or repellents, both target and non-target wildlife can be prevented from accessing the resource being damaged. Since exclusion and repellents do not involve lethal take, cumulative impacts on non-target species from the use of exclusionary methods or repellents would not occur but would likely disperse those individuals to other areas. Exclusionary methods and repellents can require constant maintenance to ensure effectiveness. Therefore, the use of exclusionary devices and repellents would be somewhat limited to small, high-value areas and not used to the extent that non-targets would be excluded from large areas that would cumulatively impact populations from the inability to access a resource, such as potential food sources or denning sites. The use of visual and auditory harassment and dispersion methods would generally be temporary with non-target species returning after the cessation of those activities. Dispersal and harassment do not involve the take (killing) of non-target species and similar to exclusionary methods would not be used to the extent or at a constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

The use of lethal methods or those methods used to live-capture target species followed by euthanasia also have the potential to affect non-target wildlife through the take or capture of non-target species. Capture methods used are often methods that would confine or restrain target wildlife after being triggered by a target individual. Capture methods would be employed in such a manner as to minimize the threat to non-target species by placement in those areas frequently used by target wildlife, using baits or lures that are as species specific as possible, and modification

of individual methods to exclude non-targets from capture. Most methods described in Appendix B are methods that confine or restrain wildlife that would be subsequently euthanized using humane methods. With all live-capture devices, non-target wildlife captured could be released on site if determined to be able to survive following release. WS policies are intended to ensure take of non-target wildlife is minimal during the use of methods to capture target wildlife.

The use of firearms and euthanasia methods would essentially be selective for target species since identification of an individual would be made prior to the application of the method. Euthanasia methods would be applied through direct application to target wildlife. Therefore, the use of those methods would not affect non-target species.

All chemical methods would be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals would be stored and transported in accordance with WS-Directives and relevant federal, state, and local regulations. Chemical methods available for use under the proposed action would include repellents, sodium cyanide, fumigants, immobilizing drugs, and euthanasia chemicals, which are described in Appendix B. Except for repellents that would be applied directly to the affected resource, those chemical methods available for use would be employed using baits that were highly species-specific, used in known burrow/den sites, and/or used in areas where exposure to non-targets would be minimal. All chemicals would be used according to product labels, which would ensure that proper use would minimize non-target threats. WS adherence to Directives governing the use of chemicals would also ensure non-target hazards would be minimal.

The methods described in Appendix B have a high level of selectivity and could be employed using policies to ensure minimal impacts to non-target species. The unintentional take of wildlife would likely be limited and would not reach a magnitude where adverse effects would occur. Based on the methods selected to resolve predator damage and/or threats, WS-Nebraska does not anticipate the number of non-targets taken to reach levels where declines in those species' populations would occur. Therefore, take under the proposed action of non-targets would not cumulatively affect non-target species. The WS-Nebraska has reviewed the T&E species listed by the USFWS in Nebraska.

Some concerns have been raised regarding the cumulative effects on wildlife populations associated with aerial overflights when added to other types of low-level overflights.

Nebraska has one military air base with routine aerial activity: Offutt Air Force Base (AFB) located in Bellevue, and two Air National Guard Units located in Lincoln and Bellevue. Not all military bases in Nebraska fly training missions. The Air National Guard in Colorado finalized an EIS (Air National Guard 1997) 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.

Many studies exist that have documented behavioral responses in wildlife associated with aerial overflights, but those studies have not provided evidence that wildlife species populations have been adversely affected to any substantial degree. The Air National Guard (1997) 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. The Air National Guard (1997) concluded that no adverse effects were expected on any wildlife species in any of the airspace components where the training flights would occur.

Aircraft overflights within 650 to 1,640 feet have been shown to increase the heart rates and cortisol levels of large herbivores (United State Forest Service 1992). However, even when animals flee temporarily from approaching aircraft, available evidence suggests risks of adverse effects 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 (United State Forest Service 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. It can be concluded that aircraft overflights will not adversely affect wildlife species within the region of influence. The Air National Guard (1997) 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.

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 the Air National Guard (1997) show that, despite considerable research on numerous wildlife species, no scientific evidence exists that indicates any substantive adverse effects on wildlife populations would occur as a result of any of the types of low level or other overflights that do or may occur. It is apparent that aerial operations activities that have occurred in Nebraska, or may occur in the future, even with the potential of other commercial or military training flights in the same area, would be 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-Nebraska. In conclusion, the WS-Nebraska has 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.

Nontarget species could be lethally removed unintentionally during PDM activities whether implemented by the WS-Nebraska, other agencies, or the public. Concern is raised frequently about the potential impacts to non-target species, including T&E species, from the use of methods to resolve damage caused by predators. The potential effects on the populations of non-target wildlife species, including T&E species, are analyzed below.

Under this alternative, methods used for PDM would continue under the current WS-Nebraska PDM program, with restrictions on resources protected only applicable to registered pesticides. Although additional activities could be conducted under this alternative to reduce damage or

threats of damage across multiple resource types, those additional activities would not likely result in a substantial increase in the unintentional take of non-targets or non-target species. WS-Nebraska would continue to implement those policies discussed in Chapter 2 to minimize the unintentional take of non-targets.

There is potential for adverse effects to non-target wildlife (non-targets) from PDM activities. Under the no action alternative, the WS-Nebraska could provide both technical assistance and direct operational assistance to those persons requesting assistance. The risks to non-targets from the use of non-lethal methods as part of an integrated direct operational assistance program would be similar to those risks to non-targets discussed in the other alternatives. Personnel from WS-Nebraska would be experienced with managing wildlife damage and would be trained in the employment of methods which would allow employees to use the WS Decision Model to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, the WS-Nebraska would employ the most selective and species-specific methods for target species. Policies to prevent and reduce any potential adverse impacts on non-targets are discussed in Chapter 2 of this EA. Despite the best efforts to minimize non-target exposure to methods during program activities, the potential for WS-Nebraska to disperse or lethally remove non-targets exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

Non-lethal methods have the potential to cause adverse effects to non-targets primarily through exclusion, harassment, and dispersal. Potential impacts to non-targets from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. Non-targets would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal removal would occur. Although non-lethal methods do not result in lethal removal of non-targets, the use of non-lethal methods could restrict or prevent access of non-targets to beneficial resources. However, non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g*., food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal methods would generally be regarded as having minimal impacts on overall populations of wildlife since individuals of those species were unharmed. Overall, potential impacts to non-targets from the use of non-lethal methods would not adversely affect populations since those methods are often temporary.

Non-lethal methods may only be effective for a short time as animals become habituated to those methods (Pfeifer and Goos 1982, Conover 1982). Generally, non-lethal methods would only be practical for small areas (Arhart 1972, Rossbach 1975, Shirota et al. 1983, Schmidt and Johnson 1984, Mott 1985, Dolbeer et al. 1986, Graves and Andelt 1987, Tobin et al. 1988, Bomford 1990). Therefore, the WS-Nebraska could also employ and/or recommend lethal methods under the no action alternative to alleviate damage, when those methods were deemed appropriate under the WS Decision Model. Available methods and the application of those methods to resolve predator damage is further discussed in Appendix B. While every precaution would be taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by predators, the use of such methods could

result in the incidental lethal take of unintended species. Unintentional lethal removal of non-targets by the WS-Nebraska is reviewed in Table 6.

From FY2010 to FY2015, WS-Nebraska lethally removed 3 different non-target species unintentionally, (see Table 10). Many of the species lethally removed by the WS-Nebraska as non-targets are also known to cause damage and could be addressed to alleviate damage or threats of damage by WS-Nebraska when requested under the no action alternative. The potential exists for the WS-Nebraska to lethally remove other non-target species unintentionally during damage management activities conducted under this alternative. Species that are of similar size or weight as the target species could be lethally removed unintentionally during damage management activities. In addition, WS-Nebraska also live-captured and released non-target animals in the state from FY 2010 through FY 2015 (see Table 6). WS-Nebraska live-captured and released only two feral non-target cats between FY 2010 and FY 2015.

Lethal removal of nontarget species averaged less than 1 percent of the total lethal removal of all animals by the WS-Nebraska in the State between FY 2010 and FY 2015. The selectiveness of methods used and the policies discussed in Chapter 2 ensure that non-target take in Nebraska remains relatively low. The non-targets taken previously by the WS-Nebraska are representative of non-targets that could be lethally taken by the WS-Nebraska under the no action alternative. Take of individuals from any species is not likely to increase substantively above the number of nontargets taken annually by the WS-Nebraska previously. In addition, four of the species lethally removed are also considered target species in this EA and the level of take analyzed for each species under Issue 1 includes non-target take that could occur by the WS-Nebraska. Therefore, the take of those species is evaluated cumulatively under Issue 1, including take that could occur when a species is considered a target or non-target.

Table 10. WS-Nebraska Non-target Take during FY 2010 – FY 2015

	Fiscal Year and Fate of Non-Target Animal												
Species	FY2010		FY2011		FY2012		FY2013		FY2014		FY2015		TOTAL
	Killed	Freed	Killed	Freed	Killed	Freed	Killed	Freed	Killed	Freed	Killed	Freed	
Feral Cat	0	0	0	0	0	0	0	0	0	2	0	0	2
Feral Dog	1	0	0	0	0	0	0	0	0	0	0	0	1
Mountain Lion	0	0	0	0	0	0	0	0	1	0	0	0	1
Opossums, Virginia	0	0	0	0	0	0	0	0	0	0	0	3	3
Otters, River	0	0	0	0	0	0	0	0	0	0	0	6	6
Raccoon	0	0	0	0	1	0	1	0	0	0	0	0	2
TOTAL	1	0	0	0	1	0	1	0	1	2	0	9	15

*Neck snare non-target take – 1 mountain lion killed during FY 2014

Between FY 2010 and FY 2015, the WS-Nebraska lethally removed 4 animals as non-targets unintentionally (1 feral dog, 2 raccoons and 1 mountain lion). Two feral cats, 3 Virginia Opossums and 6 river otters were also taken but freed on site. Non-target take by the WS-Nebraska from FY 2010 through FY 2015 of those species would be a minor component of the

annual harvest levels of those species. The WS-Nebraska anticipates the unintentional take of those species would continue to be a minor component of the annual harvest of those species and the populations of those species in Nebraska. Similarly, unintentional take of feral animal species was low enough that adverse effects did not occur, and the WS-Nebraska does not anticipate any substantial increase in non-target take under the no action alternative.

Fumigants are used in active burrows or dens only, which minimizes risk to non-targets. Fumigants are not used in burrows where signs of non-target activity are noted (*e.g.*, tracks, scat). However, since non-targets are known to occur in burrows or dens, some risks of unintentional take of non-targets does exist from the use of fumigants. For example, burrows of woodchucks can be used by a variety of non-target species such as the Eastern cottontail (*Sylvilagus floridanus*), striped skunk, raccoon, red fox, coyote, white-footed mouse (*Peromyscus leucopus*), house mouse (*Mus musculus*), and short-tailed shrew (*Blarina brevicauda*) (Hamilton 1934, Grizzell 1955, Dolbeer et al. 1991).Dolbeer et al. (1991) found one cottontail rabbit and three mice (*Permyscus* spp.) in three of 97 woodchuck burrows treated with gas cartridges during late summer. During 2,064 trap nights at 86 woodchuck burrow entrances targeting small mammals, Swihart and Picone (1995) captured 99 individuals of four small mammal species, which included short-tailed shrews (*Blarina brevicauda*), meadow voles (*Microtus pennsylvanicus*), meadow jumping mouse (*Zapus hudsonius*), and white-footed mice (*Peromyscus leucopus*). Risks to non-targets can be minimized by treating only burrows that appear to be active (Dolbeer et al. 1991). There are no secondary poisoning risks involved with the use of gas cartridges as the gas produced dissipates into the atmosphere shortly after activation.

3.2.1.3 Impacts of Aerial PDM Operations

An issue that has arisen is the potential for low-level flights to disturb wildlife, including T&E species. Aerial operations could be an important method of damage management in Nebraska when used to address damage or threats associated with predators in remote areas where access was limited due to terrain and habitat. Aerial operations involving shooting would only occur in those areas where a Work Initiation Document allowing for the use of aircraft had been signed between WS-Nebraska and the cooperating landowner or manager. Aircraft could also be used for aerial surveys of wildlife or radio telemetry. Aerial operations are typically conducted with aircraft when there is no foliage; however, aircraft could be used at any time of year. The amount of time spent conducting aerial operations would vary depending on the survey area, severity of damage, the size of the area where damage or threats were occurring, and the weather, as low-level aerial activities would be restricted to visual flight rules and would be impractical in high winds or at times when animals were not easily visible.

During FY 2010 - FY 2015, WS-Nebraska flew an average of 91.8 hours in fixed-wing aircraft (Table 11) over about 992 mi^2 of properties that were under agreements (Table 8) or less than 1.3 percent of the land area of Nebraska. WS-Nebraska aerial operations are minor in terms of geographic scope because more than 98% of the land area in the State is not exposed to any such activity. In most counties where aerial operations occurred, the land area of the county flown is usually 2% or less. Thus, the WS-Nebraska has conducted aerial operations on small areas

within the counties. The average amount of time flying over properties under agreement amounted to an average of 10.98 minute/mi^2 (Table 11).

Table 11 – Hours flown by the WS-Nebraska during aerial operations by county, FY 2010-FY 2015

County	Hours Flown						Yearly Average
	2010	2011	2012	2013	2014	2015	
Box Butte	3.4	10.9	5.7	6.2	8.8	10	7.5
Chase			3.6	7.3		6.7	5.9
Cherry	11.9	12.2	20.8	9.9	16.3	10	13.5
Cheyenne			4.1	2.8		1.5	2.8
Dawes	32.5	29.5	38.7	20.8	26.9	29.1	29.6
Dundy						1.5	1.5
Garden			9.3	2	2.4	6	4.9
Keith						5.5	5.5
Kimball				7.3			7.3
Perkins			5.6	3.1		3	3.9
Sheridan	17.1	13.6	19	12.4	8.3	8.5	13.2
Sioux	8.4	11.6	20.1	13.3	25.7	17.7	16.1
Total	**73.3**	**77.8**	**126.9**	**85.1**	**88.4**	**99.5**	**91.8**

Table 11.1 – Coyotes taken by the WS-Nebraska during aerial operations by county, FY 2010-FY 2015

County	Coyotes Taken						Yearly Average
	2010	2011	2012	2013	2014	2015	
Box Butte	28	33	32	24	31	32	30
Chase			13	16		16	15
Cherry	17	51	75	49	62	44	50
Cheyenne			4	8		4	5
Dawes	157	139	149	108	100	106	127
Dundy						5	5
Garden			21	5	2	11	10
Keith						12	12
Kimball				4			4
Perkins			15	9		2	9
Sheridan	120	76	59	58	34	41	65
Sioux	15	46	69	60	94	77	60
Total	**337**	**345**	**437**	**341**	**323**	**350**	**356**

Table 12 – Acreage for aerial operations conducted by the WS-Nebraska by county, FY 2010-FY 2015

County	Acres Flown						Yearly Average
	2010	2011	2012	2013	2014	2015	
BOX BUTTE	32,200	29,500	27,000	20,000	22,500	20,000	**25,200**
CHASE			15,000	21,000		21,940	**19,313**
CHERRY	13,700	23,700	41,100	19,200	33,200	29,600	**26,750**
CHEYENNE			4,000	5,000		2,000	**3,667**
DAWES	487,797	444,920	501,040	294,820	161,540	125,220	**335,890**
DUNDY						250	**250**
GARDEN			43,800	2,300	2,300	66,000	**28,600**
KIMBALL				13,500			**13,500**
KEITH						10,200	**10,200**
PERKINS			7,500	5,000		6,000	**6,167**
SHERIDAN	52,463	30,122	14,822	27,762	15,263	28,462	**28,149**
SIOUX	109,500	127,160	134,970	101,770	287,730	244,930	**167,677**
Total	**695,660**	**655,402**	**789,232**	**510,352**	**522,533**	**554,602**	**621,297**

A number of studies have looked at responses of various wildlife species to aircraft overflights. The National Park Service (1995) reviewed the effects of aircraft overflights on wildlife and suggested that adverse effects could occur to certain species. Some species will frequently or at least occasionally show an adverse response to even minor overflights. In general though, it appears that the more serious potential adverse effects occur when overflights are chronic (*i.e.*, they occur daily or more often over long periods). Chronic exposures generally involve areas near commercial airports and military flight training facilities. Aerial operations conducted by the WS-Nebraska rarely occur in the same areas on a daily basis and little time is actually spent flying over those particular areas.

Examples of species or species groups that have been studied with regard to the issue of aircraft-generated disturbance are as follows:

Water birds and Waterfowl: Low-level overflights of two to three minutes in duration by a fixed-wing airplane and a helicopter produced no "*drastic*" disturbance of tree-nesting colonial water birds, and, in 90 percent of the observations, the individual birds either showed no reaction or merely looked up (Kushlan 1979). Belanger and Bedard (1989, 1990) observed responses of greater snow geese (*Chen caerulescens atlantica*) to man-induced disturbance on a sanctuary area and estimated the energetic cost of such disturbance. Belanger and Bedard (1989, 1990)

observed that disturbance rates exceeding two per hour reduced goose use of the sanctuary by 50 percent the following day. They also observed that about 40 percent of the disturbances caused interruptions in feeding that would require an estimated 32 percent increase in nighttime feeding to compensate for the energy lost. They concluded that overflights of sanctuary areas should be strictly regulated to avoid adverse effects. Conomy et al. (1998) quantified behavioral responses of wintering American black ducks (*Anas rubripes*), American wigeon (*A. americana*), gadwall (*A. strepera*), and American green-winged teal (*A. crecca carolinensis*) exposed to low-level military aircraft and found that only a small percentage (2 percent) of the birds reacted to the disturbance. They concluded that such disturbance was not adversely affecting the "*time-activity budgets*" of the species. Low-level aerial operations conducted by the WS-Nebraska would not be conducted over federal, state, or other governmental agency property without the concurrence of the managing entity. Those flights, if requested, would be conducted to reduce threats and damages occurring to natural resources and should not result in impacts to bird species. Thus, there is little to no potential for any adverse effects on water birds and waterfowl.

Raptors: The Air National Guard analyzed and summarized the effects of overflight studies conducted by numerous federal and state government agencies and private organizations (Air National Guard 1997). Those studies determined that military aircraft noise initially startled raptors, but negative responses were brief and did not have an observed effect on productivity (see Ellis 1981, Fraser et al. 1985, Lamp 1989, and United States Forest Service 1992). A study conducted on the impacts of overflights to bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) suggested they were not sensitive to this type of disturbance (Ellis 1981, Fraser et al. 1985 and Holthuijzen et al. 1990).

According to Delaney et al., (1999), Mexican spotted owls (*Strix occidentalis lucida*) flushed by helicopter activity returned to their pre-disturbance behavior 10 to 15 minutes after, and observed no differences in nest or nestling success, suggesting that aircraft do not result in adverse effects on owl reproduction or survival.

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

Grubb et al. (2010) evaluated golden eagle response to civilian and military (Apache AH-64) helicopter flights in northern Utah. Study results indicated that golden eagles were not adversely affected when exposed to flights ranging from 100 to 800 meters along, towards and from behind occupied cliff nests. Eagle courtship, nesting, and fledging were not adversely affected, indicating that no special management restrictions were required in the study location.

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

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

Pronghorn (antelope) and Mule Deer: Krausman et al. (2004) found that Sonoran pronghorn (*A. a. sonoriensis*) were not adversely affected by military fighter jet training flights and other military activity on an area of frequent and intensive military flight training operations. Krausman et al. (1986) reported that fixed-wing overflights by Cessna 172 and 182 model small aircraft ≥100 feet AGL did not generally disturb desert mule deer (*O. h. eremicus*) in Arizona. Krausman et al. (1986) reported that only three of 70 observed responses of mule deer to small fixed-wing aircraft overflights at 150 to 500 feet AGL resulted in the deer changing habitats. Krausman et al. (1986) believed that the deer might have been accustomed to overflights because the study area was near an interstate highway that was followed frequently by aircraft.

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-Nebraska aerial hunting personnel frequently observe deer and antelope standing undisturbed beneath or just off to one side of WS-Nebraska aircraft.

One particular concern with overflights is the potential to affect mule deer on their winter range when stressed in years of heavy snow and poor forage availability. The WS-Nebraska has conducted aerial hunting to protect sheep in several known areas of deer winter range. The WS program in Colorado found no significant impacts to deer in their winter range including areas where aerial hunting was concentrated (USDA 2005), and the associated EA found no evidence to suggest aerial hunting over-flights contributed in some way to declining deer numbers.

Mountain Sheep: Krausman and Hervert (1983) reported that of 32 observations of the response of mountain sheep to low-level flights by small fixed-wing aircraft, 60 percent resulted in no disturbance, 81 percent in no or "slight" disturbance, and 19 percent in "great" disturbance. Krausman and Hervert (1983) concluded that flights less than 150 feet AGL could cause mountain sheep to leave an area. Another study (Krausman et al. 1998) found that 14 percent 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 penned bighorns. When Weisenberger et al. (1996) evaluated the effects of simulated low altitude jet aircraft noise on desert mule deer and mountain sheep, they found that heart rates increased according to the dB levels, with lower noise levels prompting lesser increases. When they were elevated, heart rates rapidly returned to pre-disturbance levels suggesting that the animals did not perceive the noise as a threat. Responses to the simulated noise levels were found to decrease with increased exposure.

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

Elk: Espmark and Langvatn (1985) found that elk become habituated to noise. The WS-Nebraska could find no other studies of the potential impacts of aerial overflights on elk.

Domestic Animals and Small Mammals: A number of studies with laboratory animals (*e.g.*, rodents [Borg 1979]) and domestic animals (*e.g.*, sheep [Ames and Arehart 1972]) have shown that these animals can become habituated to noise. Long-term lab studies of small mammals exposed intermittently to high levels of noise demonstrate no changes in longevity. The physiological "fight or flight" response, while marked, does not appear to have any long-term health consequences on small mammals (Air National Guard 1997). Small mammals habituate, although with difficulty, to sound levels greater than 100 dbA (United States Forest Service 1992). As discussed above, the noise levels of the aircraft used by the WS-Nebraska are low in comparison to other aircraft. Small mammals, such as field rodents and rabbits, have small home ranges and those species are generally widely distributed. The WS-Nebraska would stay at least 500 feet from livestock when conducting aerial operations, which is effective in avoiding livestock disturbance for the most part based on personal observations of WS-Nebraska aerial crews.

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

any disturbance to wildlife than military aircraft because the military aircraft produce much louder noise and would be flown over certain training areas many more times per year, and yet were found to have no expected adverse effects on wildlife (Air National Guard 1997).

WS-Nebraska would use small fixed-wing aircraft and small helicopters for aerial operations. The fixed-wing aircraft used by WS-Nebraska would be relatively quiet, whereas helicopters would be somewhat noisier. In comparison, the F-16 fighter jet has a sound level of 103 dB at 500 feet AGL while the B-2 bomber aircraft has a sound level of 114 dB (United States Air Force 2000). 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 two 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 Appendix I of Air National Guard 1997). The effects on wildlife from those and other similar types of military aircraft have been studied extensively as shown in the information presented in this section and by the Air National Guard (1997). The effects on wildlife from military-type aircraft have been studied extensively (Air National Guard 1997), and were found to have no expected adverse effects on wildlife. Therefore, it is logical to conclude that the aircraft used in aerial operations by the WS-Nebraska should have far less potential to cause any adverse disturbance effects on wildlife when compared to military aircraft. 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 (Air National Guard 1997). The WS-Nebraska only conducts aerial operations on less than 1.3 percent of the land area of Nebraska, which indicates that most animal populations would not even be exposed to aerial overflights conducted by the WS-Nebraska. In addition, such flights occur only a few days per year.

If the WS-Nebraska were requested to provide assistance on properties owned or managed by a federal entity, the coordination of activities would occur through work plans. During such coordination, the federal land manager would provide WS-Nebraska with specific locations where minimization efforts or restrictions on damage management activities might be necessary to reduce or eliminate the potential for adverse effects on specific resources. WS-Nebraska would rely on the coordination process to assist in avoiding substantive adverse effects on relevant components of the human environment.

Some persons may be concerned that the noise from gunfire when using firearms during aerial operations might result in significant disturbance impacts on wildlife species. Time spent shooting from aircraft during aerial operations would be an exceedingly small proportion of overflight times. For example, the WS-Nebraska aerial operations data for Nebraska shows an average of four coyotes killed per hour of aerial hunting. In a typical situation, shots at target coyotes would occur for only a few seconds and would usually involve two to three shots fired from a 12-gauge shotgun. It generally takes an average of just over one pass to successfully shoot and kill a coyote (because most are killed on the first pass). It has been estimated that on average no more than about 30 to 45 seconds of every hour spent flying are involved in making passes and shooting during aerial operations (L. Burraston, National Aviation Manager, WS, pers. comm. 2006), which means that only about 1 to 2 percent of the time spent during aerial operations is actually spent 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 people (Larkin 1996). Aerial operations conducted by the WS-Nebraska involving shooting accounted for average of 356 animals shot in FY 2010 - FY 2015. If four shots on average for each animal killed, the number of shots fired in FY 2010 - FY 2015 during aerial operations was 1,424 shots. The average number of shots fired from fur harvest from FY 2008 - FY 2012 for just coyotes would, at a highly conservative estimate of two shots fired per animal killed, would be nearly 45,988 shots fired. Considering all additional small and big game harvested in the State, the shooting by the WS-Nebraska would be a small proportion of the shots fired by sportsmen. Therefore, WS-Nebraska would add only exceedingly small amounts of gunshot noise to that which occurs annually as part of the existing human environment in wildlife habitat areas of Nebraska.

Gunshot noise from aerial operations conducted by WS-Nebraska would likely have no discernible or at most only minor potential to adversely affect wildlife populations because of the infrequency and duration of aerial overflights. As shown in Table 8, aerial operations that could have involved shooting from an aircraft occurred over less than 6 percent of the land area in the State, which means only small proportions of non-target wildlife populations would ever hear any noise from gunshots. In addition, shooting from aircraft is virtually always at an extreme downward angle towards the ground. Pater (1981 as 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. Personnel from the WS-Nebraska on the ground observing aerial hunting 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 suggests that shotgun noise from aircraft 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 aircraft when shooting passes are made would undoubtedly hear the firearm noise as much louder, but the low frequency of occurrence of flights and small fraction of aerial hunting time actually spent firing the shotgun, along with the very small proportion of the geographic area over which shooting passes would be made suggests only very small proportions of wildlife populations would be exposed to any close-proximity shotgun firing noise.

Under this alternative, the WS-Nebraska could provide assistance to enhance survival and recruitment of some wildlife species by reducing predation rates. In addition, this alternative would allow the WS-Nebraska to conduct activities to monitor disease prevalence in wildlife populations and to conduct disease surveillance activities. Information from disease monitoring and surveillance activities could then be used to implement measures to limit the spread of disease to benefit other wildlife or to minimize potential impacts associated with disease outbreaks.

3.2.1.4 Impacts on Biodiversity

WS-Nebraska does not attempt to eradicate any species of native wildlife. WS-Nebraska operates in accordance with federal and state laws and regulations enacted to ensure species viability. WS-Nebraska would use available methods to target individual animals or groups of animals identified as causing damage or posing a threat of damage. Any reduction of a local population or group is frequently temporary because immigration from adjacent areas or reproduction replaces the animals removed. As stated previously, WS-Nebraska would only provide assistance under the appropriate alternatives after receiving a request to manage damage or threats. Therefore, if WS-Nebraska provided direct operational assistance under the alternatives, WS-Nebraska would provide assistance on a small percentage of the land area in Nebraska. In addition, the WS-Nebraska would only target those predators identified as causing damage or posing a threat. WS-Nebraska would not attempt to suppress predator populations across broad geographical areas at such intensity levels for prolonged durations that significant ecological effects would occur. The goal of WS-Nebraska would not be to manage predator populations but to manage damage or threats associated with specific individuals of a species.

Often of concern with the use of certain methods is that predators that WS-Nebraska lethally removes would only be replaced by other predators after WS-Nebraska completes activities (*e.g.*, predators that relocate into the area) or by predators the following year (*e.g.*, increase in reproduction and survivability that could result from less competition). The ability of an animal population to sustain a certain level of removal and to return to pre-management levels demonstrates that limited, localized PDM methods have minimal impacts on species' populations.

For example, studies suggest coyote territories would not remain vacant for very long after removing coyotes from an area. 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 removals) indicated that "...localized removal effort does not negatively impact effective population size..." Chapter 3 evaluates the environmental consequences of the alternatives on the populations of target and non-target species based on available quantitative and qualitative parameters.

3.2.1.5 The Potential for Predator Removal to Cause Increases in the Populations of Other Wildlife Species

An issue often raised and identified is the potential effects of removing predators on the populations of prey species, which is similar to the previous issue discussing effects on biodiversity. For example, people are concerned that removing coyotes would cause an increase in rodent and rabbit populations, which could result in detrimental effects on vegetation and other resources. In general, predators may prolong the low points in rodent population cycles and spread the duration of the population peaks. Predators generally do not control rodent populations (Clark 1972, Wagner and Stoddart 1972, Keith 1974). It is more likely that prey

abundance regulates to some degree the populations of predators (Clark 1972, Wagner and Stoddart 1972).

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 (*Lepus californicus*) 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 are 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).

Rabbit and rodent populations normally fluctuate substantially in several-year cycles. Two hypotheses attempt to explain these cyclic fluctuations. Those two hypotheses maintain that (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). 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, increased to the point that vegetative food sources were depleted, despite predation. In others, coyotes may limit jackrabbit density and evidence indicated food shortages do not occur to limit jackrabbit abundance (Wagner 1988). Wagner and Stoddart (1972) reported that coyote predation was a major source of jackrabbit mortality in the Curlew Valley of Utah, which may have caused a decline in the local jackrabbit population in the Valley.

Henke (1995) reviewed literature concerning coyote-prey interactions and concluded that short-term coyote removal efforts ($\leq$6 months per year) typically did not result in increases of small mammal prey species populations. However, Henke (1995) concluded that long-term intensive coyote removal (9 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 change 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.

Activities conducted to reduce threats of damage (*i.e.*, proactive damage management) would likely occur for short periods (90-120 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). During FY 2010 - FY 2015, WS-Nebraska had signed MOUs, Work Initiation Documents, or other comparable document to conduct activities on properties that comprise an average of about 2.5 percent of the land area within the state. In addition, the number of predators addressed annually by WS-Nebraska and other entities is likely a small percentage of the actual populations of those species in the State;

therefore, the effects on biodiversity would of low magnitude. Evidence also exists to suggest other carnivores such as badgers, bobcats, and fox increase in number when coyote populations are reduced (Robinson 1961, Nunley 1977). Therefore, even if a localized number of coyotes were removed, the number of other predatory species could increase in those areas.

WS-Nebraska would only target those predators identified as causing damage or posing a threat. WS-Nebraska would not attempt to suppress predator populations across broad geographical areas at such intensity levels for prolonged durations that significant ecological effects would occur. The goal of WS-Nebraska would not be to manage predator populations but to manage damage or threats associated with specific individuals of a species.

3.2.1.6 Effects from the Use of Lead Ammunition

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to remove animals. As described in Appendix B, the lethal removal of predators with firearms by WS-Nebraska to alleviate damage or threats could occur using a handgun, rifle, or shotgun. WS-Nebraska could use firearms during aerial operations, ground-based shooting, harassment shooting, and/or shooting to euthanize animals captured in live traps. During aerial operations using firearms, WS-Nebraska would use shotguns and lead or non-toxic shot. Ground-based shooting activities would use lead bullets. The primary concerns, regarding sport 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. Shooting lead shot on dry land upland areas has generally not raised similar levels of concern, except where such activities are more intensively concentrated (*e.g.*, dove hunting at harvested crop fields, game bird hunting at shooting preserves) (Kendall et al. 1996). In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996). The use of firearms to target predators by WS-Nebraska would result in lead shot and bullets that are scattered in distribution over relatively wide areas, mostly in remote uninhabited locations, where contact with people or ingestion by birds picking up grit to aid in digestion of food are highly unlikely. Craig et al. (1999) found that, in general, sport hunting using rifles or shotguns, which would be similar in nature to activities conducted by WS-Nebraska with regard to the distribution of lead shot or bullets, tends to spread lead over wide areas, and at low concentrations.

The lethal removal of predators by WS-Nebraska using firearms in Nebraska would occur primarily from the use of shotguns shooting lead or non-toxic shot and rifles using lead bullets. However, the use of handguns using lead bullets could be employed to remove some species or to euthanize target animals. To reduce risks to human safety and property damage from bullets passing through predators, the use of firearms could be applied in such a way (*e.g.*, caliber, bullet weight, distance) to ensure the bullet does not pass through predators. Predators that were removed using firearms would occur within areas where retrieval of carcasses for proper disposal is highly likely. With risks of lead exposure occurring primarily from ingestion of bullet fragments or shot, the retrieval and proper disposal of carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead that may be contained within the carcass.

Deposition of lead into soil could occur if, during the use of a firearm, the projectile passes through a predator; if misses occur; or if the predator carcass was not retrieved. 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). In addition, concerns occur that lead from bullets deposited in soil from shooting activities could contaminate ground water or surface water from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "transport" readily in surface water when soils were neutral or slightly alkaline in pH (i.e., not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "fall zones" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot, which the author believed was due to runoff from the lot, and not from the shooting range areas. The study also indicated that even when lead shot was highly accumulated in areas with permanent water bodies present, the lead did not necessarily cause elevated lead levels in water further downstream. Muscle samples from two species of fish collected in 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 around bullet impact areas were far below the "action level" of 15 parts per billion as defined by the EPA (i.e., requiring action to treat the water to remove lead). The study found 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 (Craig et al. 1999). Therefore, the transport of lead from bullets or shot distributed across the landscape was reduced once the bullets and shot formed crusty lead oxide deposits on their surfaces, which served to reduce naturally the potential for ground or surface water contamination (Craig et al. 1999). Those studies suggest that, given the very low amount of lead being deposited and the concentrations that would occur from activities conducted by the WS-Nebraska to reduce predator damage using firearms, 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.

The amount of lead deposited on the landscape in Nebraska from the use of firearms by WS-Nebraska would be minor given the land area of Nebraska. During FY 2010 - FY 2015, WS-Nebraska conducted PDM activities on an annual average of 1,814,541 acres per year in Nebraska, which represents 2.4 percent of the land area of Nebraska. However, in any given year, WS-Nebraska would only conduct activities on a small portion of those areas. For example, a cooperator may own 100 acres of rangeland and WS-Nebraska could conduct activities within that 100-acre property; however, WS-Nebraska may actually only conduct activities on less than 10 acres of the property.

WS-Nebraska tracks ground-based shooting activities, harassment shooting, and animals killed in traps. If, for example, 3 shots were fired for every animal taken from FY 2010 to FY 2015,

then an average of just over 46,275 shots were fired annually over the entire State. The number of shots fired would be relatively minimal and scattered over considerable portions of the landscape. Based on activities conducted from FY 2010 - FY 2015, shooting activities would occur on less than 5 percent of the land area in Nebraska. WS-Nebraska would conduct activities on a small proportion of the lands under agreement. Thus, at most, about 5 percent of the lands in the State could have lead shot or bullets scattered on them in a year. When shot shells with lead are used in hazing or shooting, the typical amount of lead distributed by each shot is from 1.0 - 1.5 ounces. High-powered rifle bullets are about 0.3 ounces and about 0.1 ounces for small caliber firearms and pellets for air rifles. WS-Nebraska uses shotguns for about 12 percent of the shooting in the State. About 46 percent of the shooting is with high-powered rifles and the other 42 percent is to euthanize animals in traps with small caliber pistols (.22) or shoot birds with air rifles (~0.1 ounces each at most). The majority of predators shot by WS-Nebraska are retrieved and disposed of, which means those carcasses would not be available for scavenging by other wildlife. However, if the carcasses do not retain the shot or bullets or if misses occurred, lead could be deposited over the landscape. If all ammunition used was lead, the WS-Nebraska potentially deposits about 121.5 pounds of lead from shot shells[8] and 763.5 pounds from bullet fragments[9] over about 49,457,280 acres in the State. This amounts to an average of only about 0.00336 oz. (0.095 g) lead/acre, or 0.00215 oz. lead/mi^2 per year.

WS-Nebraska estimated the amount of lead in each of the spots on the ground where the soil is impacted by lead shot, and then evaluated 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 was calculated as each shot potentially distributes 1.2 to 1.5 ounces, or 34.0 to 42.5 grams of lead into an approximate 30" circle. Using the same estimate of weight per cubic foot of soil and depth of soil in which the lead shot would remain as discussed previously, the amount of lead per unit weight of soil in the 30" circle would be about 200 to 260 mg/kg (ppm). Therefore, even if a person were to encounter 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.

A reasonable estimate of the amount of lead deposited by hunters and trappers would be in the range of about 1,080,000 pounds distributed over the entire State[10]. Considering the land area of the State is about 77,277 mi.^{2} or about 49,457,280 acres, the average amount of shot distributed is about .1 g/acre per year. Assuming this lead shot deposition rate by private small game harvesters occurs on the same areas where WS-Nebraska conducts PDM activities, the total cumulative amount of lead deposited on average in the areas where the WS-Nebraska conducts activities would be about 9 g/acre per year. WS-Nebraska found that this cumulative amount of lead deposited would average about 0.03 mg/kg (equivalent to ppm) of soil. The amount of lead that the WS-Nebraska could distribute across the landscape would be 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 that range from less than 10 to 30 ppm (or 10 to 30 mg/kg), but can vary widely (Agency for Toxic Substances and Disease Registry 2007). If the

[8]Based on 1.2 oz./shell for 90 percent of the shooting and 1.5 oz./shell for 10 percent of the shooting

[9]Based on 100 grain bullets used for high-powered rifles and 50 grain bullets used for small caliber and air rifles

[10]Total number of predator animals that were most likely harvested by trappers, averaged over the last five years, was about 1.2 million predators harvested with an average of 240,175 each year. (NGPC 2013). It was estimated that 3 shots are fired per animal taken in the field. The total number of shots fired to harvest the 1.2 million animals would be about 3.6 million. At .3 ounce of shot per shell fired, the amount of lead distributed into the environment would be about 67,500 lbs.

soils in the areas where WS-Nebraska would conduct PDM activities contained the upper limit of this baseline level, it would take an additional 370 mg/kg of lead in the soil to reach the EPA hazard standard for children's playgrounds, and 1,170 mg/kg to reach the standard for other residential yard areas. It would take millions of years for enough lead to accumulate from shooting by the NWSP and sportsmen to reach the EPA hazard standard for children's playgrounds.

In a review of lead toxicity threats to the California condor, the 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, the 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.

Concerns have also arisen regarding lead poisoning from bald eagles scavenging predators that have been killed using a firearm. Pattee et al. (1981) found that 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). Hayes (1993) reviewed literature and analyzed the hazard of lead shot to raptors, in particular eagles. Key findings of that review were:

- Eagles were known to scavenge on coyote carcasses, particularly when other food sources were scarce or when food demands was 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 shot-sizes used in aerial activities. 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* spp.), and ground squirrels, which could explain how eagles could ingest lead from sources other than lead shot.

Personnel of the WS program examined nine coyotes shot with copper plated BB shot to determine the numbers of shot retained by the carcasses. In total, 59 shot pellets were recovered, averaging 6.5 pellets per coyote. Of the 59 recovered pellets, 84 percent 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 percent 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. Those 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 operations.

To minimize exposure, WS-Nebraska retrieves predator carcasses where practical and disposes of them in an area where eagles and other scavengers such as vultures would not be able to scavenge on them. In addition, no evidence has been brought forth to indicate that any animals killed during damage management activities conducted by WS-Nebraska have resulted in any indirect lead poisoning of scavenging eagles or other animals.

Since those predators removed by WS-Nebraska using firearms could be lethally removed by the entities experiencing damage using the same method in the absence of involvement WS-Nebraska, assistance provided by WS-Nebraska with removing those predators would not be additive to the environmental status quo. The amount of lead deposited into the environment could be lowered by involvement from WS-Nebraska in PDM activities due to efforts by WS-Nebraska to ensure projectiles do no pass through but are contained within the predator carcass, which limits the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by employees of WS-Nebraska in firearm use and accuracy would increase the likelihood that predators were lethally removed humanely in situations that ensure accuracy and that misses occur infrequently, which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, involvement by the WS-Nebraska would ensure predator carcasses lethally removed using firearms would be retrieved and disposed of properly in accordance with WS-Directives to limit the availability of lead in the environment and ensures predator carcasses were removed from the environment to prevent the ingestion of lead in carcasses by scavengers whenever possible. Based on current information, the risks associated with lead projectiles that could be deposited into the environment from activities conducted by WS-Nebraska due to misses, the projectile passing through the carcass, or from predator carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination of water. Based on the above analysis, we conclude that the amounts of lead deposited by WS-Nebraska, even when considered cumulatively with the amounts deposited by hunters, would be far below any level that would pose any risk to public health. WS-Nebraska has tested various nontoxic (non-lead) shot loads to reduce the concern of lead poisoning but currently the humaneness, safety, and cost of the lead free bullets have not proven to be as effective as the lead based bullets. WS-Nebraska would continue to move toward using and testing non-toxic shot/bullets as new non-toxic ammunition is developed.

3.2.1.7 Consideration of Impacts to T&E and Sensitive Species in Nebraska

Special efforts would be made to avoid affecting T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. Policies to avoid effects to T&E species are described in Section 2.5 of this EA.

Section 2.1 of this EA identified and discussed potential impacts from PDM activities to T&E and sensitive species in Nebraska. The USFWS and the NGPC monitor several species considered threatened, endangered, or sensitive in Nebraska (see Appendix C). The USFWS and the NGPC

monitor those species' populations to determine if different activities, singly or combined, would affect those species (i.e., a cumulative impact analysis). Mortality for T&E and sensitive species would be monitored where feasible by the USFWS and the NGPC. Mortalities due to road kill, loss of habitat (e.g., land development, construction, housing, industrial complexes, road, mining, and oil and gas development), and natural disasters (e.g., fires, floods, lightning, harsh winters, and drought) would be the same under all alternatives and would be considered the environmental status quo. Mortality or population limiting factors associated with those events would be difficult to determine. 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 carrying capacity of an area.

Since 2013, staff of the Nebraska-WS program, U.S. Fish and Wildlife Service, and NGPC have corresponded through emails, phone conversations and in-person meetings to develop a Biological Assessment (BA) evaluating potential impacts of WS activities on endangered and threatened species in Nebraska. The BA also describes WDM methods and standard operating procedures (i.e., conservation conditions) used to avoid and minimize such impacts. In 2017 WS-Nebraska submitted the Final Biological Assessment for Wildlife Damage Management Activities in Nebraska to the USFWS and NGPC. WS-Nebraska requested an informal consultation with USFWS to comply with Section 7 of the Endangered Species Act. In January 2018, both the USFWS and NGPC provided WS-Nebraska with concurrence on the determinations outlined in the WS-Nebraska 2017 BA. Nebraska-WS program's agreement and commitment to implementing the standard operating procedures (i.e., conservation conditions) as indicated in the BA. If WS program activities change or if new species become listed, then both agencies recommend further coordination with the Nebraska Game and Parks Commission Planning & Programming Division and the USFWS (see Appendix D).

Measures to avoid T&E and sensitive species impacts were described in Section 2.4. Those measures should ensure that the alternatives would minimize impacts on T&E species. WS-Nebraska has reviewed those species listed by the NGPC in the State and has determined this alternative would have no effect on those species based on the use patterns of the methods and locations where activities could occur in the State. WS-Nebraska will continue to consult with those agencies, as necessary, to provide information regarding potential effects on T&E species associated with damage management activities.WS-Nebraska could be requested to conduct activities to prevent predation on the endangered black-footed ferret (*Mustela nigripes*) by other predators and the potential for disease transmission (especially distemper) from predators to ferrets during reintroduction efforts. It has been found that removing predators, especially prior to the establishment of a new ferret colony, can be essential for their survival. In one of the first releases of ferrets, 34 of the 39 ferrets released were killed by predators. Removing predators in the area of reintroduction prior to the release of ferrets as well as managing predators sporadically after reintroduction helped ferret populations become established and to maintain their viability. If ferrets were released in Nebraska, WS-Nebraska would coordinate with the appropriate management agencies, including any necessary consultations prior to conducting PDM operations.

WS-Nebraska during the five year period analyzed from FY 2010 to FY 2015 did not take any T&E species in Nebraska, and it is expected such take would continue to be avoided under the current PDM program. The lack of take of any T&E species and the incorporation of policies (see Section 2.5) to protect non-target wildlife indicates that current management of the program poses minimal risk to T&E species. WS-Nebraska would continue to monitor take and coordinate with the NGPC and the USFWS on future listings to minimize any adverse impacts.

3.2.2 Analysis of the Effects of Alternative 2 on Target and Nontarget Species

Under this alternative, WS-Nebraska would not provide assistance with PDM; therefore, the WS program would not have any effect on target predator populations in the state. However, Nebraska state agencies (*e.g.*, NGPC), and private entities or organizations could and would likely continue to conduct PDM activities and those activities could increase in proportion to the reduction of assistance provided by the WS-Nebraska.

While the WS program would provide no assistance under this alternative, NGPC other individuals or entities could conduct lethal damage management resulting in lethal take levels similar to Alternative 1. Therefore, local predator populations could decline, stay the same, or increase depending on actions taken by those persons experiencing predator damage. Some resource/property owners may take illegal, unsafe, or environmentally harmful action against local populations of predators out of frustration or ignorance. If direct operational assistance was not available from WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to increased illegal take, which could lead to real but unknown effects on other wildlife populations. People have at times resorted to the illegal use of chemicals and methods to resolve wildlife damage issues (White et al. 1989, USFWS 2001, United States Food and Drug Administration 2003). For example, in Kentucky a corporation was fined for illegally using carbofuran to destroy unwanted predators, including coyotes and raptors, at a private hunting club (Porter 2004). Similarly, in Oklahoma, federal agents charged 31 individuals with illegally trapping and killing hawks and owls to protect fighting chickens (USFWS 2003).

The Cooperators requesting WS assistance could conduct damage management activities without WS-Nebraska's direct involvement or seek assistance from NGPC or other entities. Therefore, any actions to resolve damage or reduce threats associated with predators could occur by other entities despite WS-Nebraska's lack of involvement under this alternative.

For the reasons discussed in the population impacts analysis under Alternative 1, it is highly unlikely that predator populations would be affected by implementation of this alternative. Additionally, if no agency, groups, or individuals were able to respond to damage complaints, some members of the public could become intolerant of wildlife as a whole (International Association of Fish and Wildlife Agencies 2004) and the potential for use of illegal chemical toxicants may be realized and lead to unknown, but potentially serious impacts to carnivore populations.

Under this alternative, the WS program would not be directly involved with damage management activities in Nebraska. Therefore, no direct impacts to non-targets or T&E species would occur by WS under this alternative. However, Nebraska state agencies (*e.g.*, NGPC), and private entities or organizations could and would likely continue to conduct damage management activities and those activities could increase in proportion to the reduction of assistance provided by the WS program. Risks to non-targets and T&E species would continue to occur from activities conducted by Nebraska state agencies (*e.g.*, NGPC), and private entities or organizations including from those people who implement damage management activities on their own.

The ability to reduce negative impacts caused by predators to other wildlife species and their habitats, including T&E species, would be variable based upon the skills and abilities of the person implementing damage management actions under this alternative. The NDA and the NGPC would still provide some level of professional assistance, but without federal leadership. Those entities would likely continue to take minimal numbers of non-targets. If the assistance provided by those entities increased in proportion to assistance that the WS program would have provided, the effects on non-targets would likely be similar to Alternatives 1 and 2. If those entities did not increase assistance in proportion to the assistance that the WS program would have provided, those activities conducted by private entities could increase. This could result in less experienced persons implementing methods and could lead to greater take of non-target wildlife than Alternative 1. Other entities could use methods the WS program would not because WS personnel would follow those SOPs outlined in Chapter 2, such as WS self-imposed restrictions on trap placement (*e.g.*, not setting traps closer than 30 feet to livestock carcasses to avoid capturing scavenging birds or using pan-tension devices to exclude smaller animals). Therefore, hazards to raptors, including bald eagles, and other non-targets could be greater under this alternative.

Procedures that would be followed by the WS-Nebraska, if the WS program were involved, to avoid T&E impacts were described in Chapter 2. Whereas the WS-Nebraska would adhere to these measures, private citizens might or might not be required to act in accordance with them. This could lead to a much greater impact on T&E species than under Alternative 1 . It is anticipated that private efforts to take targeted predators could result in potentially adverse impacts for T&E and sensitive species. This potential could be much higher than under Alternatives 1. The illegal use of certain methods often results in loss of both target and non-target wildlife (*e.g.*, see White et al. 1989, USFWS 2001, United States Food and Drug Administration 2003). The use of illegal toxicants by those persons frustrated with the lack of assistance, or assistance that inadequately reduces damage to an acceptable level, can often result in the indiscriminate take of wildlife species. Therefore, the potential for effects on non-target wildlife would be higher under this alternative than under Alternatives 1, 3, and 4.

3.2.3 Analysis of the Effects of Alternative 3 on Target and Nontarget Species

Under this alternative, the WS program would only provide technical assistance on PDM methods and activities; however, the NGPC and the NDA, along with other entities, could continue to provide direct control assistance similar to Alternative 1 and Alternative 4. The WS program would not conduct any direct operational assistance to resolve damage or threats of

damage, and therefore, would not have any impact on predators in the State. As discussed under Alternative 2, NGPC and the NDA would likely continue to conduct damage management activities similar to Alternatives 1 with increased effort in proportion to those activities that would have been conducted by the WS program. In addition, other entities, including private nuisance wildlife control operators, could provide assistance in the absence of any involvement by the WS program. Therefore, under this alternative the number of predators lethally removed annually would likely be similar to the other alternatives since removal could occur by other entities or by those persons experiencing damage rather than by trained, professional WS employees. WS participation in a management action would not be additive to an action that would occur in the absence of WS participation.

If direct operational assistance was not available from WS or other entities, it is hypothetically possible that frustration among those experiencing damage or threats caused by the inability to conduct control activities and associated losses could lead to illegal take, which could lead to real but unknown effects on other wildlife populations. People have resorted to the illegal use of chemicals and methods to resolve wildlife damage issues (White et al. 1989, USFWS 2001, United States Food and Drug Administration 2003).

Under a technical assistance only alternative, WS-Nebraska would have no direct impact on non-target species, including T&E species. Methods recommended or provided through the loaning of equipment would be employed by those persons requesting assistance. Recommendations would be based on WS Decision Model using information provided by the person requesting assistance or through site visits. Recommendations would include methods or techniques to minimize nontarget impacts associated with the methods being recommended or loaned. Methods recommended could include non-lethal and lethal methods as deemed appropriate by the WS Decision Model and as permitted by laws and regulations. Similar to Alternative 2, the NGPC along with private entities or organizations (*e.g.*, NDA) could and would likely continue to conduct damage management activities and those activities could increase in proportion to the reduction of direct assistance provided by the WS program. Risks to non-targets and T&E species would continue to occur from activities conducted by Nebraska state agencies (*e.g.*, NDA, and NGPC), and private entities or organizations (*e.g.*, NDA), including from those people who implement damage management activities on their own similar to Alternative 2.

3.2.4 Analysis of the Effects of Alternative 4 on Target and Nontarget Species

This alternative would require personnel from the WS program to use only non-lethal methods to resolve damage or threats of damage. In accordance with WS Directive 2.101, preference is given to non-lethal methods where practical and effective under the other alternatives. Therefore, the WS program would have no effect on predator populations in Nebraska under this alternative.

Many livestock producers already use non-lethal methods to reduce predation (NASS 2000, NASS 2001, NASS 2005, and NASS 2011). The NASS (2005) reported that many Nebraska sheep and goat producers used non-lethal methods to reduce predator damage, such as fencing

(35.9 percent), guard dogs (44 percent), night penning 56.7 percent), donkeys (7.7 percent), frequent checks (9.2 percent), lamb shed (45.1 percent), culling (16.9 percent), llamas (10.9 percent), herding (5.5 percent), carrion removal (8.8 percent),change bedding (9.0 percent) other non-lethal methods (6.8 percent), and frightening tactics (2.5 percent). The NASS (2011) also reported that Texas cattle producers used non-lethal methods to reduce predator damage such as: guard animals (24.5 percent), culling (72.7 percent), frequent checks (64.9 percent), and exclusion fencing (48.1 percent). Mitchell et al. (2004) indicated that non-lethal methods to alleviate predation could be effective. However, Mitchell et al. (2004) and others, such as Knowlton et al. (1999), indicate that, although certain non-lethal methods have shown promise, further research is needed to determine their effectiveness and practicality. Non-lethal methods are an important part of the mix of current strategies used to meet the need for action; however, in some cases, the use of only non-lethal methods would not keep damage or threats of damage at a level that would be acceptable to some people. Andelt (1992) reported that about a third of sheep producers using guard dogs indicated that the use of dogs did not reduce their reliance on other predator control techniques or on predator control agencies.

The NGPC, the NDA and other entities could continue to use lethal methods under this alternative. If those non-lethal methods employed by the WS program did not reduce damage or threats of damage to levels acceptable to the requester, the requester could seek assistance from other entities, or could conduct damage management activities on their own. In some cases, property owners or managers may misuse some methods or use some methods in excess of what was necessary, which could then become hazardous and pose threats to the safety of people and wildlife species. Therefore, similar to Alternative 2 and Alternative 3, if the other entities increased their efforts in proportion to those activities that would have been conducted by the WS program using lethal methods, the potential effects on target predator populations would be similar to Alternatives 1, 2, and 3.

A non-lethal management alternative would require the WS program to only recommend and use non-lethal methods to manage and prevent predation. WS would provide technical assistance and direct operational assistance under this alternative recommending and using only non-lethal methods. Non-lethal methods have the potential to cause adverse effects to non-targets primarily through exclusion, harassment, and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that are not the primary reason the exclusion was erected; therefore, individual non-target species excluded from areas may potentially be adversely affected if the area excluded was large enough. The use of auditory and visual dispersal methods would also likely disperse non-targets in the immediate area the methods were employed. Therefore, non-targets may be permanently dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species would be temporary with target and non-target species often returning after the cessation of dispersal methods.

Live traps (*e.g.*, cage traps, foothold traps) restrain wildlife once captured and are considered live-capture methods. Live traps have the potential to capture non-target species. Trap placement in areas where target species were active and the use of target-specific attractants could minimize the capture of non-targets. If traps were attended to appropriately, any non-targets captured could be released on site unharmed.

WS involvement in the use of, or recommendation for, non-lethal methods would ensure non-target impacts were considered under WS Decision Model. Most non-lethal methods would be available under all the alternatives analyzed. Impacts to non-targets from the use of non-lethal methods would be similar to the use of those non-lethal methods under any of the alternatives. Non-targets would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal take would occur from their use. Similar to Alternatives 3 and 4, NDA and the NGPC along with private entities or organizations could and would likely continue to use lethal methods and those activities could increase in proportion to the reduction of assistance using lethal methods provided by the WS program. Risks to non-targets and T&E species would continue to occur from activities conducted by Nebraska state agencies (e.g., NDA, and NGPC), and private entities or organizations, including from those people who implement damage management activities on their own similar to Alternatives 2 and 3.

3.3 Effects on Human Health and Safety

A common concern is the potentially adverse effects that methods available could have on human health and safety. The threats to human safety of methods available under the alternatives are evaluated below by each of the alternatives.

3.3.1 Analysis of the Effects of Alternative 1 on Human Health and Safety

Under this alternative, methods used for PDM would be the same as those used under the current program, with restrictions on resources protected only applicable to registered pesticides. Additional activities could be conducted under this alternative to reduce damage or threats of damage across multiple resource types; however, those additional activities would not likely result in a substantial increase in threats to human safety. WS-Nebraska would continue to implement those policies discussed in Chapter 2 to minimize the effects of methods on human safety.

Under this alternative, WS-Nebraska may integrate the protection of human health or safety into decisions regarding PDM. For example, rabies management projects could include active surveillance of potential vectors/reservoirs of the rabies virus. Red fox, coyotes, bobcats, raccoons, and striped skunks that could be removed during predation management efforts could be sampled to determine the presence and extent of rabies outbreaks. Those species could also be removed to reduce threats of disease transmission.

The cooperator requesting assistance would be made aware through a MOU, Work Initiation Document, or a similar document that those methods agreed upon could potentially be used on property owned or managed by the cooperator. Therefore, the cooperator would be made aware of the possible use of those methods on property they own or manage to identify any risks to human safety associated with the use of those methods. Cooperators would be made aware by signing a MOU, cooperative service agreement, or another similar document, which would assist the WS-Nebraska and the cooperating entity with identifying any risks to human safety associated with methods at a particular location.

Under the no action alternative, those methods discussed in Appendix B could be singularly or in combination to resolve and prevent damage associated with predators in the State. WS-Nebraska would use the Decision Model to determine the appropriate method or methods that would effectively resolve the request for assistance. Those methods would be continually evaluated for effectiveness and if necessary, additional methods could be employed. Non-lethal and lethal methods could be used under the no action alternative. WS-Nebraska would continue to provide technical assistance and/or direct operational assistance to those persons seeking assistance with PDM or threats from predators. Those non-lethal methods that could be used as part of an integrated approach to managing damage, that would be available for use by WS-Nebraska as part of direct operational assistance, would be similar to those risks associated with the use of those methods under the other alternatives.

Lethal methods available under the no action alternative would also be available to other agencies involved in PDM and the public under the other three alternatives. Employees of WS-Nebraska who conduct PDM would be knowledgeable in the use of the methods available and the wildlife species responsible for causing damage or threats. That knowledge would be incorporated into the decision-making process inherent with the WS Decision Model that would be applied when addressing threats and damage caused by predators. When employing lethal methods, employees of WS-Nebraska would consider risks to human safety when employing those methods based on location and method. For example, risks to human safety from the use of methods would likely be lower in rural areas that are less densely populated. Consideration would also be given to the location where PDM activities would be conducted based on land ownership. If locations where methods would be employed occur on private property in rural areas where access to the property could be controlled and monitored, the risks to human safety from the use of methods would likely be less. If PDM activities occurred at public parks or near other public use areas, then risks of the public encountering PDM methods and the corresponding risk to human safety would increase. Activities would generally be conducted when human activity was minimal (e.g., early mornings, at night) or in areas where human activities was minimal (e.g., remote rural areas, in areas closed to the public). Additionally, warning signs would be prominently posted to alert the public when and where, in the general area, methods were deployed. WS-Nebraska would coordinate with cooperators or landowners about where and when methods would be used, thereby decreasing the human safety risk.

The use of live-capture traps, snares, and body-gripping traps has been identified as a concern. Live-capture traps available for predators would typically be walk-in style traps or foothold traps where predators enter but are unable to exit. Live-traps, snares, and body-gripping traps would typically be set in situations where human activity was minimal to ensure public safety. Those methods rarely cause serious injury and would only be triggered through direct activation of the device. Therefore, human safety concerns associated with live-traps, snares, and body-gripping traps used to capture wildlife, including predators, would require direct contact to cause bodily harm. Therefore, if left undisturbed, risks to human safety would be minimal. Signs warning of the use of those tools in the area could be posted for public view at access points to increase awareness that those devices were being used and to avoid the area.

Firearms safety concerns have been expressed. To help ensure the safe use of firearms and to increase awareness of those risks, employees of the WS-Nebraska who use firearms during

official duties are required to attend an approved firearms safety-training course and to remain certified for firearm through training in accordance with WS Directive 2.615. As a condition of employment, WS employees who carry and use firearms are subject to the Lautenberg Domestic Confiscation Law, which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence (18 USC § 922(g)(9)). A safety assessment based on site evaluations, coordination with cooperating and local agencies (if applicable), and consultation with cooperators would be conducted before firearms were deemed appropriate to alleviate or reduce damage and threats to human safety when conducting activities. WS-Nebraska would work closely with cooperators requesting assistance to ensure all safety issues were considered before firearms would be deemed appropriate for use. The use of all methods, including firearms, would be agreed upon with the cooperator to ensure the safe use of those methods. The security of firearms would also occur pursuant to WS Directive 2.615.

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed has been raised as a concern. Under Alternative 1, the use of chemical methods could include immobilizing drugs, euthanasia chemicals, sodium cyanide, fumigants, and repellents.

Immobilizing drugs would only be administered to predators that have been live-captured using other methods or administered by injection using a projectile (e.g., dart gun). Immobilizing drugs used to sedate wildlife would be used to temporarily handle and transport animals to lessen the distress. Drug delivery would likely occur on site with close monitoring of immobilized animals. Drugs used in capturing and handling wildlife that would be available include ketamine, a mixture of ketamine/xylazine, and telazol.

If predators were immobilized for sampling or translocation and released, risks could occur to human safety through and consumption. Methods used by WS-Nebraska to reduce these risks are discussed in Chapter 2 and in Appendix B. Policies that would be part of the activities conducted include:

- All immobilizing drugs used in capturing and handling wildlife would be under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and WS-Nebraska.
- As determined on a state-level basis by those veterinary authorities (as allowed by AMDUCA), wildlife hazard management programs may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting or trapping season for the target species to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. Ear tagging or other marking of animals drugged and released to alert hunters and trappers that they should contact state officials before consuming the animal.
- Most animals administered immobilizing drugs would be released well before hunting/trapping seasons, which would give the drug time to completely metabolize out of the animals' systems before they might be taken and consumed by people. In some instances, animals collected for control purposes would be euthanized when they are

captured within a certain specified time period prior to the legal hunting or trapping season to avoid the chance that they would be consumed as food while still potentially having immobilizing drugs in their systems.

Meeting AMDUCA requirements should preclude adverse effects to human health with regards chemical immobilization.

Euthanizing chemicals would be administered under similar circumstances to immobilizing drugs. Euthanizing chemicals would be administered to animals live-captured using other methods. Euthanasia chemicals would include sodium pentobarbital, potassium chloride, and Beuthanasia-D. Euthanized animals would be disposed of in accordance with WS Directive 2.515; therefore, would not be available for harvest and consumption. Euthanasia of target animals would occur in the absence of the public to minimize risks, whenever possible.

The EPA (1994) has concluded that the encapsulated use of sodium cyanide in M-44 ejectors poses minimal risk to the environment based on the use and degradation pattern of sodium cyanide. Sodium cyanide readily reacts with moisture and atmospheric carbon dioxide to produce hydrogen cyanide gas. If a spill occurs or when the ejector is fired, the reaction of the sodium cyanide with moisture and carbon dioxide produces hydrogen cyanide gas that would diffuse into the atmosphere and be diluted into the air (EPA 1994). Reactions with soil components convert sodium cyanide to carbon dioxide and ammonia or other nitrogen containing compounds (EPA 1994). Microorganisms are also known to decompose cyanide in soils by producing carbon dioxide and ammonia as end products. Therefore, the EPA (1994) determined that groundwater contamination by cyanide from M-44 ejectors was not anticipated. In addition, the EPA (1994) indicates that cyanide poisoning risks to workers is minimal when used according to label. During a recent registration review of sodium cyanide in the M-44 device, these findings were reaffirmed (EPA 2009).

Gas (sodium nitrate) cartridges act as a fumigant by producing carbon monoxide gas when ignited and can be used to fumigate burrows and den sites of woodchucks, coyotes, fox, and skunks in areas where damage is occurring. Escaping carbon monoxide dissipates into the atmosphere (EPA 1991). No risks to human safety would occur in on-label use.

The recommendation of repellents or the use of those repellents registered for use to disperse predators in the state could occur under the proposed action as part of an integrated approach to managing predator damage. Repellents for many mammal species contain different active ingredients with most occurring naturally in the environment. The most common ingredients of repellents are coyote urine, putrescent whole egg solids, and capsaicin. Those chemical repellents that would be available to recommend for use or that could be directly used by the WS-Nebraska under this alternative would also likely be available under any of the alternatives. Therefore, risks to human safety from the recommendation of repellents or the direct use of repellents would be similar across all the alternatives. Risks to human safety would be similar across all the alternatives. Involvement by WS-Nebraska, either through recommending the use of repellents or the direct use of repellents, would ensure that label requirements of those repellents were discussed with those persons requesting assistance when recommended through technical assistance or would be specifically applied by WS-Nebraska. Therefore, the risks to

human safety associated with the recommendation of or direct use of repellents could be lessened through participation by WS-Nebraska.

No adverse effects to human safety occurred from the use of PDM methods by WS-Nebraska during FY 2010 - FY 2015. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, is considered low. Based on the use patterns of available PDM methods this alternative would comply with Executive Order 12898 and Executive Order 13045.

Non-chemical methods described in Appendix B would be used within a limited period, would not be residual, and do not possess properties capable of inducing cumulative effects on human health and safety. Non-chemical methods would be used after careful consideration of the safety of those persons employing methods and to the public. When possible, capture methods would be used where human activity was minimal to ensure the safety of the public. Capture methods also require direct contact to trigger ensuring that those methods, when left undisturbed, would have no effect on human safety. All methods would be agreed upon by the requesting entities, which would be made aware of the safety issues of those methods when entering into a MOU, Work Initiation Document, or other comparable document between the WS-Nebraska and the cooperating entity. WS policies would also ensure the safety of the public from those methods used to capture or take wildlife.

Personnel employing non-chemical methods would continue to be trained to be proficient in the use of those methods including the use of firearms, to ensure the safety of the applicator and to the public. Based on the use patterns of non-chemical methods, those methods would not cumulatively affect human safety.

Repellents to disperse predators from areas of application would be available. Repellents must be registered with the EPA according to the FIFRA and with the NDA. Many of the repellents currently available for use have active ingredients that are naturally occurring and are generally regarded as safe. Although some hazards exist from the use of repellents, hazards occur primarily to the handler and applicator. When repellents are applied according to label requirements, no effects to human safety would be expected. Similarly, fumigants must also be registered for use with the EPA and the NDA. Given the use patterns of repellents and fumigants, no cumulative effects would occur to human safety.

WS-Nebraska has received no reports or documented any effects to human safety from PDM activities conducted during FY 2010 - FY 2015. No cumulative effects from the use of those methods discussed in Appendix B are expected given the use patterns of those methods for resolving predator damage in Nebraska.

Consequences of Aerial Wildlife Operations Accidents

Aerial wildlife operations, like any other flying, may result in an accident. Pilots and crewmembers of WS-Nebraska would be trained and experienced to recognize the circumstances that lead to accidents and have thousands of hours of flight time. The national WS Aviation Program has increased its emphasis on safety, including funding for additional training, the

establishment of a WS Flight Training Center and annual recurring training for all pilots. Still, accidents may occur and the environmental consequences should be evaluated.

***Major Ground or Forest Fires*:** Although fires could result from aircraft-related accidents, no such fires have occurred from aircraft incidents previously involving government aircraft and low-level flights. The period of greatest fire danger typically occurs during the summer months, but WS-Nebraska ordinarily conducts few, if any, aerial operations during the summer months.

***Fuel Spills and Environmental Hazard from Aviation Accidents*:** A representative of the National Transportation Safety Board has stated previously 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 (USDA 2005). Helicopters used for aerial wildlife operations carry less fuel than fixed-wing aircraft (52-gallon maximum in a fixed-wing aircraft and 91-gallon maximum in the helicopters used by WS-Nebraska). In some cases, little or none of the fuel would be spilled if an accident occurs. Thus, there should be little environmental hazard from unignited fuel spills.

***Oil and Other Fluid Spills*:** With the size of aircraft used by WS-Nebraska, the quantities of oil (*e.g.*, 6 to 8 quarts maximum for reciprocating (piston) engines and 3 to 5 quarts for turbine engines) capable of being spilled in any accident would be small with minimal chance of causing environmental damage. Aircraft used by the WS-Nebraska would be single engine models, so the greatest amount of oil that could be spilled in one accident would be about 8 quarts.

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 were not cleaned up, the oil does not persist in the environment or persists in such small quantities that no adverse effects would be expected. In addition, accidents generally would occur in remote areas away from human habitation and drinking water supplies. Thus, the risk to drinking water appears to be exceedingly low to nonexistent.

***Human Safety Consequences of Aerial Hunting Accidents*:** Beyond environmental consequences, other issues related to aviation accidents include the loss of aircraft and risks to the public and crewmembers. The use of aircraft by WS-Nebraska would be quite different from general aviation (GAV) use. The environment in which WS-Nebraska would conduct aerial operations would be inherently a higher risk environment than that for GAV. Low-level flights introduce hazards, such as power lines and trees, and the safety margin for error during maneuvers is higher compared to high-level flights. In 1998, the WS program commissioned an independent review of its aerial hunting operations because of several accidents. The panel made several recommendations to WS regarding enhanced aerial safety. The WS program implemented most all of those 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. Pilots and contractors would be highly skilled with commercial pilot ratings that have passed proficiency tests in the flight environment encountered by the WS-Nebraska. Pilots, gunners, and ground crews would be trained in hazard recognition and shooting would only be conducted in safe environments. Federal aviation regulations require pilots to fly a minimum distance of 500 feet from structures and people, and all employees involved in those operations would adhere to this requirement. Because of the remote locations in which WS-Nebraska conducts aerial operations, the risk to the public from aviation operations or accidents would be minimal.

3.3.2 Analysis of the Effects of Alternative 2 on Human Health and Safety

Under this alternative, WS-Nebraska would not be directly involved with PDM activities in Nebraska. Therefore, no direct impacts to human safety from methods would occur by WS under this alternative. However, like Alternative 3, and 4 , Nebraska state agencies (*e.g.*, University of Nebraska Cooperative Extension, and NGPC), and private entities or organizations (*e.g.*, ICWDM) could and would likely continue to conduct PDM activities and those activities could increase in proportion to the reduction of assistance provided by the WS program. Threats to human safety would continue to occur from methods used by Nebraska state agencies (*e.g.*, University of Nebraska Cooperative Extension, and NGPC), and private entities or organizations (*e.g.*, ICWDM), including from those people who implement PDM activities on their own.

The ability to reduce threats to human safety posed by available methods would be variable based upon the skills and abilities of the person implementing PDM actions under this alternative. The University of Nebraska Cooperative Extension, the ICWDM, and the NGPC would still provide some level of professional assistance, but without assistance and supervision by the WS program. Those entities would likely continue to employ those methods discussed in Appendix B. If the assistance provided by those entities increased in proportion to assistance that the WS-Nebraska program would have provided, the potential threats to human safety from methods available would be similar to Alternative 1. If those entities did not increase assistance in proportion to the assistance that the WS-Nebraska program would have provided, those activities conducted by private entities could increase. This could result in less experienced persons implementing methods and could lead to greater risks to human safety than Alternative 1. Other entities could use methods where the personnel of the WS-Nebraska program may not because WS personnel would follow policies outlined in Chapter 2 to reduce threats to human safety. Whereas the WS-Nebraska would adhere to these measures, private citizens might or might not be required to act in accordance with them. This could lead to a higher risk to human safety than under Alternative 1.

The NGPC currently issues aerial hunting permits for private shooting predators from aircraft. It is expected that private flying would increase under this alternative, as well as Alternative 3, and 4. So the chance of accidents would likely increase because private pilots would most likely not receive the same level of training as pilots from WS-Nebraska and low-level flying has inherent risks associated with it. It is expected that more aircraft accidents could occur under Alternative 2.

3.3.3 Analysis of the Effects of Alternative 3 on Human Health and Safety

Under the technical assistance only Alternative, WS-Nebraska would not directly employ PDM methods. Therefore WS-Nebraska actions under this alternative would not pose any safety risk. Technical assistance recommendations would be based on WS Decision Model using information provided by the person requesting assistance or through site visits. Methods recommended or provided through loaning of equipment could be employed by those persons requesting assistance. Therefore, the cooperator requesting assistance would be made aware of threats to human safety associated with the use of those methods recommended by the WS-Nebraska program. Risks to human safety from activities and methods recommended under this alternative would be similar to the other alternatives since the same methods would be available for other agencies and public use.

Methods recommended could include non-lethal and lethal methods as deemed appropriate by the WS Decision Model and as permitted by laws and regulations. Similar to Alternative 2, the University of Nebraska Cooperative Extension and the NGPC along with private entities or organizations (e.g., ICWDM) could and would likely continue to conduct damage management activities and those activities could increase in proportion to the reduction of direct assistance provided by the WS program. Threats to human safety would continue to occur from activities conducted by Nebraska state agencies (e.g., University of Nebraska Cooperative Extension, and NGPC), and private entities or organizations (e.g., ICWDM), including from those people who implement PDM actions on their own similar to Alternative 2.

The NGPC would continue to issue aerial hunting permits for private shooting predators from aircraft and it is expected that more aircraft accidents could occur under this Alternative.

If misused or applied inappropriately, any of the methods available to alleviate predator damage could threaten human safety. However, when used appropriately, methods available to alleviate damage would not threaten human safety. The recommendation of methods by WS-Nebraska would comply with Executive Order 12898 and Executive Order 13045.

3.3.4 Analysis of the Effects of Alternative 4 on Human Health and Safety

A non-lethal alternative would require the WS-Nebraska program to only recommend and use non-lethal PDM methods. WS-Nebraska, would provide technical assistance and direct non-lethal operational assistance under this alternative recommending and using only non-lethal methods. Similar to Alternative 2 and 4, the University of Nebraska Cooperative Extension and the NGPC along with private entities or organizations (e.g., ICWDM) could and would likely continue to use lethal methods and those activities could increase in proportion to the reduction of assistance using lethal methods provided by the WS-Nebraska program. Threats to human safety would continue to occur from activities conducted by Nebraska state agencies (e.g., University of Nebraska Cooperative Extension, and NGPC), and private entities or organizations (e.g., ICWDM), including from those people who implement damage management activities on their own similar to Alternative 2 and Alternative 3.

Non-lethal methods recommend or employed by the WS-Nebraska program have the potential to threaten human safety. Threats to human safety associated with non-lethal methods that would be available under this alternative were address under Alternative 1. The threats to human safety associated with non-lethal methods under this alternative would be the same as those threats addressed under Alternative 1. The recommendation and use of non-lethal methods by WS would comply with Executive Order 12898 and Executive Order 13045 under this alternative.

The University of Nebraska Cooperative Extension, the ICWDM, and the NGPC would still provide assistance using lethal methods under this alternative. Those entities would likely continue to employ those lethal methods discussed in Appendix B. If the assistance using lethal methods provided by those entities increased in proportion to assistance that the WS-Nebraska program would have provided using lethal methods, the potential threats to human safety from methods available would be similar to Alternatives 1. If those entities did not increase assistance using lethal methods in proportion to the assistance that the WS program would have provided, those activities conducted by private entities using lethal methods could increase. This could result in less experienced persons implementing lethal methods and could lead to greater risks to human safety than Alternative 1. Other entities could use lethal methods where the personnel of the WS program may not because WS personnel would follow those policies outlined in Chapter 2 to reduce threats to human safety. Lethal methods employed by those persons not experienced in the use of methods or were not trained in their proper use, could increase threats to human safety. The NGPC would continue to issue aerial hunting permits for private shooting predators from aircraft and it is expected that more aircraft accidents could occur under this Alternative as addressed under Alternative 2.

Policies that would be followed by the WS-Nebraska, if the WS program were involved, to reduce threats to human safety were described in Chapter 2. Whereas the WS-Nebraska would adhere to these measures, private citizens might or might not be required to act in accordance with them. This could lead to a higher risk to human safety than under Alternative 1.

3.4 Effects on Socio-cultural Resources

Recreation encompasses a wide variety of outdoor entertainment in the form of consumptive and non-consumptive uses. Consumptive uses 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 would likely be restricted by landowners and, thus, activities would not likely be impacted as much as on public lands.

Effects of PDM Activities on Recreational Activities

Based on a review of activities, it is not likely that alleviating predation risks in public-use areas would cause adverse effects to recreational activities. WS-Nebraska would only conduct PDM activities properties when requested by the appropriate property owner or manager. WS-Nebraska would attempt to minimize conflicts with public-use areas by coordinating activities

with the requesting land management agency (e.g., by developing work plans). Therefore, the requesting entity would determine what activities would be allowed and when assistance was required. Because the WS-Nebraska would only conducted activities when requested by the appropriate property owner or manager and the requesting entity would determine what methods would be used to alleviate damage, no conflict with recreational activities would likely occur.

Aesthetics and Non-consumptive Uses

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.

Mortality in wildlife populations is a natural occurrence and people who form affectionate bonds with animals experience loss of those animals over time in most instances. A number of professionals in the field of psychology have studied human behavior in response to attachment to pet animals (Gerwolls and Labott 1994, Marks and Koepke 1994, Zasloff 1996, Archer 1999, Ross and Baron-Sorensen 1998, Meyers 2000). Similar observations were probably applicable to close bonds that could exist between people and wild animals. As observed by researchers in human behavior, normal human responses to loss of loved ones proceed through phases of shock or emotional numbness, sense of loss, grief, acceptance of the loss or what cannot be changed, healing, and acceptance and rebuilding which leads to resumption of normal lives (Lefrancois 1999). Those who lose companion animals, or animals for which they may have developed a bond and affection, are observed to proceed through the same phases as with the loss of human companions (Gerwolls and Labott 1994, Boyce 1998, Meyers 2000). However, they usually establish a bond with other individual animals after such losses. Although they may lose the sense of enjoyment and meaning from the association with those animals that die or are no longer accessible, they usually find a similar meaningfulness by establishing an association with new individual animals or through other relational activities (Weisman 1991). Through this process of coping with the loss and establishing new affectionate bonds, people may avoid compounding emotional effects resulting from such losses (Parkes 1979, Lefrancois 1999).

Some predators with which humans have established affectionate bonds may be removed from some project sites by WS-Nebraska. However, other individuals of the same species would likely continue to be present in the affected area and people would tend to establish new bonds with those remaining animals. In addition, human behavior processes usually result in individuals ultimately returning to normalcy after experiencing the loss of association with a wild animal that might be removed from a specific location. Activities conducted by WS-Nebraska would not be expected to have any cumulative effects on this element of the human environment.

Since those predators that could be removed by WS-Nebraska under the appropriate alternatives could be removed by other entities, the involvement of WS-Nebraska in removing those predators would not likely be additive to the number of predators that could be removed in the absence of involvement by WS-Nebraska. In addition, activities that could occur under the

alternatives by WS-Nebraska would occur on a relatively limited portion of the total area in Nebraska, and the portion of various predator species' populations removed activities would typically be low. In localized areas where WS-Nebraska conducts PDM, 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.

The target species addressed in this EA are relatively abundant, but may not be commonly observed because many of the species are secretive and nocturnal. The environmental consequences that each alternative could have on target predator populations are addressed in Chapter 3.2. The effects on target predator populations from PDM activities 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 majority of land in Nebraska.

Hunting

Another issue commonly identified is a concern that PDM activities conducted by WS-Nebraska would affect the ability of persons to harvest those species during the regulated hunting and trapping seasons either by reducing local populations through the lethal removal of predators or by reducing the number of predators present in an area through dispersal techniques. Hunting and trapping seasons exist for fur-bearing animals (skunks, red foxes, gray foxes, raccoons, opossums, badgers and bobcats) in Nebraska. Canada lynx, martins and river otters are considered fur-bearing animals in the State (see Nebraska Game and Parks Statutes, Article 2, Chapter 37, Section 226). However, no trapping season exists for martins, river otters and Canada lynx. Coyotes are not protected and may be harvested throughout the year.

Potential impacts could arise from the use of non-lethal or lethal PDM methods. Non-lethal methods used to alleviate damage caused by those predator species could reduce predator densities through dispersal in areas where damage or the threat of damage was occurring. Similarly, lethal methods used to reduce damage associated with those predators could lower densities in areas where damage was occurring resulting in a reduction in the availability of those species during the regulated harvest season. The magnitude of lethal take addressed in the proposed action would be low when compared to the mortality of those species from all known sources. When the removal of predators by WS-Nebraska in Nebraska was included as part of the known mortality of those species and compared to the estimated populations under the relevant alternatives analyzed in detail, the impact on those species' populations was below the level of removal required to lower population levels (see Section 3.2). Based on the low magnitude of removal that could occur by WS-Nebraska, activities conducted pursuant to the relevant alternatives analyzed in detail would not reach a magnitude that would limit the ability of people to harvest target species in the Nebraska.

3.4.1 Analysis of the Effects of Alternative 1 on Socio-cultural Resources.

The PDM activities under this alternative would be similar to those used under the current program, with restrictions on resources protected only applicable to registered pesticides. Additional activities could be conducted under this alternative to reduce damage or threats of damage across multiple resource types; however, those additional activities would not likely

result in a substantial increase in activities that adverse effects to recreational activities would result. WS-Nebraska would continue to implement those Policies discussed in Chapter 2 to minimize the effects on recreational activities.

WS-Nebraska would only conduct PDM on properties when requested by the appropriate property owner or manager. WS-Nebraska would only conduct activities after the WS-Nebraska and the entities requesting assistance signed a MOU, Work Initiation Document, or a comparable document. Therefore, the requesting entity would determine what activities would be allowed and when assistance was required. Therefore no conflict with recreational activities would likely occur.

WS-Nebraska uses practical and efficient techniques that do not typically conflict with other land uses. The WS-Nebraska would only employ methods in accordance with landowner permission. During previous years of conducting activities to alleviate predator damage, no measurable disruption to recreation was observed by WS-Nebraska or was identified by other entities.

Most of Nebraska consists of private properties where the owner or manager would have the discretion to determine what occurs or does not occur on property they own or manage. From FY 2010 to FY 2015 Nebraska-WS work 79.2% of the time on private land compared to 20.8% on public land in the state of Nebraska. When assistance was requested on federal and/or state properties by the land management agency, WS-Nebraska would coordinate activities with the agency through work plans or similar documents, which would be intended to identify potential conflicts with recreational use of those areas. For example, high-use recreational areas would be identified and avoided when WS-Nebraska conducted PDM. WS-Nebraska would not conduct PDM in high-use recreational areas, except when specifically requested by the appropriate manager or property owner. For example, WS-Nebraska could conduct PDM to alleviate immediate threats to human safety or in recreational areas if recreational use in an area was seasonal. High use recreation and other sensitive areas would be identified at the site-specific level on work plan maps or comparable documents, which would be modified as new damage situations arise. Human safety zones, planned control areas, and restricted or coordinated control areas would be identified through interagency communications.

In some cases, such as with the placement of traps, signs would be used to notify the public as required by WS Directive 2.450. Personnel would post signs in prominent places to alert the public that PDM occurring in an area. On private lands, the landowner or manager would be aware of what methods were being used on their property; therefore, the landowner or manager could alert guests using the property that methods were being used on the property. Landowners would determine the areas and timing of equipment placement; thereby, avoiding conflicts with recreationists. For public lands, the WS-Nebraska would abide by all applicable laws and regulations regarding the use of different methods. WS-Nebraska would coordinate with the different land management agencies requesting assistance to determine high public use areas and times of the year when activities would be conducted (e.g., after hunting seasons).

3.4.2 Analysis of the Effects of Alternative 2 on Socio-cultural Resources

Under this alternative, WS-Nebraska would not be directly involved with PDM in Nebraska. Therefore, no direct impacts to recreational activities would occur by the WS program under this alternative. The University of Nebraska Cooperative Extension, the ICWDM, and the NGPC would still provide some level of professional assistance, but without assistance and supervision by the WS program. Those entities could increase activities in proportion to the reduction of assistance provided by WS-Nebraska. Threats to recreational activities could continue to occur from activities conducted by those entities, including from those people who implement PDM on their own.

If the assistance provided by those entities increased in proportion to assistance that WS-Nebraska would have provided, the effects on recreational activities would likely be increased compared to Alternative 1. This could result in less experienced persons implementing methods and could lead to greater threats to recreational activities than Alternative 1. Other entities could use methods where the personnel of the WS program may not because WS personnel would follow those policies outlined in Chapter 2. This could lead to a much greater threat to recreational activities than under Alternative 1.

The illegal use of methods often results in loss of both target and non-target wildlife (*e.g.*, see White et al. 1989, USFWS 2001, United States Food and Drug Administration 2003). The use of illegal toxicants by those persons frustrated with the lack of assistance or assistance that inadequately reduces damage to an acceptable level can often result in the indiscriminate take of wildlife species. Therefore, the potential threats to recreational activities could be higher under this alternative than Alternative 1.

3.4.3 Analysis of the Effects of Alternative 3 on Socio-Cultural Resources

Under a technical assistance by the WS program alternative, WS would have no direct impact on recreational activities. Methods recommended or provided through loaning of equipment could be employed by those persons requesting assistance. Recommendations would be based on the WS Decision Model using information provided by the person requesting assistance or through site visits. Methods recommended could include non-lethal and lethal methods as deemed appropriate by WS Decision Model and as permitted by laws and regulations. Similar to Alternative 2, the University of Nebraska Cooperative Extension and the NGPC along with private entities or organizations (e.g., ICWDM) could and would likely continue to conduct PDM activities and those activities could increase in proportion to the reduction of direct assistance provided by WS Nebraska. Risks to non-targets and T&E species would continue to occur from activities conducted by Nebraska state agencies (e.g., University of Nebraska Cooperative Extension, and NGPC), and private entities or organizations (e.g., ICWDM), including from those people who implement PDM on their own similar to Alternative 2.

3.4.4 Analysis of the Effects of Alternative 4 on Socio-cultural Resources.

The effects to recreation under a non-lethal only approach by WS-Nebraska program would be similar to the effects associated with those non-lethal methods identified under Alternative 1. Impacts to recreational activities from the use of non-lethal methods would be similar to the use

of those non-lethal methods under any of the alternatives. Similar to Alternatives 2 and 3, other entities could and would likely continue to use lethal methods and those activities could increase in proportion to the reduction of assistance using lethal methods provided by the WS program. Risks to recreational activities would continue to occur from activities conducted by Nebraska state agencies (*e.g.*, University of Nebraska Cooperative Extension, and NGPC), and private entities or organizations (*e.g.*, ICWDM), including from those people who implement PDM activities on their own similar to Alternatives 2 and 3.

3.5 Humaneness and Ethics

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, and marine mammals) are protected and managed by federal agencies or through collaboration between state and federal agencies. Within the context of wildlife management, personnel associated with state and federal agencies and Native American tribes may handle or capture individual animals or groups of animals for various purposes, including research. During the course of these management actions,

individual animals may become injured or debilitated and may require euthanasia; in other cases, research or collection protocols dictate that some of them be killed. Sometimes population management requires the lethal control of wildlife species, and the public may identify and/or present individual animals to state or federal personnel because they are orphaned, sick, injured, diseased (e.g., rabid), or becoming a nuisance."

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 also has the potential to result in litters of coyotes, red fox, and badgers becoming orphaned. When WS-Nebraska 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-Nebraska'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 den fumigant 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 Specialists are trained in techniques to minimize the risk of capturing non-target wildlife. Section 4.2.1.2 discussed the proposed program's potential for affecting non-target species 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 this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology. WS-Nebraska 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. 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-Nebraska supports the most humane, selective, and effective damage management techniques and would continue to incorporate advances into program activities. WS-Nebraska Specialists conducting predator damage management are highly experienced professionals skilled in the use of management methods and committed to minimizing pain and suffering. WS Program Directives and training ensure that WS-Nebraska'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-Nebraska's use of PDM methods include implementing Trapping Best Management Practices where appropriate for PDM actions and complying with regulations on trap check intervals.

3.5.1 Analysis of the Effect of Alternative 1 on Humaneness and Ethics

Additional activities could be conducted under this alternative to reduce damage or threats of damage across multiple resource types; however, those additional activities would not likely result in substantial humaneness concerns. WS-Nebraska would continue to implement the policies discussed in Chapter 2 to ensure methods were used as humanely as possible.

Under this alternative, non-lethal methods would be used by the WS-Nebraska that were generally regarded as humane. Non-lethal methods that would be available include resource management methods (e.g., cultural practices, modification of human behavior), translocation, exclusion devices, frightening devices, cage traps, foothold traps, immobilizing drugs, and repellents (see Appendix B for a complete list of methods).

People may perceive the humaneness of an action differently. Schmidt and Brunson (1995) conducted a public attitude survey in which respondents were asked to rate a variety of methods on humaneness based on their individual perceptions of the methods. Schmidt and Brunson (1995) found that the public believes that the non-lethal methods, such as animal husbandry, fences, and scare devices, were the most humane and traps, snares, and shooting from aircraft was the least humane.

Some individuals believe any use of lethal methods to resolve damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Others believe that certain lethal methods can lead to a humane death. Others believe most non-lethal methods of capturing wildlife to be humane because the animal is generally unharmed and alive. Still others believe that any disruption in the behavior of wildlife is inhumane. With the multitude of attitudes on the meaning of humaneness and the varying perspectives on the most effective way to address damage and threats in a humane manner, agencies are challenged with conducting activities and employing methods that are perceived to be humane while assisting those persons requesting assistance to manage damage and threats associated with wildlife. The goal of WS-Nebraska would be to use methods as humanely as possible for resolving requests for assistance to reduce damage and threats

to human safety. WS-Nebraska would continue to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

Some methods have been stereotyped as “humane” or “inhumane”. However, many “humane” methods can be inhumane if not used appropriately. For instance, a cage trap would generally be considered by most members of the public as “humane”, since the animal would be alive and generally unharmed. Yet, without proper care, live-captured wildlife in a cage trap could be treated inhumanely if not attended to appropriately.

The goal of WS-Nebraska is to effectively address requests for assistance using the most humane methods possible to minimize stress and pain to the animal. Overall, the use of resource management methods, harassment methods, and exclusion devices are regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals is likely temporary.

Although some issues of humaneness could occur from the use of cage traps, foothold traps, reproductive inhibitors, translocation, immobilizing drugs, nets, and repellents, those methods, when used appropriately and by trained personnel, would not result in the inhumane treatment of wildlife. Concerns from the use of those non-lethal methods would be from injuries to animals while those animals were restrained and from stress to the animal while being restrained or during the application of the method. Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress.

If predators were to be live-captured by the WS-Nebraska, traps would be checked daily as per state law to ensure predators captured were addressed in a timely manner and to prevent injury. Although stress could occur from being restrained, timely attention to live-captured wildlife would alleviate suffering. Stress would likely be temporary.

Under Alternative 1, lethal methods could also be employed to alleviate or prevent predator damage and threats, when requested. Lethal methods would include shooting, body-gripping traps, cable restraints, fumigants, euthanasia chemicals, sodium cyanide (M-44 device), and the recommendation of harvest during hunting and/or trapping seasons. In addition, target species live-captured using non-lethal methods could be euthanized by WS-Nebraska. The use of lethal methods by WS-Nebraska under the Alternative 1 would follow those required by WS directives (see WS Directive 2.505, WS Directive 2.430).

Euthanasia methods being considered for use under Alternative 1 for live-captured predators would be carbon dioxide, carbon monoxide, gunshot, and barbiturates or potassium chloride in conjunction with general anesthesia. Those methods are considered acceptable methods by the AVMA for euthanasia and the use of those methods would meet the definition of euthanasia (AVMA 2013). The use of carbon dioxide, carbon monoxide, barbiturates, and potassium chloride for euthanasia would occur after the animal had been live-captured and would occur away from public view. Although the AVMA guideline also lists gunshot as a conditionally acceptable method of euthanasia for free-ranging wildlife, there is greater potential the method may not consistently produce a humane death (AVMA 2013). WS personnel that employ firearms to

address predator damage or threats to human safety would be trained in the proper placement of shots to ensure a timely and quick death.

Research and development by the WS program has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Personnel from WS-Nebraska would be experienced and professional in their use of PDM methods. Consequently, management methods would be implemented in the most humane manner possible. Many of the methods discussed in Appendix B to alleviate predator damage could be used under any of the alternatives by those persons experiencing damage regardless of involvement by WS-Nebraska. Therefore, the issue of humaneness associated with methods would be similar across any of the alternatives since those methods could be employed by other entities in the absence of involvement by WS-Nebraska. Those persons who view a particular method as humane or inhumane would likely continue to view those methods as humane or inhumane under any of the alternatives. WS-Nebraska Policies listed in Chapter 2 ensure that the methods that are humane.

3.5.2 Analysis of the Effects of Alternative 2 on Humaneness and Ethics

Under this alternative, the WS program would not be involved with any aspect of PDM in the Canyon District. Like Alternatives 3 and 4, Nebraska state agencies (e.g., University of Nebraska Cooperative Extension, and NGPC), and private entities or organizations (e.g., ICWDM) could and would likely continue to conduct PDM activities and those activities could increase in proportion to the reduction of assistance provided by the WS program. The issue of humaneness would continue to occur from methods used by Nebraska state agencies (e.g., University of Nebraska Cooperative Extension, and NGPC), and private entities or organizations (e.g., ICWDM), including from those people who implement damage management activities on their own. Those entities and people experiencing damage or threats associated with predators could continue to use those methods legally available.

Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the public since methods are often labeled as inhumane by segments of society no matter the entity employing those methods. The humaneness of methods would be based on the skill and knowledge of the person employing those methods.

A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by the WS program under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to use to resolve damage and threats caused by predators. Under this alternative, euthanasia or killing of live-captured animals would also be determined by those persons employing methods to live-captured wildlife.

3.5.3 Analysis of the Effects of Alternative 3 on Humaneness and Ethics

The issue of humaneness of methods under this alternative would be similar to the humaneness issues discussed under the other Alternatives. This perceived similarity would be derived from WS recommendation of methods that some people may consider inhumane. WS would not directly be involved with PDM activities under this alternative. However, the recommendation of the use of methods would likely result in the requester employing those methods...

WS would instruct and demonstrate the proper use and placement of methodologies to increase effectiveness in capturing target predator species and to ensure methods were used in such a way as to minimize pain and suffering. However, the efficacy of methods employed by a cooperator would be based on the skill and knowledge of the requestor in resolving the threat to safety or damage situation despite WS demonstration. Therefore, a lack of understanding of the behavior of predators or improperly identifying the damage caused by predators along with inadequate knowledge and skill in using methodologies to resolve the damage or threat could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the potential for pain and suffering would likely be regarded as greater than discussed in the proposed action.

In addition, the issue of humaneness would continue to occur from methods used by Nebraska state agencies (e.g., University of Nebraska Cooperative Extension, and NGPC), and private entities or organizations (e.g., ICWDM), including from those people who implement damage management activities on their own. Those entities and people experiencing damage or threats associated with predators could continue to use those methods legally available.

3.5.4 Analysis of the Effects of Alternative 4 on Humaneness and Ethics

Under this alternative, only non-lethal methods would be used by the WS program, which would generally be regarded as humane. Non-lethal methods would include resource management methods (e.g., minor habitat modification, modification of human behavior), translocation, exclusion devices, frightening devices, live traps, foothold traps, cable restraints, and repellents.

Although some issues of humaneness could occur from the use of non-lethal methods, those methods, when used appropriately and by trained personnel, would not result in the inhumane treatment of wildlife. Concerns from the use of those non-lethal methods would be from injuries to animals while restrained, from the stress of the animal while being restrained, or during the application of the method. Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

Overall, the use of resource management methods, harassment methods, live-capture methods, and exclusion devices would be regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals would likely be temporary and would cease once the animal was released. Similar to Alternative 1, 2 and 3, the University of Nebraska Cooperative Extension, NGPC, and/or private entities or organizations (e.g., ICWDM) could continue to use lethal methods with similar effects regarding humaneness.

3.6 Effects on Ecosystem Function

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 which 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, etc. In other words, such less complex ecosystems have lower ecosystem resilience (Beschta *et al.* 2013, Crooks and Soulé 1999, Ritchie and Johnson 2009, Estes *et al.* 2011, Bergstrom *et al.* 2014).

Predators directly impact ecosystems through predation and indirectly through exclusion/reduction in populations of other predators/mesopredators, and alteration of prey behavior and habitat use. Theses impacts, both direct and indirect, affect the abundance of prey species and alter 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). Wallach *et al.* (2010) showed that increases in dingo populations (due to the absence of exclusion and poison baiting) resulted in decreases in mesopredators and generalist herbivores, and increases in small and intermediate-weight mammals. Allowing predator populations to achieve a degree of social stability (the presence of packs and associated territoriality) has also been identified as important, because it establishes natural population control at sustainable levels. The complete loss of apex predators from an ecosystem can reduce biodiversity and shorten 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 (Berger *et al.* 2001, Beschta and Ripple 2006, Ripple and Beschta 2006, Prugh *et al.* 2009, Estes *et al.* 2011). Presence of native predators in a healthy ecosystem may also improve the ability of the system to resist adverse impacts of invasive species.

Trophic Cascades and 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 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 1997). 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) found no evidence that the presence of vertebrate predators fundamentally affected primary production or seed survival in a grassland ecosystem.

Mesopredator release is a trophic cascade where the removal of an apex predator (*e.g.*, wolves or coyotes) results in increased populations of smaller predator(s) (*e.g.*, fox, raccoons, feral cats), which may produce different impacts on prey populations and other trophic levels (Prugh *et al.* 2009, Brashares *et al.* 2010, Miller *et al.* 2012). For example, 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). Also, 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). And carnivores such as badgers, bobcats, and fox have also been shown to increase in number when coyote populations are reduced (Robinson 1961, Nunley 1977, Crooks and Soulé 1999).

3.6.1 Analysis of the Effects of Alternative 1 on Ecosystem Function

3.6.1.1 Impacts on Biodiversity and Ecosystem Resilience

Some members of the public have raised concerns that PDM actions by WS may result in unintentional adverse impacts on biodiversity and ecosystem resilience by eliminating or reducing predator populations (Bergstrom *et al.* 2014, Estes *et al.* 2011). However, Under Alternative 1, WS-Nebraska PDM activities would occur in localized areas and would not be conducted throughout the year, as previously discussed. This includes corrective PDM, which occurs for short periods after damage had occurred, and preventive PDM, which would likely occur for short periods 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). WS-Nebraska only conducts activities on a small portion of the land acres allowed under MOUs, annual WPs, Work Initiation Documents, or other comparable documents. As discussed in Chapter 1, WS-Nebraska typically conducts PDM on only 1/5 of the land area under agreement in any given year thus, we anticipate that WS-Nebraska would conduct PDM on less than 1% of the land area of Nebraska. In addition, the number of predators taken annually by WS-Nebraska and other entities is a small percentage of the estimated populations of those species in the state. Under Alternative 1, we anticipate similar levels of work and similar levels of take; therefore, WS-Nebraska does not anticipate any impact on biodiversity or associated ecosystem resilience.

Most evaluations of the impacts of predator removal or loss on biodiversity involve the complete removal of a predator species from the ecosystem for multiple years (*e.g.*, Berger *et al.* 2001, Beschta and Ripple 2006, Frank 2008, Gill *et al.* 2009). WS-Nebraska's actions will not result in

long-term extirpation or eradication of any wildlife species, so findings of most of these studies are not relevant to the proposed action. WS-Nebraska operates in accordance with federal, and state laws and regulations enacted to ensure species viability. WS-Nebraska operates on a relatively small percentage of the land area of Colorado, and take is only a small proportion of the total population of any species. The analyses in this EA and in GAO (1990) indicate that the impacts of the current WS-Nebraska program on biodiversity are not significant statewide or nationally. 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-Nebraska take of most predator species listed in this EA is so low that substantive shifts in population age structure are not anticipated (Section 3.1). Below, we analyze the potential for such impacts due to the take of coyotes, because they are the species most commonly taken by WS-Nebraska.

Henke (1992, Henke and Bryant 1999) documented decreases 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. However, the year-round level of coyote removals in these studies does not occur during normal PDM operations which would occur in Nebraska under Alternative 1. Similarly, the degree of PDM (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 PDM efforts by WS-Nebraska. This combined with the fact that cumulative take of coyotes in Nebraska is well below the low the 70% and 60% removal threshold of the estimated coyote population, and WS-Nebraska take accounts for (7% of the total recorded harvest) indicates that PDM has a minimal effect on the overall ecosystems in Nebraska (Table 9-1). Based on findings of Gese (2005), both the number of coyotes and the number of packs in areas with PDM levels similar to that of WS-Nebraska 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-Nebraska program are not of sufficient magnitude or scope at the local or state level to adversely impact biodiversity or ecosystem resilience. Under Alternative 1, we anticipate similar levels of PDM and take; thus, there would be no impact on biodiversity or ecosystem resilience.

3.6.1.2 The Potential for Trophic Cascades and Mesopredator Release.

Some individuals have expressed concerns that activities such as WS 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-Nebraska has reviewed these studies but, for the most part, they are not applicable to the types of PDM proposed for Nebraska, because they involve the complete absence of apex consumers from the system (*e.g.*,

Berger *et al.* 2001, Beschta and Ripple 2006, Frank 2008, Gill *et al.* 2009, Ripple *et al.* 2012, Gill *et al.* 2009, Ripple *et al.* 2013; Estes *et al.* 2011). 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, Henke and Bryant 1999 and Wallach *et al.* 2010 discussed above).

The data on the impacts of coyotes and coyote removal on prey populations are mixed. In two studies conducted in south Texas (Beasom 1974, 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 antelope fawns had no apparent effect on rodent or rabbit populations.

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 made no connections between PDM and jackrabbit mortality or coyote populations. Moreover, the coyote population in this study was subject to much more sustained and intensive control (coyotes were taken through use of aerial PDM, 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-Nebraska PDM program.

Wagner (1988) reviewed literature on PDM impacts on prey populations, and concluded that such impacts vary by location. In some ecosystems, prey species, such as snowshoe hares, increased to the point that vegetative food sources were depleted, despite predation. In others, coyotes might limit jackrabbit density, whereas food shortages do not (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 mi^2 study had no observable impact on local lagomorph abundance. Some of the reason for this lack of impact 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. This conclusion was based on a previous study (Henke 1992) conducted in the rolling plains 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, sustained reduction in coyote populations (and presumably other mesopredators) after restoration of wolf populations resulted in increases in the number of voles within 3 km of wolf dens (Miller *et al.* 2012).

The 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), "*[c]oyote 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.* (1987) 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 the red fox population would increase if the coyote population was reduced, because the removal of territorial coyotes would create vacant coyote territories that could then become occupied by red foxes.

However, other research has demonstrated that 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 about half of the time when encountered in Yellowstone National Park, although they would sometimes show aggression toward and kill the foxes.

Other studies suggest that 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*…." Considering the level of coyote removals that WS PDM activities achieve (less than 2% of the estimated population), 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 studies discussed above.

Ripple and Beschta (2007) and Ripple and Beschta (2012) examined a trophic cascade involving wolves, aspen and elk in Yellowstone National Park. The study documented the first significant growth of aspen on the northern winter range in the park (Ripple and Beschta 2007). They claimed their findings were consistent with a behaviorally-mediated and density-mediated trophic cascade. They presented data showing an increasing wolf population with a concurrent decrease in the elk population, and increase in the growth of aspen. Additionally, as elk populations decreased, bison and beaver increased, possibly due to increased forage from grass and aspen growth (Ripple and Beschta 2012). However, while Ripple and Beschta (2007, 2012) documented population responses from bison and beaver, and growth of grasses and forbs during a period of elk population decline, the elk population decline was not from wolf predation. Vucetich *et al.* (2005) and White and Garrott (2005) analyzed the extent wolf predation contributed to elk population decline from 17,000 to 8,000 animals on northern range in Yellowstone National Park. They determined that the elk population declined due to legal hunting outside the park and weather. Wolf predation on elk in the park was compensatory (Vucetich *et al.* 2005). White and Garrott (2005) also documented the large effect legal hunting had on reducing the elk population in Yellowstone National Park. Additionally, they recommended a reduction in female elk harvest to not accelerate the decrease in elk numbers. Whereas Beschta and Ripple (2007) documented a correlation, these other studies show that is was not a cause and effect.

An impact sustained over a period of decades was found at a site in Zion National Park which was largely avoided by cougars due to high human activity (Ripple and Beschta 2006). The decrease in cougars 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. However, this is another example of dramatic and long-term population reduction, which is not analogous to WS-Nebraska PDM.

As discussed in this EA, WS-Nebraska only conducts PDM when and where it is needed. When direct management of a depredating animal(s) is needed, efforts focus on management of the specific depredating animal or local group of animals. WS-Nebraska 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 Sections 3.1 and 3.2, 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-Nebraska's 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-Nebraska involves removal of a small percentage of individuals of the total population from relatively isolated locations. This level of removal is not of sufficient magnitude to result in substantive reductions in predator species abundance.

Given the patchy and limited scope of WS-Nebraska's 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 potential reductions in the age structure of the population (Gese 2005).

In the study by Gese (2005) a combination of aerial PDM and trapping removed approximately 44-61% and 51-75%, respectively, of an estimated coyote population from a 131 mi^2 project over the first and second year of a two-year study. Removals resulted in substantial reductions in coyote pack size and an associated decrease in density, but both pack size and density rebounded to pre-removal levels within 8 months. Radio collar data and shifts in age structure support the hypothesis that the coyotes colonizing the area after control were non-territorial individuals, which included yearlings from adjacent reproducing pairs of coyotes. The coyote population in the removal area had a younger age structure than the control area. Home range size did not vary for coyotes remaining after coyotes in adjacent territories were removed. Mean litter size did not differ substantially after the first year of winter and spring coyote removals, but increased the second year. Average litter size was correlated to the density of coyotes entering the breeding season. Increases in available prey the second year of the removals also have influenced coyote reproductive success, with a significant positive correlation between prey per coyote and litter size. However, lagomorph (*i.e.*, rabbits) abundance increased in both the area with coyote removal and the control area without coyote removal and was not the result of coyote removals. The seasonality of the coyote removal in the Gese (2005) study was similar to that which occurs in WS-Nebraska, but the proportion of the coyote population removed in the Gese (2005) study was likely higher than typically occurs in Nebraska.

Similarly, red foxes are highly mobile, and PDM actions are patchy in nature. Because of strong compensatory density feedback, primarily through immigration (Lieury *et al.* 2015), removals are not expected to result in long-term reductions in fox. Given the above factors, we believe it is unlikely that PDM actions by WS-Nebraska would result in unintended adverse impacts on ecosystems through perturbation of trophic cascades, or specifically, mesopredator release.

3.6.1.3 Impact of PDM on Disease of Prey Populations.

Mountain lions have been shown to selectively prey on mule deer with chronic wasting disease (CWD) (Miller *et al.* 2008, Krumm *et al.* 2010). Removal of infected individuals from a population by predators, or by testing and culling, has been theorized as an effective control strategy for CWD (Gross and Miller 2001, Packer *et al.* 2003, Wolf *et al.* 2004). However, Miller *et al.* (2008) concluded that, in spite of selective predation by mountain lions, predation did not decrease CWD transmission. Thus, Miller *et al.* (2008) and Krumm *et al.* (2009) concluded that CWD has persisted in mule deer populations despite selective mountain lion predation.

Wild *et al.* (2011) used a mathematical model to evaluate the potential elimination of CWD by gray wolves selectively predating on infected ungulates. The model concluded a rapid decline in CWD prevalence and eventual elimination in a closed population. Whereas the model is helpful in exploring possibilities, the natural environment is an open population. Wild *et al.*

(2011) identified that continued reintroduction of CWD in an open population would result in a lower prevalence of CWD, but elimination was unachievable. It would be beneficial to evaluate if wolves can reduce the prevalence of CWD where the disease and wolves occur concurrently.

Some scientists have suggested that wolves might decrease the spread of brucellosis in wild elk and bison because the wolves would be expected to eat aborted fetuses, thereby removing infectious material from the environment (Johnson 1992), or decrease transmission among elk due to population control and behavior modification (Cross *et al.* 2010). However, we are aware of no credible evidence to support these speculations. In fact, some researchers have reported findings that wolves in Yellowstone do not reduce the risk of brucellosis transmission in wild elk and bison (Proffitt *et al.* 2010), or findings which suggest that wolves might increase the risk of brucellosis transmission among elk (Proffitt *et al.* 2009).

The best available science indicates that predator removal would not impact diseases of prey populations, because predators do not control disease in prey populations. This is especially true for the removal of predators during PDM under Alternative 1, due to the small fraction of predators removed, and the lack of any significant impact on their populations, as discussed in Section 3.1.1.

3.6.1.4 Impact of PDM on Prey Populations.

Rabbit and rodent populations normally fluctuate substantially in multi-year cycles. Keith (1974) concluded that: 1) during cyclic declines in prey populations, predation has a depressive effect, further decreasing prey populations and holding them 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) because 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 respond to an abundance of jackrabbits by shifting their diet toward jackrabbits. Conversely, when a broad range of prey species is available, coyotes 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 the impacts of predators 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 food shortages do not seem 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.

Henke (1995) reviewed literature concerning coyote-prey interactions and concluded that short term (≤6 months per year) coyote removal typically does 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 of Texas. Whether such changes would occur in all ecosystems is unknown. But even if they would, 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 year round, but would occur for short periods after damage occurs (corrective control), or for short periods (typically less than 20 days per year) just before and during calving and lambing seasons (preventive control).

(2) WS-Nebraska typically conducts PDM in less than 5% of the land area of Colorado in any year, and takes only a small percentage (< 2%) of the state's population of coyotes in any one year. Thus, any potential impacts would be small or negligible, and limited to isolated areas.

Other prey species of coyotes include white-tailed, mule deer, and pronghorn (antelope). Local short term predator population reductions may enhance deer and pronghorn populations (see Chapter 1). 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, because WS-Nebraska only conducts PDM on less than 5% of the land area of the state and takes less than 2% of the coyote population in any one year, it is unlikely that positive effects on deer or pronghorn populations would be significant, except in isolated areas where PDM was designed to produce such results, at the request of NGPC. If NGPC or a Tribe requested coyote removal for the purpose of enhancing pronghorn 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 more intense, and longer-lasting, but would end when herd management goals were met. Even in such a scenario, it is unlikely that impacts would be significant over major portions of the state.

In general, it appears that predators prolong the low points in rodent population cycles and spread the duration of the peaks. Predators generally do not "control" rodent populations (Keith 1974, Clark 1972, Wagner and Stoddart 1972). It is more likely that prey abundance controls predator populations, especially a species such as the lynx which exhibits a classic predator-prey relationship with the snowshoe hare. The USFWS (1979, p. 128) concluded that "*[APHIS-WS] Program activities have no adverse impacts to populations of rodents and lagomorphs.*"

3.6.2 Analysis of the Effects of Alternative 2 on Ecosystem Function

Direct, Indirect, and Cumulative Impacts: Under this alternative, WS-Nebraska would not provide any direct operational work, or technical assistance with PDM. Therefore, WS-

Nebraska would have no direct effect on ecosystem function. However, predator take for PDM would still occur because predator damage would still occur. The cumulative harvest of target predator species under Alternative 2 would likely be negligibly lower (<1%), or about the same as that analyzed under Alternative 1 (see Section 3.2.1 for discussion and analysis).

Non-target take would likely increase moderately under Alternative 2, due to increased PDM by private entities with less experience, less professionalism, less access to the most selective tools, and less oversight, as discussed in Section 3.2.2.

These differences in target and non-target species take would not alter our analyses of impacts on ecosystem function under Alternative 1, including potential impacts on biodiversity, ecosystem resilience, trophic cascades, mesopredator release, and prey populations. Under Alternative 2, there would be no significant cumulative impacts to ecosystem function.

3.6.3 Analysis of the Effects of Alternative 3 on Ecosystem Function

Direct, Indirect, and Cumulative Impacts: Under Alternative 3 WS-Nebraska would not conduct direct operational PDM. Therefore, WS-Nebraska would not have any direct impact on ecosystem function. Under this alternative, NDA and NGPC would likely provide some level of professional assistance with PDM, and private PDM efforts would likely increase. The cumulative harvest of target predator species under this Alternative would likely be negligibly lower (<1%) than under Alternative 1 for all species because the vast majority of cumulative take for these species is sportsman harvest, which would not be different.

Although technical assistance from WS-Nebraska might lead to more selective use of PDM methods by private parties than that which could occur under Alternative 2, private efforts to reduce or prevent depredations would likely result in less experienced persons implementing PDM methods, leading to greater take of non-target wildlife and potentially T&E species, as discussed in Section 3.2. This would likely result in a moderate increase in non-target take under Alternative 3.

These differences in target and non-target take would not change our impact analyses under Alternative 1, including potential impacts on biodiversity, ecosystem resilience, trophic cascades, mesopredator release, and prey populations. Under Alternative 3, there would be no significant cumulative impacts on ecosystem function.

3.6.4 Analysis of the Effects of Alternative 4 on Ecosystem Function

This alternative would require personnel from the WS program to use only non-lethal methods to resolve damage or threats of damage. In accordance with WS Directive 2.101, preference is given to non-lethal methods where practical and effective under the other alternatives. Therefore, the WS program would have no effect on ecosystem function in Nebraska under this alternative.

The NGPC, the NDA and other entities could continue to use lethal methods under this alternative. If those non-lethal methods employed by the WS program did not reduce damage or threats of damage to levels acceptable to the requester, the requester could seek assistance from other entities, or could conduct damage management activities on their own. In some cases, property owners or managers may misuse some methods or use some methods in excess of what was necessary, which could then become hazardous and pose threats to the safety of people and wildlife species and potentially local ecosystems function.

3.7 Summary and Conclusion

There would be no significant negative environmental impacts under Alternatives 1 or 4. The only significant negative impacts under Alternatives 2, 3, and 4 would be the somewhat higher impacts to human health and safety. Differences would occur among the alternatives regarding the amount of target predator take and non-target take, but those differences would not result in significant impacts under any of the Alternatives. This includes the likely direct, indirect, and cumulative impacts under each Alternative.

From an environmental impact perspective; Alternative 1, the continuation of the current WS-Nebraska PDM program, is the Alternative which best accomplishes the goals and objectives of APHIS-WS and WS-Nebraska and it is the only Alternative which is likely to accomplish them all. It is therefore the Preferred Alternative based on the analyses in this EA.

Under Alternative 1, past, present, and reasonably foreseeable future actions would not result in cumulatively significant negative environmental impacts. All WS-Nebraska PDM activities under this Alternative will comply with relevant laws, regulations, policies, orders, and procedures (including the ESA, MBTA, and FIFRA). When finalized, this EA will remain valid until WS and other appropriate agencies determine that new actions or new alternatives, having substantially different environmental effects, must be analyzed; or until changes in environmental policies, the scope of the WS-Nebraska PDM Program, or other issues trigger the need for additional NEPA analysis. This EA will be reviewed periodically for its continued validity, including regular monitoring of the impacts of WS-Nebraska PDM activities on populations of both target and non-target species, and will be updated as needed.

CHAPTER 4: LIST OF PREPARERS, PERSONS CONSULTED, AND REVIEWERS

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APPENDIX A LITERATURE CITED

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APPENDIX B METHODS AVAILABLE FOR RESOLVING OR PREVENTING PREDATOR DAMAGE

The most effective approach to resolving wildlife damage problems would be to integrate the use of several methods, either simultaneously or sequentially. An adaptive plan would integrate and apply practical methods of prevention and reduce damage by predators while minimizing harmful effects of damage reduction measures on people, other species, and the environment. An adaptive plan may incorporate resource management, physical exclusion and deterrents, and population management, or any combination of these, depending on the characteristics of specific damage problems.

In selecting damage management techniques for specific damage situations, consideration would be given to the responsible species and the magnitude, geographic extent, duration and frequency, and likelihood of wildlife damage. Consideration would also be given to the status of target and potential non-target species, local environmental conditions and impacts, social and legal aspects, and relative costs of damage reduction options. The cost of damage reduction may sometimes be a secondary concern because of the overriding environmental, legal, and animal welfare considerations. Those factors would be evaluated in formulating damage management strategies that incorporate the application of one or more techniques.

A variety of methods would potentially be available to manage or reduce damage from predators. Various federal, state, and local statutes and regulations and WS directives would govern the use of damage management methods by WS-Nebraska. WS-Nebraska would develop and recommend or implement strategies based on resource management, physical exclusion, and wildlife management approaches. Within each approach there may be available a number of specific methods or techniques. The following methods could be recommended or used by WS-Nebraska in Nebraska. Many of the methods described would also be available to other entities in the absence of any involvement by the WS program.

Non-chemical Wildlife Damage Management Methods

Non-chemical management methods consist primarily of tools or devices used to repel, capture, or kill a particular animal or local population of wildlife to alleviate damage and conflicts. Methods may be non-lethal (e.g., fencing, frightening devices) or lethal (e.g., firearms, body gripping traps). If personnel of WS-Nebraska apply those methods, a MOU, cooperative service agreement, or other similar document must be signed by the landowner or administrator authorizing the use of each damage management method.

Resource management includes a variety of practices that may be used by agriculture producers and other resource owners to reduce their exposure to potential predator depredation losses. Implementation of these 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 the WS-Nebraska, but usually implemented by producers. Many

of these techniques can require the producer to devote significant time and initial expense towards implementing, but can be very effective (Knowlton et al. 1999, Conover 2002, Mitchell et al. 2004). The WS-Nebraska could assist producers in implementing some of these changes to reduce problems. Non-chemical methods used or recommended by the WS-Nebraska could include:

Exclusion pertains to preventing access to resources through fencing or other barriers. Fencing of small critical areas can sometimes prevent animals that cannot climb from entering areas of protected resources. Fencing installed with an underground skirt can prevent access to areas for many mammal species that dig, including coyotes, fox, feral cats, and striped skunks. Areas such as airports, yards, or gardens may be fenced. Hardware cloth or other metal barriers can sometimes be used to prevent the entry of mammals into buildings through existing holes or gaps. Electric fences of various constructions have been used effectively to reduce damage to various crops by raccoons (Boggess 1994).

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 (e.g., fencing in the shape of an "L" going outward) about 2 feet down and 2 feet out helps make a fence more wildlife proof; the "L" keeps predators out 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. In addition, if large areas are fenced, the wildlife being excluded has to be removed from the enclosed area to make it useful. Some fences inadvertently trap, catch or affect the movement of non-target wildlife and may not be practical or legal in some areas (e.g., restricting access to public land).

Netting consists of placing wire nets (chicken wire-mesh) or heavy-duty plastic, around or over resources, likely to be damaged or that have a high value. 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. Complete enclosure of areas with netting can be very effective at reducing damage by excluding all problem species, but can be costly.

Cultural Methods includes the application of practices that seek to minimize exposure of the protected resource to damaging animals through processes other than exclusion. They may include animal husbandry practices, such as employing guard dogs, herders, shed lambing, carcass removal, or pasture selection. Strategies may also include minimizing cover where damaging predators might hide, manipulating the surrounding environment through barriers or fences to deter animals from entering a protected area, or planting lure crops on fringes of protected crops.

For example, WS-Nebraska may talk with residents of an area to eliminate the feeding of wildlife that occurs in parks, recreational sites, or residential areas to reduce damage by certain predators, such as coyotes. Some predators that cause damage in urban environments are attracted to homes by the presence of garbage or pet food left outside and unprotected. Removal or sealing of garbage in tight trash receptacles, and elimination of all pet foods from outside areas can reduce the

presence of unwanted mammals. If raccoons are a problem, making trash and garbage unavailable, and removing all pet food from outside during nighttime hours can reduce their presence. However, many people who are not directly affected by problems caused by wildlife enjoy wild animals and engage in activities that encourage their presence.

Another example of human behavior modification consists of assisting people that have a fear of an animal. WS-Nebraska receives calls about species, such as large carnivores, that are not causing damage. Their mere presence is perceived as a threat to the callers even though the animal is in its natural habitat. Personnel of WS-Nebraska provide educational information and reassurance about these species.

Guard Animals are used in PDM to protect a variety of resources, primarily livestock, and can provide adequate protection at times. Guard animals (e.g., dogs, burros, and llamas) have proven successful in many sheep and goat operations. 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 (e.g., sheep foraging on open range) is widely scattered, or where the guard animal to resource ratios are less than recommended. In addition, some guard animals intended for protection against small to medium size predators, like coyotes, may be prey to larger predators like mountain lions and black bears. The WS-Nebraska often recommends the use of guard dogs, but does not have an operational guard dog program.

Habitat Management would involve localized manipulation of habitats to minimize the presence of predators. Localized habitat management is often an integral part of damage management. The type, quality, and quantity of habitat are directly related to the wildlife produced or attracted to an area. Habitat can be managed to reduce the attractiveness of certain wildlife species. Habitat management is typically aimed at eliminating cover used by particular predators at specific sites. Limitations of habitat management as a method of reducing predator damage are determined by the characteristics of the species involved, the nature of the damage, economic feasibility, and other factors. Legal constraints may also exist that preclude altering particular habitats. Most habitat management recommended by the WS-Nebraska would be aimed at reducing wildlife aircraft strike hazards at airports (e.g., managing brush and grass cover at airports to reduce field rodent populations that are a prey-base attractant) or reducing cover for predators near lambing or calving pens and grounds to reduce predation. The last is particularly important because predators are more likely to be successful if the area is conducive to ambush or allows the predator to approach the prey species under the cover of dense brush. Removal or thinning of the brush can discourage predator activity. In addition, opening the area allows for better monitoring and increases the value of shooting. WS-Nebraska provides recommendations at airports to modify the habitat, but generally does not engage in habitat management directly. WS-Nebraska generally does not modify habitats nor recommend any sort of habitat modifications in T&E species habitat. Habitat modifications may require additional NEPA analysis if conducted by WS-Nebraska, depending on the size of the project and the proposed method.

Animal Husbandry Techniques includes modifications in the level of care and attention given to livestock, shifts in the timing of breeding and births, selection of less vulnerable livestock species 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 increase, so does the degree of protection (Robel et al. 1981). In operations where livestock are left unattended for extended periods, the risk of depredation is increased. 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). Additionally, the risk of depredation is usually greatest with immature livestock. This risk diminishes as age and size increase and can be minimized by holding expectant 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 those herders accompanying bands of sheep on open range where they are highly susceptible to predation.

Animal behavior modification refers to tactics that deter or repel damaging mammals and thus, reduce damage to the protected resource. Those techniques are usually aimed at causing target animals to respond by fleeing from the site or remaining at a distance. They usually employ extreme noise or visual stimuli. Unfortunately, many of these techniques are only effective for a short time before wildlife habituate to them (Conover 1982). Devices used to modify behavior in mammals include electronic guards (siren strobe-light devices), propane exploders, pyrotechnics, laser lights, human effigies, effigies of predators, and the noise associated with the discharge of a firearm.

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 the techniques must be sufficiently varied to prolong their effectiveness. Over time, animals often habituate to commonly used 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. Scaring devices, for the most part, are directed at specific target species and operated by private individuals or personnel of WS-Nebraska working in the field. However, several of these devices, such as scarecrows and propane exploders, are automated.

Harassment and other methods to frighten animals are probably the oldest methods of combating wildlife damage. These devices 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 (e.g., 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 such as the Electronic Guard use a combination of stimuli (siren and strobe light). These are used to frighten predators from the immediate vicinity of the damage prone area. As with other damage management efforts, these techniques tend to be more effective when used collectively in an integrated approach rather than individually. However, the continued success of these methods frequently requires reinforcement by limited shooting or other local population reduction methods.

Other frightening methods in use are rubber bullets and beanbags that are shot from shotguns. Rubber bullets and beanbags do not kill or pass through an animal, but are intended to cause enough pain and freight without causing injury to avoid a particular activity again. Rubber bullets and beanbags have been used mostly for nuisance predators (e.g., raccoons in garbage cans). 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.

Live Capture and Translocation can be accomplished using hand capture, hand nets, net guns, catch poles, cage traps, cable restraints, or with foothold traps to capture some predator species for the purpose of translocating them for release in other areas. WS-Nebraska could employ those methods when the target animal(s) can legally be translocated or can be captured and handled with relative safety by personnel. Live capture and handling of mammals poses an additional level of human health and safety threat if target animals are aggressive, large, or extremely sensitive to the close proximity of people. For that reason, WS-Nebraska may limit this method to specific situations and certain species. In addition, moving damage-causing wildlife to other locations can typically result in damage at the new location. In addition, translocation can facilitate the spread of diseases from one area to another. The AVMA, the National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists all oppose the relocation of mammals because of the risk of disease transmission, particularly for small mammals such as raccoons or skunks (CDC 1990). Although translocation is not necessarily precluded in all cases, it would be logistically impractical, in most cases, and biologically unwise due to the risk of disease transmission. High population densities of some animals may make this a poor wildlife management strategy for those species. The consideration of translocation would be evaluated by WS-Nebraska on a case-by-case basis; however, translocation would only occur when permitted by State law.

Trapping can utilize a number of devices, including nets, foothold traps, cage-type traps, and body-gripping traps, foot snares, and neck/body snares. All WS-Nebraska PDM trapping is conducted in accordance with WS Directive 2.450.

Net Guns of various sizes have occasionally been used, primarily for research purposes, to catch target predators from aircraft or on the ground. The nets shoot from a rifle with prongs, go about 20 yards, and wrap around the target animal. This technique is mostly used in research to capture animals that will be sampled or equipped with radio telemetry devices. These would most likely be used to assist in capturing particular species such as coyotes for management purposes.

Foothold Traps can be effectively used to capture a variety of mammals. Foothold traps can be placed beside, or in some situations, in travel ways being actively used by the target species. Placement of traps is contingent upon the habits of the respective target species, habitat conditions, and presence of non-target animals. Effective trap placement and adjustment, and the use and placement of appropriate baits and lures by trained personnel also contribute to the selectivity of foothold traps. An additional advantage is that foothold traps can allow for the on-site release of non-target animals since animals are captured alive. The use of foothold traps requires more skill than some methods. WS-Nebraska uses traps identified as meeting BMP testing criteria for each species trapped in Nebraska. Animals live-captured in foothold traps that are to be euthanized are euthanized humanely.

Cable Restraints are typically made of wire or cable, and can be set to capture an animal by the neck, body, or foot. They can be used effectively to catch most species, but are most frequently used to capture coyotes, fox, and mountain lions. Cable restraints are much lighter and easier to transport than other methods and are not generally affected by inclement weather. Cable restraints may be used as either lethal or live-capture devices depending on how they are set. Cable restraints set to capture an animal by the neck are usually lethal but stops can be attached to the cable to increase the probability of a live capture depending on the trap check interval. Snares positioned to capture the animal around the body can be a useful live-capture device, but are more often used as a lethal control technique. Snares can incorporate a breakaway feature to release non-target wildlife and livestock where the target animal is smaller than potential non-targets (Phillips 1996). Snares can be effectively used wherever a target animal moves through a restricted travel lane (*e.g.*, under fences or trails through vegetation). When an animal moves forward into the loop formed by the cable, the noose tightens and the animal is held. Snares must be set in locations where the likelihood of capturing non-target animals is minimized.

The foot or leg snare can be set as a spring-powered non-lethal device, activated when an animal places its foot on the trigger or pan. Foot snares are used effectively to capture large predators, such as mountain lions. Additionally, 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 the location of many wildlife conflicts. Snares must be set in locations where the likelihood of capturing non-target animals is minimized.

Cage traps come in a variety of styles to live-capture animals. The most commonly known cage traps are box traps. Box traps are usually rectangular and are made from various materials, including metal, wire mesh, plastic, and wood. These traps are used to capture animals alive and can often be used where many lethal tools were impractical. These traps are well suited for use in residential areas and work best when baited with foods attractive to the target animal. Box traps are generally portable and easy to set-up.

Cage traps do have some known disadvantages. Some individual target animals may avoid cage traps (*i.e.*, become trap shy). Some non-target animals may associate the traps with available food and they purposely enter the traps to eat the bait, making the trap unavailable to catch target animals. Cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions. Some animals will fight to escape, which may cause injuries to the animal. Cage traps can be expense to purchase.

Trap monitors are devices that send a radio signal to a receiver if a set trap is disturbed and alerts field personnel that an animal may be captured. Trap monitors can be attached directly to the trap or attached to a string or wire and then placed away from the trap in a tree or shrub. When the monitor is hung above the ground, it can be detected from several miles away, depending on the terrain in the area. There are many benefits to using trap monitors, such as saving considerable time when checking traps, decreasing fuel usage, prioritizing trap checks, and decreasing the need for human presence in the area.

Trap monitoring devices would be employed, when applicable, that indicate when a trap has been activated. Trap monitoring devices would allow personnel to prioritize trap checks and decrease the amount of time required to check traps, which decreases the amount of time captured target or non-targets would be restrained. By reducing the amount of time targets and non-targets are restrained, pain and stress can be minimized and captured wildlife can be addressed in a timely manner, which could allow non-targets to be released unharmed. Trap monitoring devices could be employed where applicable to facilitate monitoring the status of traps in remote locations to ensure any captured wildlife was removed promptly to minimize distress and to increase the likelihood non-targets could be released unharmed.

Body-grip Traps are designed to cause the quick death of the animal that activates the trap. Body-grip traps are not often used during PDMexcept for smaller predators (*e.g.*, raccoons). One type of body-grip trap that is often used for smaller predators is the Conibears® trap. The Conibears® trap consists of a pair of rectangular wire frames that close like scissors when triggered, killing the captured animal with a quick body blow. For body-gripping traps, the traps should be placed so ensure the rotating jaws close on either side of the neck of the animal to ensure a quick death. Body-gripping traps are lightweight and easily set. WS policy prohibits the use of body-grip traps with a jaw spread exceeding 8 inches (*e.g.*, 330 Conibears®) for land sets. Safety hazards and risks to people are usually related to setting, placing, checking, or removing the traps. Body-grip traps present a minor risk to non-target animals. Selectivity of body-grip traps can be enhanced by placement, trap size, trigger configurations, and baits. When using body-grip traps, risks of non-target capture can be minimized by using recessed sets (placing trap inside a cubby, cage, or burrow), restricting openings, or by elevating traps. Choosing appropriately sized traps for the target species can also exclude non-targets by preventing larger non-targets from entering and triggering the trap. The trigger configurations of traps can be modified to minimize non-target capture.

Catchpoles are made of a coated cable on a pole that can be tightened around an animal to capture a predator by hand (typically diseased or entrapped animals) or safely handle a predator or non-target animal to remove it from a trap. This device consists of a hollow pipe with an internal cable or rope that forms an adjustable noose at one end. The free end of the cable or rope extends through a locking mechanism on the end opposite the noose. By pulling on the free end of the cable or rope, the size of the noose is reduced sufficiently to hold an animal. Catchpoles are used primarily to remove live animals from traps without danger to or from the captured animal, but they may be used to remove predators confined in small areas.

Shooting with firearms is very selective for the target species and would be conducted with rifles, handguns, and shotguns. Methods and approaches used by the WS-Nebraska may include use of vehicles or aircraft, illuminating devices, bait, firearm suppressors, night vision/thermal equipment, and elevated platforms. Shooting is an effective method and may at times be one of the only methods available to effectively and efficiently resolve a PDM problem.

Shooting predators is frequently performed in conjunction with calling, particularly for coyotes, bobcats, and fox. Vocal calls, handheld mouth-blown calls, and electronic calls could be used to mimic target species (*e.g.*, coyote howls and raccoons fighting) or prey (*e.g.*, injured jackrabbit

and chicken) vocalizations. Shooting would be limited to locations where it is legal and safe to discharge a weapon.

Shooting can also be used in conjunction with an illumination device at night, which is especially useful for nocturnal mammals, such as raccoons, coyotes, and bobcats. Spotlights may or may not be covered with a red lens, which nocturnal animals may not be able to see, making it easier to locate them undisturbed. Night shooting operations may be conducted in sensitive areas that have high public use or other activity during the day, which would potentially be less safe. The use of night vision and Forward Looking Infrared (FLIR) devices can also be used to detect mammals at night, and is often the preferred equipment due to the ability to detect and identify animals in complete darkness. Night vision and FLIR equipment aid in locating wildlife at night when wildlife may be more active... Personnel of the WS-Nebraska most often use this technology to target predators in the act of causing damage or likely responsible for causing damage. Those methods aid in the use of other methods or allow other methods to be applied more selectively and efficiently. Night vision and FLIR equipment allow for the identification of target species during night activities, which reduces the risks to non-targets and reduces human safety risks. Night vision equipment and FLIR devices only aid in the identification of wildlife and are not actual methods of take. The use of FLIR and night vision equipment to remove target predators would increase the selectivity of direct management activities by targeting those predators most likely responsible for causing damage or posing threats.

Aerial Shooting (*i.e*., shooting from an aircraft) is a commonly used coyote damage management method; it can be especially effective in removing offending predators (*e.g*., coyote, bobcat) 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 from an aircraft. Local depredation problems (*e.g*., lamb and calf predation by coyotes) can often be resolved quickly through aerial shooting. Aerial shooting is mostly species-selective (there is a slight potential for misidentification) and can be used for immediate control to reduce livestock and natural resource losses if weather, terrain, and cover conditions are favorable. WS has also used aerial shooting for disease surveillance (*e.g*., taking deer samples for chronic wasting disease and searching for carcasses in areas where an anthrax outbreak has occurred). Fixed-wing aircraft are most frequently used in flat and gently rolling terrain whereas helicopters with better maneuverability have greater utility and are safer over brush covered ground, timbered areas, steep terrain, or broken land where animals are more difficult to spot.

Cain 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 hunting in taking confirmed sheep-killing coyotes. Wagner (1997) and Wagner and Conover (1999) found that aerial shooting might be an especially appropriate tool as it reduces risks to non-target animals and minimizes contact between PDM operations and recreationists. They 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 hunting.

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. Air temperature (high temperatures), which influences air density affects low-level flight safety and may restrict aerial shooting activities. In broken timber or deciduous cover, aerial shooting is more effective in winter when snow cover improves visibility and leaves have fallen or in early spring before the leaves emerges. The WS program aircraft-use policy helps ensure that aerial shooting is conducted in a safe and environmentally sound manner, in accordance with federal and state laws. Pilots and aircraft must be certified under established WS program procedures. Ground crews are often used with aerial operations for safety reasons. Ground crews can also assist with locating and recovering target animals, as necessary.

Aircraft overflights have created concerns about disturbing wildlife. The National Park Service (1995) reviewed studies on the effects of aircraft overflights on wildlife. Their report revealed that a number of studies documented responses by certain wildlife species that could suggest adverse impacts may occur. Few, if any studies, have proven that aircraft overflights cause significant adverse impacts to wildlife populations, although the report stated it is possible to draw the conclusion that affects to populations could occur. It appears that some species will frequently, or at least occasionally, show adverse responses to even minor overflight occurrences. In general, it appears that the more serious potential impacts occur when overflights are frequent, such as hourly, and over long periods of time, which represents chronic exposure. Chronic exposure situations generally occur in areas near commercial airports and military flight training facilities. The use of firearms from aircraft would occur in remote areas where tree cover and vegetation allows for visibility of target animals from the air. WS-Nebraska conducts aerial activities on areas only under signed agreement and concentrates efforts during certain times of the year and to specific areas. WS Predator Damage Management Environmental Assessments (e.g., USDA 2005) that have looked at the issue of aerial shooting overflights on wildlife have found that WS has annually flown less than 10 min./mi.^{2} on properties under agreements. WS flies very little over any one property under agreement in any given year. As a result, no known problems to date have occurred with WS aerial hunting overflights on wildlife, nor are they anticipated in the future.

Denning is the practice of locating coyote or fox dens and killing the young, adults or both to stop an ongoing predation problem or prevent future depredation of livestock. Denning is used in coyote and fox damage management, but is 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 and red fox depredations on livestock and poultry often increase in the spring and early summer due to the increased food requirements associated with feeding and rearing litters of pups (Till and Knowlton 1983, Till 1992). Removal of pups will often stop depredations even if the adults are not taken (Till 1992). 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. Pups are typically euthanized in the den using a registered gas fumigant cartridge or by digging out the den and euthanizing the pups with sodium pentobarbital (see discussion of gas cartridges and sodium pentobarbital). Den hunting for adult coyotes and their young is often combined with calling and shooting and aerial hunting. Denning is labor intensive with no guarantee of finding the den of the target animal. Denning is very target-specific and is most often used in open terrain where dens are comparatively easy to find.

Hunting/Trapping is sometimes recommended by the WS-Nebraska to resource owners. The WS-Nebraska could recommend resource owners consider legal hunting and trapping as an option for reducing predator damage. Although legal hunting/trapping is impractical and/or prohibited in many urban-suburban areas, it can be used to reduce some local populations of predators.

Aerial Surveying is a commonly used tool for evaluating and monitoring damage and establishing population estimates and locations of various species of wildlife. The WS uses aerial surveying throughout the United States to monitor damages and/or populations of coyotes, fox, wolves, feral swine, feral goats, feral dogs, bobcats, mountain lions, white-tailed deer, pronghorn antelope, elk, big-horn sheep, and wild horses but any wildlife species big enough to see from a moving aircraft could be surveyed using this method. As with aerial shooting, the WS program aircraft-use policy helps ensure that aerial surveys are conducted in a safe and environmentally sound manner, in accordance with federal and state laws. Pilots and aircraft must also be certified under established WS program procedures and policies.

Aerial Telemetry is used in research projects studying the movements of various wildlife species. Biologists will frequently place radio-transmitting collars on selected individuals of a species and then monitor their movements over a specified period. Whenever possible, the biologist attempts to locate the research subject using a hand-held antennae and radio receiver, however, occasionally animals will make large movements that prevent biologists from locating the animal from the ground. In these situations, WS-Nebraska can utilize either fixed wing aircraft or helicopters and elevation to conduct aerial telemetry and locate the specific animal wherever it has moved to. As with any aerial operations, the WS aircraft-use policy helps ensure that aerial surveys would be conducted in a safe and environmentally sound manner, in accordance with federal and state laws.

Trained Dogs are frequently used in PDM to locate, pursue, or decoy animals. The WS-Nebraska could use trailing/tracking, decoy, and trap-line companion dogs. Training and maintaining suitable dogs requires considerable skill, effort, and expense.

Tracking Dogs or trailing dogs are commonly used to track and "tree" target wildlife species, such as mountain lions, bobcats, and raccoons. Although not as common, they sometimes are trained to track coyotes (Rowley and Rowley 1987, Coolahan 1990). Dogs commonly used are different breeds of hounds, such as blue tick, red-bone, 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. Tracking dogs are trained not to follow the scent of non-target species. Personnel of the WS-Nebraska typically find the track of the target species at fresh kills or drive through the area of a kill site until the dogs strike. Personnel would then put their dogs on the tracks of the target predator. Typically, if the track is not too old, the dogs can follow the trail and tree the animal. The animal usually seeks refuge 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 personnel arrive and dispatch, tranquilize, or release the animal, depending on the situation. A possibility exists that dogs could switch to a fresher trail of a non-target species while pursuing the target species. This could occur with any animal that they have been trained to follow, and could 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 bobcat, if they cross a fresher track. With this said, this risk can be minimized greatly by the personnel of the WS-Nebraska

looking at the track prior to releasing the dogs and calling them off a track if it is determined that they have switched tracks.

Decoy Dogs are primarily used in coyote damage management in conjunction with calling. Dogs are trained to spot and lure coyotes into close shooting range for personnel of the WS-Nebraska. Decoy dogs are especially effective for territorial pairs of coyotes. Decoy dogs are typically medium-sized breeds that are trained to stay relatively close to personnel.

Trap-line Companion Dogs could accompany personnel of the WS-Nebraska in the field while they were setting and checking equipment. They would be especially effective in finding sites to set equipment by alerting their owners to areas where coyotes or other predators have traveled, urinated, or defecated, which are often good sites to make sets. Trap-line companion dogs stay with personnel and most always have no effect on non-target animals. Trap-line dogs may increase the selectivity towards territorial coyotes by identifying territorial canine scent locations.

Chemical Wildlife Damage Management Methods

Chemical Pesticides are widely used because they are often very effective at reducing or stopping damage. Although some pesticides are specific to certain taxonomic groups (e.g. birds vs. mammals), pesticides are typically not species specific, and their use may be hazardous to non-target species unless they are used with care by knowledgeable personnel. The proper placement, size, type of bait, and time of year are keys to selectivity and successful use of pesticides for damage management. When a pesticide is used according to its EPA registered label, it poses minimal risk to people, the environment, and non-target species.

All pesticides used by the WS-Nebraska would be registered under the FIFRA and administered by the EPA and the NDA. All personnel of the WS-Nebraska who apply restricted-use pesticides would be certified pesticide applicators by NDA and have specific training by WS for pesticide application. The EPA and the NDA require pesticide applicators to adhere to all certification requirements set forth in the FIFRA. Pharmaceutical drugs, including those used in wildlife capture and handling, are administrated by United States Food and Drug Administration and/or the United States Drug Enforcement Agency. Employees of the WS-Nebraska that use immobilizing drugs and euthanasia chemicals would be certified for their use and follow the guidelines established in the WS Field Operational Manual for the Use of Immobilization and Euthanasia Drugs.

Chemicals would not be used by WS-Nebraska on public or private lands without authorization from the land management agency or property owner or manager. Under certain circumstances, personnel of WS-Nebraska could be involved in the capture of animals where the safety of the animal, personnel, or the public could be compromised and chemical immobilization would provide a good solution to reduce those risks. For example, chemical immobilization could be used to capture mountain lions, coyotes, and raccoons in residential areas where public safety was at risk. Immobilizing drugs are most often used by WS-Nebraska to remove animals from cage traps to be examined (e.g., for disease surveillance) 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, blowguns, or syringe pole). Immobilization is usually followed by release (e.g., after radio collaring a mountain lion for a study), translocation,

or euthanasia. Chemically euthanized animals would be disposed of by incineration or deep burial to avoid secondary hazards. Immobilizing drugs and euthanasia chemicals would be monitored closely and stored in locked boxes or cabinets according to WS policies and Drug Enforcement Administration guidelines. Most drugs fall under restricted-use categories and must be used under the appropriate license from the Drug Enforcement Administration. The following chemical methods have been proven selective and effective in reducing damage by predators.

Ketamine (Ketamine HCl) is a fast acting dissociative anesthetic (i.e., loss of sensation with or without loss of consciousness) that is used to capture wildlife. Ketamine produces catatonia (i.e., lack of movement, activity, or expression) and profound analgesia (i.e., insensibility to pain without loss of consciousness), but not muscle relaxation. It is used to eliminate pain, calm fear, and allay anxiety. Ketamine is possibly the most versatile drug for chemical capture, and it has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs, such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety.

Telazol is a more powerful anesthetic and usually used for larger animals. Telazol is a combination of equal parts of tiletamine hydrochloride and zolazepam hydrochloride (a tranquilizer). Tiletamine hydrochloride is a dissociative anesthetic drug that disrupts the central nervous system to produce a cataleptic state. Zolazepam hydrochloride is a muscle relaxant that when combined with tiletamine produces a state of immobility, muscle relaxation, freedom from reflex movement, and analgesia. The product is generally supplied sterile in vials, each containing 500 mg of active drug, and when dissolved in sterile water has a pH of 2.2 to 2.8. Telazol produces a state of unconsciousness in which protective reflexes, such as coughing and swallowing, are maintained during anesthesia. Schobert (1987) listed the dosage rates for many wild and exotic animals. Before using Telazol, the size, age, temperament, and health of the animal are considered. Following a deep intramuscular injection of Telazol, onset of anesthetic effect usually occurs within 5 to 12 minutes. Muscle relaxation is optimum for about the first 20 to 25 minutes after the administration, and then diminishes. Recovery varies with the age and physical condition of the animal and the dose of Telazol administered, but usually requires several hours.

Xylazine is a sedative (i.e., tending to calm, moderate, or tranquilize nervousness or excitement) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with ketamine to produce a relaxed anesthesia. It can also be used alone to facilitate physical restraint. Because xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel should be even more attentive to minimizing sight, sound, and touch. When using ketamine/xylazine combinations, xylazine will usually overcome the tension produced by ketamine, resulting in a relaxed, anesthetized animal (Fowler and Miller 1999). This reduces heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions.

Sodium Pentobarbital is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. Barbiturates are a recommended euthanasia drug for free-ranging wildlife (AVMA 2013). Sodium pentobarbital would only be administered after deer have been

live-captured and properly immobilized to allow for direct injection. There are Drug Enforcement Agency restrictions on who can possess and administer this drug. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Certified personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with Drug Enforcement Agency and state regulations. All animals euthanized using sodium pentobarbital and all of its dilutions (e.g. Beuthanasia-D, Fatal-Plus) would be disposed of immediately through incineration or deep burial to prevent secondary poisoning of scavenging animals and introduction of these chemicals to non-target animals.

Potassium Chloride used in conjunction with prior general anesthesia is used as a euthanasia agent for animals, and is considered acceptable and humane by the AVMA (2013). Animals that have been euthanized with this chemical experience cardiac arrest followed by death, and are not toxic to predators or scavengers.

Beuthanasia®-D combines pentobarbital with another substance to hasten cardiac arrest. Intravenous (IV) and intracardiac (IC) are the only acceptable routes of injection. As with pure sodium pentobarbital, IC injections with Beuthanasia®-D are only acceptable for animals that are unconscious or deeply anesthetized. With other injection routes, there are concerns that the cardiotoxic properties may cause cardiac arrest before the animal is unconscious completely. It is a Schedule III drug, which means it can be obtained directly from the manufacturer by anyone with a United States Drug Enforcement Agency registration. However, Schedule III drugs are subject to the same security and record-keeping requirements as Schedule II drugs.

Fatal-Plus® combines pentobarbital other substances to hasten cardiac arrest. IV is the preferred route of injection; however, IC is acceptable as part of the two-step procedure used by the WS-Nebraska. Animals are first anesthetized and sedated using a combination of ketamine/xylazine and once completely unresponsive to stimuli and thoroughly sedated, Fatal-Plus® is administered. Like Beuthanasia®-D, it is a Schedule III drug requiring a United States Drug Enforcement Agency registration for purchase and is subject to the security and record-keeping requirements of Schedule II drugs.

Carbon dioxide is sometimes used to euthanize mammals that are captured in live traps and when relocation is not a feasible option. Live mammals are placed in a sealed chamber. CO_2 gas is released into the chamber and the animal quickly dies after inhaling the gas. This method is approved as a euthanizing agent by the AVMA. CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is the gas released by dry ice. The use of CO_2 by the WS-Nebraska for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

Repellents are usually naturally occurring substances or chemicals formulated to be distasteful or to elicit pain or discomfort for target animals when they are smelled, tasted, or contacted. Repellents are non-lethal chemical formulations used to discourage or disrupt particular wildlife behaviors. 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 (e.g., 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 that are applied to areas or surfaces to discourage travel of wildlife by causing irritation such as to the feet.

Only a few repellents are commercially available for mammals, and are registered for only a few species. The only repellents available for predators are unrestricted chemicals, such as tobacco dust (e.g., F&B Rabbit and Dog Chaser®) and capsaicin from hot pepper (e.g., Hot Sauce®, Miller®) that are sold over-the-counter to the general public to repel dogs and cats from areas where they are not wanted (e.g., flower beds, gardens). Repellents would not be available for many species that may present damage problems, such as some predators or furbearing species. Repellents are variably effective and depend largely on resource to be protected, time and length of application, and sensitivity of the species causing damage. Again, acceptable levels of damage control would usually not be realized unless repellents were used in conjunction with other techniques.

Gas cartridges (EPA Reg. No. 56228-21, EPA Reg. No. 56228-2) are often used to treat dens of coyotes, fox, or skunks. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the den. Sodium nitrate is the principle active chemical in gas cartridges and is a naturally occurring substance. Although stable under dry conditions, it is readily soluble in water and likely to be highly mobile in soils. In addition, dissolved nitrate is very mobile, moving quickly through the vadose zone to the underlying water table (Bouwer 1989). However, burning sodium nitrate, as in the use of a gas cartridge as a fumigant in a den, is believed to produce mostly simple organic and inorganic gases, using all of the available sodium nitrate. In addition, the human health drinking water tolerance level for this chemical is 10 mg/L, a relatively large amount, according to EPA Quality Criteria for Water (EPA 1986*a*, EPA 1986*b*). The gas along with other components of the cartridge, are likely to form oxides of nitrogen, carbon, phosphorus, and sulfur. Those products are environmentally non-persistent because they are likely to be metabolized by soil microorganisms or they enter their respective elemental cycles. In rodent cartridges, sodium nitrate is combined with seven additional ingredients: sulfur, charcoal, red phosphorus, mineral oil, sawdust, and two inert ingredients. None of the additional ingredients in this formulation is likely to accumulate in soil, based on their degradation into simpler elements by burning the gas cartridge. Sodium nitrate is not expected to accumulate in soils between applications, nor does it accumulate in the tissues of target animals (EPA 1991). The EPA stated sodium nitrates "...as currently registered for use as pesticides, do not present any unreasonable adverse effects to humans" (EPA 1991). The NWSP would only use gas cartridges in dens that show signs of active target animal use to minimize risks to non-target species.

Sodium Cyanide (EPA Reg. No. 56228-15) is used in the M-44 device, a spring-activated ejector device developed specifically to kill coyotes and other canids. The M-44 is a mechanical device that ejects sodium cyanide powder into the mouth of an animal that pulls up on it with its teeth. The M-44 is made of four parts and is set with special pliers. It is selective for canids (members of the dog family) due to their feeding behavior (scavenging) and because the attractants used 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. The M-44 device consists

of: (1) a capsule holder wrapped with fur, cloth, or wool; (2) a capsule containing 0.97 grams 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. A canine 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 swallowed, inhaled as a dust, or absorbed through the skin. When it encounters carbon dioxide or acids, it forms hydrogen cyanide gas. Hydrogen cyanide gas is highly and quickly toxic by contact, ingestion, or inhalation of vapors at which time it enters the bloodstream. Hydrogen cyanide gas 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. Breathing is rapid at first, but soon becomes slow and gasping. Convulsions may follow, but in severe poisoning cases, especially if untreated, coma and death may occur in a few minutes. Personnel must be certified to use the M-44. WS personnel are required to abide by the EPA label for the M-44 use restrictions and WS Directive 2.415. Although the M-44 is selective for canids, the NWSP could lethally remove unintentionally some non-targets other than canids on rare occasions.

APPENDIX C FEDERAL AND STATE LISTED SPECIES IN NEBRASKA

SPECIES	Status	State Locale	PDM
MAMMALS			
Gray Wolf*	F, S, E		0
Black-footed Ferret	F,S,E		
River Otter	S,T		
Southern Flying Squirrel	S, T		0
Northern Long-eared bat	F,S, T		
Swift Fox	S, E		
BIRDS			
Eskimo Curlew	F, S, E		
Least Tern	F, S, E		
Mountain Plover	S, T		
Piping Plover	F, S, T		
Whooping Crane	F, S, E		0
Rufa Red Knot	F,S, T		
REPTILES			
Western Massasauga Rattle Snake	S, T		0
NO AMPHIBIANS			
FISH			
Black Nose Shiner	S, E		0
Dace, Finescale	S, T		0
Dace, Northern Redbelly	S, T		0
Lake Sturgeon	S, T		0
Pallid Sturgeon	F, S, E		0
Sturgeon Chub	S, E		0
Topeka Shiner	F, S, E		0
PLANTS			
Colorado Butterfly Plant	F, S, E		0
Ginseng	S, T		0
Hayden’s Blowout Penstemon	F, S, E		0

Saltwort	F, S, E		0
Small White Lady's Slipper	S, T		0
Ute Lady's Tresses	F, S, T		0
Western Prairie Fringed Orchid	F, S, T		0
INSECTS			
American Burying Beetle	F, S, E		
Salt Creek Tiger Beetle	F, S, E		0
MOLLUSKS AND CRUSTACEANS			
Scaleshell Mussel	F, S, E		0
NO SPIDERS AND RELATIVES			

APPENDIX D BIOLOGICAL ASSESSMENT FOR WDM ACTIVITES CONDUCTED BY NEBRASKA-WS PROGRAM IN NEBRASKA.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Nebraska

Ecological Services Field Office

9325 South Alda Road
Wood River, Nebraska 68883

January 12, 2018

FWS-NE: 2018-096

Timothy Veenendaal

State Director

U.S. Department of Agriculture

5940 S 58th Street

Lincoln, Nebraska 68516

RE: Biological Assessment for the Wildlife Damage Management Program Conducted by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services Program in Nebraska

Dear Mr. Veenendaal:

This responds to your December 22, 2017, request for concurrence from the U.S. Fish and

Wildlife Service (Service) on the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Service's (USDA-APHIS-WS) effect determinations made for federally listed species in the Biological Assessment (BA) for the Wildlife Damage Management

(WDM) Program in Nebraska. The Service has responsibility for the conservation and management of fish and wildlife resources for the benefit of the American public under the following authorities: 1) Endangered Species Act of 1973 (ESA); 2) Fish and Wildlife Coordination Act; 3) Bald and Golden Eagle Protection Act (Eagle Act); and 4) Migratory Bird Treaty Act (MBTA). The National

Environmental Policy Act requires compliance with these statutes and the project proponent and lead federal agency are responsible for compliance with these federal laws.

The Service has special concerns for endangered and threatened species, migratory birds, and other fish and wildlife and their habitats. Habitats frequently used by fish and wildlife species are wetlands, streams, riparian (streamside) woodlands, and grasslands. Special attention is given to proposed developments that include the modification of wetlands, stream alterations, loss of riparian habitat, or contamination of habitats. When this occurs, the Service recommends ways to avoid, minimize, or compensate for adverse effects to fish and wildlife and their habitats.

ENDANGERED SPECIES ACT

Pursuant to section 7(a)(2) of the ESA, every federal agency, shall in consultation with the Service, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. If a proposed project may affect federally listed species or designated critical habitat, section 7 consultation is required.

The Service has reviewed the final BA prepared for the WDM Program in Nebraska, including the effect determinations made for the federally listed threatened and endangered species found in the Program area. Based on the information provided, we concur with the USDA-APHISWS's may affect, but is not likely to adversely affect, determination made for the following species:

Gray wolf (*Canis lupus*)

Northern long–eared bat *(Myotis septentrionalis)*

Whooping crane (*Grus americanus*)

Piping plover *(Charadrius melodus)*
Least rern *(Sterna antillarum)*
Rufa red knot *(Calidris canutus rufa)*
Topeka shiner *(Notropis topeka)*

We acknowledge the determination that WDM activities in Nebraska would have no effect on the following species:

Black-footed ferret (*Mustela nigripes*)

Eskimo curlew (*Numenius borealis*)
Pallid sturgeon (*Scaphirhynchus albus*)
American burying beetle (*Nicrophorus americanus*)

Salt Creek tiger beetle (*Cicindela nevadica lincolniana*)
Scaleshell mussel (*Leptodea leptodon*)

Colorado butterfly plant (*Gaura neomexicana ssp. coloradensis*)
Blowout penstomen (*Penstemon haydenii*)

Western prairie fringed orchid (*Platanthera praeclara*)

Ute's ladies-tresses (*Spiranthes diluvialis*)

The Service commends USDA-APHIS-WS for developing standard operating procedures that benefit the conservation of federally listed species. Should any methods or the WDM Program area change, or during the term of the program, additional information on listed or proposed species or their critical habitat become available, or if new information reveals effects of the action that were not previously considered, consultation with the Service should be initiated to assess any potential impacts on listed species.

All federally listed species under ESA are also State-listed under the Nebraska Nongame and Endangered Species Conservation Act. However, there are also State-listed species that are not federally listed. To determine if the proposed project may affect State-listed species, the Service recommends that the project proponent contact Michelle Koch, Nebraska Game and Parks Commission (Commission), 2200 N. 33rd Street, Lincoln, Nebraska 68503-0370.

REVIEW, COMMENTS, AND RECOMMENDATIONS ON THE PROPOSED PROJECT ACTION UNDER OTHER FISH AND WILDLIFE STATUTES

Bald and Golden Eagle Protection Act

The Eagle Act provides for the protection of the bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*). The golden eagle is found in arid, open country with grassland for foraging in western Nebraska and usually near buttes or canyons which serve as nesting sites. Golden eagles are often a permanent resident in the Pine Ridge area of Nebraska. Bald eagles utilize mature, forested riparian areas near rivers, streams, lakes, and wetlands and occur along all the major river systems in Nebraska. The bald eagle southward migration begins as early as October and the wintering period extends from December through March. Additionally, many eagles nest in Nebraska from mid-February through mid-July. Disturbances within 0.5-mile of an active nest or within line-of-sight of the nest could cause adult eagles to discontinue nest building or to abandon eggs. Both bald and golden eagles frequent river systems in Nebraska during the winter where open water and forested corridors provide feeding, perching, and roosting habitats, respectively. The frequency and duration of eagle use of these habitats in the winter depends upon ice and weather conditions. Human disturbances and loss of wintering habitat can cause undue stress leading to cessation of feeding and failure to meet winter thermoregulatory requirements. These effects can reduce the carrying capacity of preferred wintering habitat and reproductive success for the species. To comply with the Eagle Act, it is recommended that the project proponent determine whether the proposed project would impact bald or golden eagles. If it is determined that either species could be affected by the proposed project,

the Service recommends that the project proponent notify this office as well as the Commission for recommendations to avoid adverse impacts to bald and golden eagles.

The Migratory Bird Treaty Act

The BA identifies methods used for bird and wildlife damage management and disease monitoring that intentionally and unintentionally target migratory birds. The USDA-APHIS-WS has agreed to comply with the MBTA by conducting surveys for migratory birds and active nests prior to performing any vegetation thinning or removal. Furthermore, the USDA-APHIS-WS will apply for a Migratory Bird Depredation Permit from the Service before performing actions that intentionally target migratory birds at airfields, concentrated animal feeding operations, and other property.

The Service appreciates the opportunity to review and comment on the final BA as well as the opportunity to collaborate on the WDM Program. Should you have questions regarding these comments, please contact Amanda Ciurej within our office at amanda_ciurej@fws.gov or (308) 382-6468, extension 211.

Sincerely,

Eliza Hines
Nebraska Field Supervisor

cc: NGPC; Lincoln, NE (Attn: Michelle Koch) USDA-APHIS-WS; Lincoln, NE (Attn: James Thiele) USDA-APHIS-WS; Denver, CO (Attn: Thomas Hall)

USDA-APHIS-WS; Denver, CO (Attn: Michael Green)

APPENDIX E NEBRASKA GAME AND PARKS BA CONCURRENCE LETTER

2200 N. 33rd St. • P.O. Box 30370 • Lincoln, NE 68503-0370 • Phone: 402-471-0641

December 26, 2017

Timothy Veenendaal

United States Department of Agriculture 5940 S
58th St.

Lincoln, NE 68516

Re: Biological Assessment for Wildlife Damage Management (WDM) Activities Conducted by the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) Program in Nebraska

Dear Mr. Veenendaal:

Please make reference to your letter dated December 22, 2017. This letter is in response to your request for concurrence regarding the effects WS program activities may have on endangered and threatened species in Nebraska. The Nebraska Game and Parks Commission (NGPC) has responsibility for protecting endangered and threatened species under authority of the Nongame and Endangered Species Conservation Act (NESCA) (Neb. Rev. Stat. § 37-801 to 37-811). We have reviewed the information provided pursuant to NESCA, and we offer the following comments.

Since 2013, staff of the USDA, APHIS, WS program, U.S. Fish and Wildlife Service, and NGPC have corresponded through emails, phone conversations and in-person meetings to develop a Biological Assessment (BA) evaluating potential impacts of WS activities on endangered and threatened species in Nebraska. The BA also describes WDM methods and standard operating procedures (i.e., conservation conditions) used to avoid and minimize such impacts. Staff of the NGPC have reviewed this information and concur with the effect determinations listed in the BA for the species as follows:

May Affect, Not Likely to Adversely Affect: gray wolf, northern long-eared bat, river otter, southern flying squirrel, swift fox, Interior Least Tern, Mountain Plover, Piping Plover, *Rufa* Red Knot, Whooping Crane, Blacknose shiner, Finescale dace, Northern redbelly dace, Sturgeon chub, Topeka shiner, and western massasauga

No Effect: black-footed ferret, Eskimo Curlew, Lake sturgeon, Pallid sturgeon, American burying beetle, Salt Creek tiger beetle, scaleshell mussel, American ginseng, blowout penstemon, Colorado butterfly plant, saltwort, small white lady's slipper, Ute ladies'-tresses, and western prairie fringed orchid

This concurrence is based on a review of the material you sent, information exchanged via phone, email or in person, and the WS program's agreement and commitment to implementing the standard operating procedures (i.e., conservation conditions) as indicated in the BA. If WS program activities change or if new species become listed, then we recommend further coordination with the Nebraska Game and Parks Commission Planning & Programming Division.

TIME OUTDOORS IS TIME WELL SPENT

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We appreciate the collaborative effort put forth by all agencies involved to develop the BA, and we commend WS on their determination to complete the document. Thank you for the opportunity to provide comments and input throughout the process. If you have any questions or need additional information, please contact me at (402) 471-5438 or michelle.koch@nebraska.gov.

Sincerely,

Michelle R Koch

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APPENDIX F RESPONSE TO PUBLIC COMMENTS

WS-Nebraska Responses to Public Comments Received During the 2018 draft EA Public Comment Period:

1. **Public Comment:** APHIS must begin decreasing it's "wildlife management" (reckless slaughter) of native wildlife, particularly carnivores.

   WS-Nebraska Response: WS-Nebraska disagrees with the claim regarding “reckless slaughter” of wildlife.

2. **Public Comment:** These animals are vital to the continued viability of American ecosystems and a growing body of research shows that lethal control of predator species does not decrease livestock loss or lessen damage to agricultural production.

   WS-Nebraska Response: We agree that predators are an essential part of healthy ecosystems. There is much debate amongst researchers regarding the effectiveness of lethal removal of predators to protect livestock. WS-Nebraska is not responsible for settling debates among researchers. An analysis of effectiveness of each of the WS-Nebraska alternatives considered in detail is found in Section 3.2. Alternative 4 considers the use of nonlethal methods only. 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 3.3 of the EA. Typically, multiple nonlethal strategies have previously been deployed by the resource owner prior to requesting WS-Nebraska assistance with lethal methods. WS-Nebraska gives preference to non-lethal methods when practical and effective

3. **Public Comment:** This program serves as little more than a federal subsidy to livestock and hunting interests; two fields that are already overly subsidized and are extremely harmful to the ecological stability of the Great Plains region.

   WS-Nebraska Response: It is a false statement that WS provides PDM as a federal subsidy. 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-Nebraska to support its constituency.

4. **Public Comment:** When Lewis and Clark crossed the Great Plains, they had to navigate via astronomical means because the grasses were so tall, the biodiversity so lush, the wildlife so abundant. However, in the past 150 years, Americans have wiped out all but 1% of native tall grass prairie; we have reduced the biodiversity of the region to little more than a handful of species (corn, soy, wheat, Eurasian bovines, Eurasian pigs), and made the soil so toxic that it has caused a dead zone the size of New Jersey when washed out to the Gulf of Mexico. Continuing on this path of reckless and wanton slaughter of wildlife for large corporate contract farmers, largely growing subsidy crops for livestock feed (the most inefficient use of food resources on earth), does little more than line the pockets of Monsanto shareholders at the expense of literally all human and wild life on this continent.

   WS-Nebraska Response: Nebraska is not a regulatory agency. This comment is outside of the scope of this EA.

5. **Public Comment:** APHIS must stop presenting its use of lethal control as a scientific endeavor - the research does not support its actions. This is solely a social experiment, one that will end poorly in the long term if society's actions are not changed. What strikes me with this EA is how APHIS describes "carrying capacity" and "social carrying capacity" of wildlife while never looking in the mirror of the impending

carrying capacities of the large simian apes wreaking havoc across this planet. Wildlife is not the issue - unfettered human growth and humanities failure to think in more than 1 to 2 year timelines are.

WS Nebraska Response: The need for WS-Nebraska PDM program is discussed in section 1.5 of the EA. WS-Nebraska cited numerous publications and research in the EA that supports the continuation of the proposed action. The comment regarding human carrying capacity is outside of the scope of this EA.

6. **Public Comment:** I am against inhumane methods of hunting. I do not think spotlight hunting, killing of hibernating bears, etc. should be permitted by law.

   WS Nebraska Response: This is a non-substantive comment. Simply opposing an action does not warrant an agency's response. WS-Nebraska PDM is not hunting, it is professional wildlife damage management. WS-Nebraska is not the authority responsible for laws regarding hunting in Nebraska.

7. **Public Comment:** Stop killing coyotes. It does not work. Wildlife "Services" should be in the business of non-lethally controlling predators especially coyotes. Killing coyotes does not work as new coyotes just move into a formerly vacant territory. So why does WS kill around 2,000 in Nebraska every year, using our tax-paying money? It makes no sense.

   WS-Nebraska Response: Section 1.16.3 discusses effectiveness of Lethal PDM for protection of livestock. Typically, multiple nonlethal strategies have previously been deployed by the resource owner prior to requesting WS-Nebraska assistance with lethal methods. WS-Nebraska gives preference to non-lethal methods when practical and effective. Often, the use of lethal methods is the only effective way to reduce or stop the damage from occurring from habituated animals. 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.

   Not all WS-Nebraska PDM is funded using tax dollars. 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-Nebraska to support its constituency.

8. **Public Comment:** You provide lip-serve that you have non-lethal options but everyone knows that is lip service to continue as the killing agency. There is abundant info that you should stop using mis-guided science to support killing carnivores especially coyotes. This DQA challenge - ignored so far by the federal government - just shows how misguided WSs activities are:

   WS-Nebraska Response: WS-Nebraska disagrees with this comment. WS-Nebraska conducts an Integrated Predator Damage Management program and uses the best available science and research as discussed in section 1.4 of the EA.
9. **Public Comment:** Carlesco, A., J.G. Way, and L. Kane. 2017. Complaint about information quality: Use of the Connolly and Longhurst (1975) paper in justifying coyote control. URL: https://www.peer.org/assets/docs/usda/12_20_17_PEER_DQA_Complaint.pdf. 23 pages.

   WS-Nebraska Response: The EA does not rely solely on the conclusion of the Connolly and Longhurst (1975) paper for justifying the actions of WS-Nebraska. The EA section 3.2.1.1 also uses the Pitt et al 2001 population model that supports the findings of Connolly and Longhurst paper. Based on the information provided in the EA, the potential impact on the coyote population in Nebraska, by WS-Nebraska, would not affect the coyote population because the total take of coyotes in Nebraska is currently

far less than 60 percent of the estimated population.

10. **Public Comment:** Stop killing coyotes! It does not work especially long term.

    WS-Nebraska Response: As discussed in the preferred Alternative, use of lethal methods to reduce damage by and conflicts with predators as currently conducted and proposed by the WS-Nebraska program is primarily intended as a short-term strategy to reduce depredations at the specific locations where conflicts occur or locations that have had a recent history of depredation conflicts.

11. **Public Comment:** I don't think this rule should be suspended or reversed or rescinded on national reserves. The reserve is there for conservation and enjoyment. The Alaska laws are enough to allow hunters to enjoy game hunting in designated Alaskan space. Thanks

    WS-Nebraska Response: This comment is outside of the scope of this EA.

12. **Public Comment:** The use and over exploitation of natural resources has been known to play its effect on biodiversity as well. Through the use of natural resources, one type of resource strikes out in particular which is the use of natural lumber. The need for lumber has put an increased amount in the need for processes such as deforestation and forest degradation. Deforestation is the conversion of forest for some type of land use or it can also be the long-term reduction of the tree canopy cover. This can include conversion of natural forest to tree plantations, agriculture, water reservoirs and urban areas. This can very much so effect predators in a similar area as well. From this when can explore this issue more and find the roots of the issues as well.

    WS-Nebraska Response: WS-Nebraska considers cumulative effects on predator species in this EA and determined that the PDM program would have no significant impact on the species covered in this EA. Deforestation and forest degradation is outside of the scope of this EA.