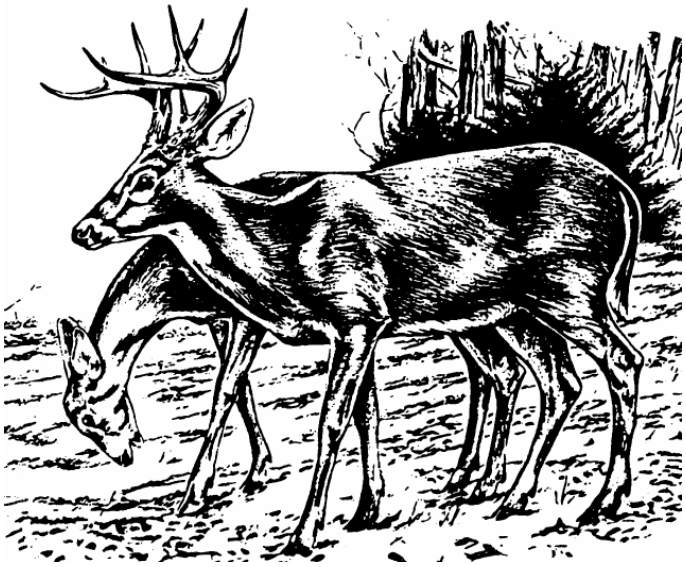
ENVIRONMENTAL ASSESSMENT

White-tailed Deer
Damage Management
in Oklahoma



Prepared By:

United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

In Cooperation with:

Oklahoma Department of Agriculture, Food, and Forestry
Oklahoma Department of Wildlife Conservation

February 2007

Table of Contents

ACRONYMS

ADC	Animal Damage Control
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DDM	Deer Damage Management
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FY	Fiscal Year
IWDM	Integrated Wildlife Damage Management
MIS	Management Information System
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOA	Notice of Availability
ODAFF	Oklahoma Department of Agriculture, Food and Forestry
ODWC	Oklahoma Department of Wildlife Conservation
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
WDM	Wildlife Damage Management
WS	Wildlife Services

CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

While all wildlife is a valuable natural resource, some species of wildlife can cause problems with human interests. Many times, the wildlife species and individual animals that cause problems are ones that have adapted to, and thrive in, the presence of people. Individuals and groups of white-tailed deer (*Odocoileus virginianus*) fit this depiction and are considered overabundant in many areas of the United States, particularly in suburban and urban areas in eastern States, including Oklahoma. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program has personnel with expertise to respond to damage caused by wildlife, including white-tailed deer. This Environmental Assessment (EA) evaluates alternatives to minimize damage with deer in Oklahoma. The Oklahoma WS Program has conducted limited white-tailed deer damage management (DDM) over the last 10 years.

APHIS-WS has the Federal statutory authority under the Act of March 2, 1931, as amended, and the Act of December 22, 1987, to cooperate with other federal agencies and programs, states, tribes, local jurisdictions, individuals, public and private agencies, organizations, and institutions while conducting a program of wildlife services involving animal species that are injurious or a nuisance to, among other things, agriculture, horticulture, forestry, animal husbandry, natural resources such as wildlife, and human health and safety as well as conducting a program of wildlife services involving mammalian and avian (*bird*) species that are reservoirs for zoonotic diseases. WS is a cooperatively funded, service-oriented program. Cooperators range from private citizens to other agency personnel.

WS cooperates closely with the Oklahoma Department of Agriculture, Food, and Forestry (ODAFF), Oklahoma Department of Wildlife Conservation (ODWC), the Oklahoma State Department of Health (OSDH), and U.S. Fish and Wildlife Service (USFWS). In Oklahoma, white-tailed deer are protected and managed by ODWC. WS, under ODWC permits, assists landowners, local governments, and organizations to resolve white-tailed deer damage problems. WS would also assist public entities and Tribes with DDM when requested.

A major overarching factor in determining how to analyze potential environmental impacts of WS' involvement in DDM is that such management can be conducted by state and local government, or private entities with or without assistance from WS and these groups are not necessarily subject to compliance with the National Environmental Policy Act (NEPA). In fact, WS conducts much of its wildlife damage management (WDM) as an agent of requesting cooperators that have obtained permits from ODWC that could conduct DDM themselves. Additionally, ODAFF has stated in a letter that they would continue WDM programs in Oklahoma should WS not have that ability. This means that the Federal WS program has limited ability to affect the environmental outcome of DDM in Oklahoma, except that WS implemented DDM has determined to have lower risks to nontarget species and the public than some alternatives discussed at depth in the EA. Therefore, WS has limited ability to affect the environmental *status quo*. Despite this limitation of federal decision-making in this situation, this EA process is valuable for informing the public and decision-makers of the substantive environmental issues and alternatives of DDM for resource protection.

1.1.1 Background

Across the United States, wildlife habitat has substantially changed as human populations have expanded and land has been transformed to meet varying human needs. These changes often compete with wildlife and have inherently increased the potential for conflicts between wildlife and people. Some species of wildlife have adapted to and thrive in the presence of humans and the changes that have been made. These species, in particular, are often responsible for the majority of conflicting activities between humans and wildlife. The Final Environmental Impact Statement (EIS) for the USDA-APHIS-WS program (hereinafter referred to as USDA 1997) summarized the relationship in American culture of wildlife values and wildlife damage in this way:

"Wildlife has either positive or negative values, depending on varying human perspectives and circumstances . . . Wildlife generally is regarded as providing economic, recreational and aesthetic

benefits . . . , and the mere knowledge that wildlife exists is a positive benefit to many people. However, . . . the activities of some wildlife may result in economic losses to agriculture and damage to property . . . Sensitivity to varying perspectives and values is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural, and economic considerations as well."

USDA is authorized and directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authorities for the APHIS-WS program are the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c). To protect American resources, WS conducts WDM. The following EA describes a portion of this responsibility, DDM. Much information will be given here, but additional information will be referenced in the EA. The Council on Environmental Quality (CEQ) regulations for implementing NEPA authorize agencies to eliminate repetitive discussions of issues addressed in a programmatic EIS by tiering to the broader documents (40 CFR (Code of Federal Regulations) 1500.4(I); 1502.20). Thus, this EA incorporates relevant discussions and analysis from USDA (1997) and includes discussions of the methods specifically used by WS in Oklahoma. USDA (1997) may be obtained by contacting the USDA, APHIS, WS Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

WDM is defined as the alleviation of damage or other problems caused by wildlife (Leopold 1933, Berryman 1991, The Wildlife Society 1992). WS uses an Integrated WDM (IWDM) approach as defined in USDA (1997). This includes nonlethal strategies such as the modification of the habitat or offending animal's (s') behavior, and control of the offending animal(s) or local population of the offending species with lethal or nonlethal methods (USDA 1997). The goal of IWDM is to stop wildlife damage or reduce it to a tolerable level. Wildlife damage is also reduced via state hunting seasons that maintain deer populations at reduced levels. Without hunting and trapping it is estimated that wildlife damage would increase from $20 billion to $70 billion in the United States resulting in the public becoming less tolerant of wildlife (International Association of Fish and Wildlife Agencies 2004).

WS's mission, developed through a strategic planning process (APHIS 2006), is to "*... provide Federal leadership in managing problems caused by wildlife. WS recognizes that wildlife is an important public resource greatly valued by the American people. By its very nature, however, wildlife is a highly dynamic and mobile resource that can damage agricultural and industrial resources, pose risks to human health and safety, and affect other natural resources. The WS program carries out the Federal responsibility for helping to solve problems that occur when human activity and wildlife are in conflict with one another.*" This is accomplished through:

- training of WDM professionals;
- development and improvement of strategies to reduce economic losses and threats to humans from wildlife;
- the collection, evaluation, and dissemination of management information;
- cooperative WDM programs;
- informing and educating the public on how to reduce wildlife damage; and
- providing technical advice and a source for limited-use management materials and equipment such as cage traps.

The WS Policy Manual[1] reflects this mission and provides guidance for engaging in WDM activities. WS cooperates with land and wildlife management agencies, when appropriate and as requested, to combine efforts to effectively and efficiently resolve wildlife damage problems in compliance with all applicable federal, state, and local laws and Memorandums of Understanding (MOUs) between WS and other agencies. At the State level, WS has current MOUs or similar documents with ODAFF and ODWC that specify roles and functions of each agency with regards to WDM. The MOUs with ODAFF and ODWC specifically address which agency is responsible for the different species causing damage and for what types of damage.

[1] WS Policy Manual - Provides guidance for WS personnel to conduct WDM activities through Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Section.

WS is the federal agency directed by law and federally authorized to protect American resources from damage associated with wildlife. APHIS-WS has the Federal statutory authority under the Act of March 2, 1931, as amended, and the Act of December 22, 1987, to cooperate with other federal agencies and programs, states, tribes, local jurisdictions, individuals, public and private agencies, organizations, and institutions while conducting a program of wildlife services involving animal species that are injurious or a nuisance to, among other things, agriculture, horticulture, forestry, animal husbandry, natural resources such as wildlife, and human health and safety as well as conducting a program of wildlife services involving mammalian and avian (*bird*) species that are reservoirs for zoonotic diseases. WS is a cooperatively funded, service-oriented program. Cooperators range from private citizens to other agency personnel. To fulfill this Congressional direction, WS activities are conducted to prevent or reduce wildlife damage caused to agricultural, industrial and natural resources, property, and threats to public health and safety on private and public lands in cooperation with federal, state and local agencies, private organizations, and individuals. Therefore, WDM is not based on punishing offending animals but as one means of reducing damage and is used as part of the WS Decision Model (Slate et al. 1992) depicted in Figure 1. The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated. The need for action is derived from the specific threats to resources or the public. WS's vision is to improve the coexistence of people and wildlife, and its mission is to provide Federal leadership in managing problems caused by wildlife.

1.1.2 Proposed Action

WS proposes to administer an IWDM program to alleviate white-tailed deer damage to agriculture, property, and natural resources, and protect human health and safety. An IWDM approach would be implemented on private and public lands in Oklahoma where a need exists, a request is received, and funding is available. An IWDM strategy would be recommended and used, encompassing the use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, other species, and the environment. Under this action, WS would provide technical assistance and operational damage management, including Nonlethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, habitat modifications, harassment, repellents, and physical exclusion could be recommended and utilized to reduce deer damage. In other situations, deer would be removed as humanely as possible by sharp shooting and live capture followed by euthanasia under permits issued by ODWC. In determining the damage management strategy, preference would be given to practical and effective Nonlethal methods. However, Nonlethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of Nonlethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. DDM would be conducted in the State, when requested, on private or public property after an *Agreement for Control* or other comparable document has been completed. All DDM would be consistent with other uses of the area and would comply with appropriate federal, state and local laws.

1.2 PURPOSE AND NEED FOR ACTION

Deer damage affects a variety of resources including agriculture, property, and natural resources, and can pose a threat to human health and safety. Damage associated with deer has been increasing steadily with the overall population of deer. One of the major increases in deer damage has been threats to human health and safety from vehicular collisions and property damage in suburban areas. The purpose of DDM in Oklahoma is to alleviate deer damage to these resources. Under the Proposed Action, DDM could be conducted on private, federal, state, tribal, county, and municipal lands in the state of Oklahoma upon request for WS assistance.

Normally, according to the APHIS procedures for implementing NEPA, individual WDM actions are categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6,000-6,003, 1995). However, this EA have been prepared to determine if DDM by WS in Oklahoma is having significant impacts on the quality of the human environment. Additionally, it is being written to facilitate planning and interagency coordination, to streamline program management, and to clearly communicate with the public the analysis of cumulative impacts. Preparation of an EA for WS DDM on all land classes in Oklahoma complies with NEPA, and with CEQ (40 CFR 1500) and APHIS NEPA implementing regulations (7 CFR 372). All WS WDM that

would take place in Oklahoma would be undertaken according to relevant laws, regulations, policies, orders and procedures, including the Endangered Species Act (ESA). WS will obtain all necessary permits from the ODWC. Notice of the availability of this document will be made available consistent with the agency's NEPA procedures.

In Oklahoma, the white-tailed deer has increased to the point of being overabundant in many areas of the state in just the past twenty years and damage has increased correspondingly. No comprehensive studies or research has been conducted in Oklahoma regarding deer damage statistics. Airports, agricultural, producers, and other resource owners are just now beginning to report significant increases in deer populations and a corresponding increase in deer-vehicle collisions, and crop and other damage (M. Shaw, ODWC pers. comm. 2006). ODWC does issue depredation permits to farmers and other resource to take deer for the protection of agriculture crops and other resources but does not currently document monetary losses (M. Shaw, ODWC pers. comm. 2006).

1.2.1 Protection of Human Health and Safety

Deer-Vehicle Collisions. Deer-vehicle collisions are a serious concern nationwide due to human injury and death, and property losses (Conover 1997, Conover et al. 1995, Romin and Bissonette 1996) and about 1.5 million occur annually (Conover et al. 1995, Insurance Institute for Highway Safety 2004). Conover et al. (1995) estimated that the average cost to repair the vehicle after a collision with a deer was $1,500. The Insurance Institute for Highway Safety (2004), more recent data, found that the average cost of an insurance claim was almost $2,000. The total damage to vehicles in the United States annually from deer-vehicle collisions is estimated to be much greater than $1 billion (Conover et al. 1995) with over 13,000 injuries and 200 fatalities to people annually (Insurance Institute for Highway Safety 2004). In Oklahoma, 713, 580, 555, 532, and 489 deer-vehicle collisions were reported annually from 1999 to 2003, respectively. During that time frame fatalities caused by deer were 1 in 2000, 2 in 2002 and 1 in 2003. Of the total number of animal/vehicle collisions during those years, deer were responsible for between 29% and 34% of all crashes. In FY04, State Farm Insurance reported 1,274 animal/vehicle claims amounting to over $4 million in damages in Oklahoma (H. Lewis, State Farm, pers. comm.. 2005).

Deer-Aircraft Strikes at Airports and Airbases. Airports provide ideal habitat for deer and other wildlife due to the large grassy areas adjacent to the brushy, forested areas used by airports as noise barriers. Airport habitats harbor excellent feeding and bedding sites for deer and they are usually protected from hunting and many other human disturbances. White-tailed deer are a commonly encountered problem at airfields in Oklahoma, causing considerable hazards to the safe operation of aircraft at those facilities. Oklahoma has a total of 140 public use airports. Collisions between deer and aircraft can cause major damage to the aircraft, and potentially cause injury and loss of human life. Serious consequences are also possible if pilots lose control of the aircraft while attempting to avert a collision with deer.

Analysis of wildlife strike reports from three major airports in the United States showed that less than 20% of all strikes occurring at these airports were reported to Federal Aviation Administration (FAA). Additionally, many reports received by FAA were filed before aircraft damage had been fully assessed. For these reasons, the information on the number of strikes and their associated costs compiled from the voluntary reporting program is believed to underestimate the magnitude of the problem (Cleary et al. 1997).

Deer/aircraft strikes can result in loss of human life, injury to passengers or people on the ground, damage or malfunction of aircraft, aircraft navigational aids, or airport facilities. Mammals colliding with aircraft during the most vulnerable phases of flight, takeoff or landing, can cause the aircraft to crash or sustain physical damage. In Oklahoma, there have been several deer/airplane strikes and near misses. Oklahoma airports have reported 9 deer/airplane collisions from 1994 though 2004 (S. Wright, WS, *from* FAA National Wildlife Strike Database, pers. comm.. 2006). The most recent strike occurred in November 2004 and caused $70,000 damage to the plane. Deer are unpredictable in their initial response to approaching aircraft. Deer may wander onto runway surfaces and be startled into the path of oncoming aircraft, and at night, freeze when caught in beams of light causing a strike. The majority of deer strikes occur at night and in the fall during the breeding season (Dolbeer et al. 1995).

Threats to Human Health and Safety from Disease Transmission. Deer potentially could be involved in the transmission of a disease or play a role in the disease life-cycle. Currently, the most common disease associated with deer is Lyme disease. This disease is caused by the spirochete *Borrelia burgdorferi* and transmitted to humans by the deer tick (*Ixodes scapularis)* in the eastern, north-central, and southern United States, the western black-legged tick (*I. pacificus*) in the West, and the lone star tick (*Amblyomma americanum*) throughout its range (CDC 2006). The Centers for Disease Control (CDC 2006) had over 16,000 cases reported to them in 1999 and finds this to be about the average annual number of infections in the United States in recent years. Lyme disease transmitted to humans in Oklahoma is fairly common and is considered a health risk for people working or recreating in the out of doors. Oklahomans are annually warned of the hazards from ticks especially during the warmer spring and summer months when outdoor activities increase. The initial symptoms of Lyme disease include a flu-like illness with headache, fever, muscle or joint pain, neck stiffness, swollen glands, jaw discomfort, and inflammation of the eye membranes (McLean 1994). If left untreated during its early stages, Lyme disease may lead to serious and persistent health problems including arthritis, carditis, and various neurologic symptoms (Gage et al. 1995).

Research has shown a correlation between infected ticks, deer numbers, and Lyme disease cases (Deblinger et al. 1993, Magnarelli et al. 1984). Deer are an important reservoir for Lyme disease and are the primary host for the adult black-legged tick (Conover 1997). As many as 500 adult ticks may parasitize a single deer (Piesman et al. 1979, Anderson and Magnarelli 1980, Main et al. 1981, Schulze et al. 1984). Wilson et al. (1985, 1988) and Anderson et al. (1987) found that islands with deer contained active populations of deer ticks (*I. dammini*, identified in 1993 as the same species as the eastern black-legged tick (Oliver et al. 1993) and *B. burgdorferi*-infected ticks, whereas islands without deer did not. Where deer are culled in an area that are a reservoir for Lyme disease, the risk of infection to humans increases initially because ticks will feed on humans; however, the risk decreases over time as the larval ticks are not exposed to the disease.

1.2.2 Deer Damage to Agriculture

Conover et al. (1995) estimated that deer cause $100 million in damage to agricultural productivity annually. Deer are most often cited as being the source of the wildlife damage (Conover and Decker 1991); 67% of all farmers reported problems with deer (Conover 1994).

Damage to Agricultural Crops. Deer damage several agricultural commodities, usually dependent on the crops grown in an area. In Michigan, Campa et al. (1997) studied deer-agricultural crop damage and characterized significant economic loss as a harvest loss valued above $20 per acre. This study surveyed alfalfa (n=157), grain corn (n=246), soybean (n=106), and table bean (n=29) farmers in the Lower Peninsula and found that 20% of the alfalfa, 25% of the grain corn, 30% of the soybean, and 55% of the table bean farmers had substantial losses. Deer damage to crops in Oklahoma has significantly increased over the last several decades (M. Shaw, ODWC, pers. comm.. 2006). WS receives a few requests for assistance annually.

Deer Damage to Timber Productivity. Herbivory on small trees constitutes the main source of deer damage to the timber industry (Conover 1997). Deer browsing may either kill trees or stunt their growth, which increases the number of years it takes trees to reach commercial size and results in a loss of productivity (Conover 1997). In the eastern deciduous forests of the United States, many tree species grown for saw timber are highly palatable to deer (Marquis and Brenneman 1981). Marquis (1981) estimated that annual timber losses from deer in the 16 million acre Allegheny hardwood forest in Pennsylvania amounted to about $23/acre or $367 million per year (Conover et al. 1995).

In the mixed, conifer-hardwood forests, hemlock (*Tsuga canadensis*), white cedar (*Thuja occidentalis*), and yellow birch (*Betula lutea*) are generally considered preferred or second-choice deer browse. When deer are abundant, the impact of deer on hemlock regeneration is intensified by deer yarding in hemlock stands during the winter (Blouch 1986). Under these conditions, hemlock seedlings visible above the snow line were browsed heavily and seldom survived to produce a sapling (Mladenoff and Stearns 1993).

The second most abundant forest type in Michigan is the aspen-birch type which covers approximately 20 million acres. Research has shown that heavy browsing (browsing on >50% of twigs) by deer and elk can impact the density, structure, composition, and nutritional quality of some bigtooth (*Populus*

grandidentata) and quaking (*P. tremuloides*) aspen stands (Campa et al. 1993, Raymer 1996). During the 1980's, browsing intensities in some stands within the Pigeon River Country State Forest were >50% and, therefore, may have caused changes in stand characteristics and plant composition within those stands (Raymer 2000). Overbrowsing has also been observed to reduce the density of bigtooth and quaking aspen in clearcuts >13 years old and caused a 50% reduction in the merchantable volume for 15-17 year old clearcuts (Raymer 2000).

Oklahoma has a substantial commercial conifer-hardwood timber industry in the eastern third of the state where tree density is 75% conifers and 25% hardwood. Timber production ranks 5th of all agriculture commodities produced in Oklahoma resulting in approximately $200,000,000 being added to state and local economies (K. Atkinson, ODAFF, pers. comm. 2006). Damage from deer overpopulation could have significant impacts to production. There have been reports of white-tailed deer browsing and rubbing on immature trees causing stunting of growth and loss in production. White-tailed deer damage to such a large industry is considered minimal and of no great concern to large timber producers. However, small landowners and horticulture producers increasingly report damage to newly planted windbreaks and commercial hardwood landscaping saplings. Data on economical deer damage has not been gathered from tree producers, but damage is expected to increase with the increasing white-tailed deer population (K. Atkinson, ODAFF, pers. comm. 2006).

Threats to Livestock Health and Safety from Disease Transmission. Tuberculosis(TB) is a contagious disease of both animals and humans and can be caused by three specific types of the *Mycobacterium* bacteria. Bovine TB, caused by *M. bovis,* primarily affects cattle and other bovine-like animals (e.g., bison, deer, and goats) but can be transmitted to humans and other animals. Transmission between deer and cattle can occur via either direct or indirect means. Direct transmission could occur through nose-to-nose contact. Due to the social nature of deer, transmission between deer could be amplified. Transmission between deer is known to occur from doe to fawn through not only milk but also nose-to-nose contact and licking. Transmission among other age classes of deer occurs primarily through nose-to-nose contact. Older bucks show higher prevalence rates possibly due to breeding activity. Indirect transmission could occur at contaminated hay bales, feed troughs, and feed piles.

Pathogenesis of *M. bovis* infection in white-tailed deer begins with either inhalation or ingestion of infectious organisms. Transmission is aided by high deer density and prolonged contact, as occurs at supplemental feeding sites. The bacilli commonly invade tonsils first, later spreading to other cranial lymph nodes. If the infection is contained, it spreads no further. In some animals the infection spreads to the thorax where it may disseminate throughout the lungs; these animals may then shed the bacteria by aerosol or oral secretions. The most susceptible animals develop disseminated infections throughout their abdominal organs, and can even shed bacilli through their feces or through their milk to their fawns.

Since 1994, Michigan has recognized a problem with bovine TB in wild white-tailed deer from a twelve county area in northeastern lower Michigan. A total of 87,877 free-ranging deer have been tested and 397 have been found to be positive for *M. bovis*. In addition to testing deer, the Michigan Department of Agriculture and the USDA Veterinary Services have been testing cattle for TB. As of January 30, 2002 whole herd tests were conducted on 728,251 head of cattle. In the high risk area, 17 beef and 2 dairy herds have been found with bovine TB (Stine 2002). *M. bovis* has been diagnosed in humans in Oklahoma, but none of the known active human infection cases were from exposure to free-ranging white-tailed deer in Oklahoma.

1.2.3 Deer Damage to Property and Natural Resources

Overbrowsing by deer damages and destroys landscaping and ornamental trees, shrubs, and flowers. As rural areas are developed, deer habitat may actually be enhanced because fertilized lawns, gardens, and landscape plants serve as high quality sources of food (Swihart et al. 1995). Furthermore, deer are prolific and adaptable, characteristics which allow them to exploit and prosper in most suitable habitat near urban areas, including residential areas (Jones and Witham 1995). Although damage to landscaping and ornamental plants has not been quantified in and around urban parks, deer have caused severe and costly property damage to homeowners, parks, and common areas. In addition to browsing pressure, male white-tailed deer damage ornamental trees and shrubs by antler rubbing which results in broken limbs and bark

removal. While large trees may survive antler rubbing damage, smaller saplings often die or become scarred to the point that they are not aesthetically acceptable for landscaping.

Deer overabundance can affect native vegetation and natural ecosystems in addition to ornamental landscape plantings. White-tailed deer selectively forage on vegetation (Strole and Anderson 1992), and thus can have substantial impacts on certain herbaceous and woody species and on overall plant community structure (Waller and Alverson 1997). These changes can lead to adverse impacts on other wildlife species, which depend on these plants for food or shelter. Numerous studies have shown that overbrowsing by deer can decrease tree reproduction, understory vegetation, plant density, and plant diversity (Warren 1991). Located within the suburbs of Detroit, Michigan, an overpopulation of deer in Kensington Metropark resulted in substantial damage to native flora. Within this park, of the plants documented, at least 23 native wildlife flower species were extirpated. At least 19 additional species of native wildflowers were greatly diminished in abundance throughout the park. Naturalists have also noticed a paucity of tree seedlings throughout forested areas, and high mortality of those that remain (Courteau et al. 1998). In the DuPage County Forest Preserve, near Chicago, Illinois, overabundant deer were causing increasing damage to native flora. After a series of annual deer removals, mean percent ground cover, mean plant height, and number of plant indicator species had a considerable positive response annually (Etter et al. 2000). This response was the result of cumulative deer harvests and a subsequent decline in deer populations. At Plum Brook Station in Ohio, the deer population was decreased between 1994 and 2001 from an estimated 2,000 to 500. This reduction in deer was determined to positively benefit to several of the rare plant species as more were found in a 2001 survey whereas many were thought to have been extirpated in earlier surveys (SAIC 2002).

Overbrowsing by deer can have a dramatic impact on other wildlife (e.g., neotropical migrant songbirds and small mammals) that depend upon the understory vegetative habitat that can be altered and destroyed by deer browsing (Virginia Dept. Game and Inland Fisheries 1999). In Pennsylvania, DeCalesta (1994) reported that deer browsing affected vegetation that songbirds need for foraging surfaces, escape cover, and nesting. Species richness and abundance of intermediate canopy nesting songbirds was reduced in areas with higher deer densities (DeCalesta 1997). Intermediate canopy-nesting birds declined 37% in abundance and 27% in species diversity at higher deer densities. Five species of birds were found to disappear at densities of 38.1 deer per square mile and another two disappeared at 63.7 deer per square mile. Waller and Alverson (1997) hypothesize that by competing with squirrels and other fruit eating animals for oak mast, deer may further affect many other species of animals and insects.

1.3 WS DDM IN OKLAHOMA

WS's DDM activities have coincided with the increase in white-tailed deer numbers in Oklahoma. Oklahoma WS has been increasingly involved in a number of DDM activities to help reduce the negative impacts of deer to agricultural resources, threats to human health and safety, and disease suppression. Many of these have been resolved with technical assistance by informing resource owners of several nonlethal methods that have proven effective in reducing or preventing these problems with deer. Thus far deer have been removed from relatively few areas in Oklahoma by WS. WS has conducted operational DDM primarily at airports to prevent or reduce hazardous threats to human health and safety. These immediate hazards have been addressed through sharpshooting followed by technical assistance (primarily fencing recommendations) to prevent future deer/aircraft strikes. WS's take of deer will be analyzed in Section 4.

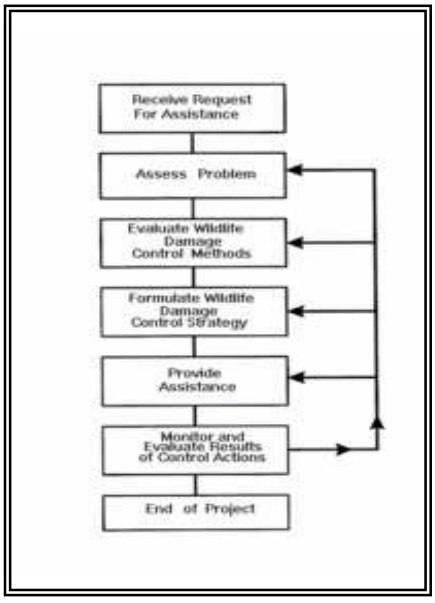


Figure 1. The WS Decision Model (Slate et al. 1992) used at the field level during DDM.

1.4 WS OBJECTIVES

- Respond to 100% of the requests for assistance with the appropriate action (technical assistance or direct control) as determined by Oklahoma WS personnel, applying the WS Decision Model (Slate et al. 1992) represented in Figure 1.

- Endeavor to hold the lethal take of nontarget animals by WS personnel during DDM to less than 1% of the total animals taken.

1.5 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

WS Programmatic Final EIS. USDA (1997) completed a Final programmatic EIS on the national APHIS-WS program. This EA is consistent with the Record of Decision signed for USDA (1997). Pertinent information available in USDA (1997) has been incorporated by reference into this EA.

1.6 DECISION TO BE MADE

WS is the lead agency for this EA, and therefore responsible for the scope, content, and decisions made. Agencies assisting in the production of this EA were ODAFF, ODWC, and USFWS. Each of the cooperating agencies was asked to provide input and direction to WS to insure that Program actions are in accordance with applicable regulations and policies, and with the desires of the State of Oklahoma.

Based on the scope of this EA, the following decisions need to be made.

- Should WS conduct DDM in Oklahoma to alleviate damage to agriculture, property, natural resources, and human health and safety?

- What standard operating procedures (SOPs) should be implemented to lessen identified potential impacts?

- Does the proposed action have significant impacts requiring preparation of an EIS?

1.7 SCOPE OF THE EA ANALYSIS

1.7.1 Actions Analyzed

This EA evaluates DDM to protect property, agricultural resources, natural resources, and human health and safety in Oklahoma.

1.7.2 American Indian Lands and Tribes

Currently, WS does not have any MOUs or signed agreements with any Tribe in Oklahoma to conduct DDM activities. If WS enters into an agreement with a Tribe for DDM, this EA would be reviewed and supplemented if appropriate to insure compliance with NEPA.

1.7.3 Period for which this EA is Valid

This EA, should it result in a Finding of No Significant Impact (FONSI), will remain valid until Oklahoma WS or other appropriate agencies determine that new needs for action, changed conditions, or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. The EA will be reviewed annually to ensure that it is complete and still appropriate for the scope of DDM activities in Oklahoma. If the EA results in a finding of significant impact, then an EIS would be prepared which would supercede this EA.

1.7.4 Site Specificity

This EA analyzes potential impacts of DDM on the human environment as required by NEPA and addresses WS DDM activities on all lands under *Cooperative Agreement* or *Agreements for Control*, or as

otherwise covered by *WS Work Plans* (e.g., on federal public lands) within Oklahoma. It also addresses the impacts of DDM on areas where additional agreements with WS may be written in the reasonably foreseeable future in Oklahoma. Because the proposed action is to continue the current program and because the current program's goal and responsibility is to provide service when requested within the constraints of available funding and manpower, it is conceivable that additional DDM efforts could occur. Thus, this EA anticipates potential expansion and analyzes the impacts of such expanded efforts as part of the current program.

Planning for the management of deer damage must be viewed as being conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, and insurance companies. Although some of the sites where deer damage is likely to occur and lead to requests to WS for assistance can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. This EA emphasizes major issues as they relate to specific areas whenever possible; however, many issues apply wherever deer damage and resulting management occurs, and are treated as such.

The WS Decision Model (Figure 1) and WS Directive 2.105 is the site-specific routine thought process for determining methods and strategies to use or recommend for individual actions conducted by WS in Oklahoma (see USDA 1997, Chapter 2 and Appendix N for a more complete description of the WS Decision Model and examples of its application). The Decision Model is not intended to require documentation or a written record each time it is used, and it necessarily oversimplifies complex thought processes. Decisions made using the model would be in accordance with SOPs described herein and adopted or established as part of the Decision for this EA.

The analysis in this EA considers impacts on target and nontarget wildlife species, people, pets, and the environment. Wildlife populations, with the exception of threatened and endangered (T&E) species, are monitored over large geographic areas (i.e., the West, the State) and smaller geographic areas (i.e., game management units). ODWC monitors white-tailed deer take for the State and in each game management unit. WS monitors take in the State and for each of the WS Districts. The game management units and Districts do not correspond to each other in Oklahoma, thus, analysis of wildlife population impacts is better analyzed at the statewide level.

1.7.5 Interdisciplinary Development of the EA

Comments were solicited from the ODAFF, ODWC, and USFWS to facilitate an interdisciplinary approach to analysis. Comments are maintained in an administrative file located at the WS State Office, 2800 N Lincoln Blvd., Oklahoma City, OK 73105-4298.

1.7.6 Public Involvement and Notification

As part of the EA process, and as required by the Council on Environmental Quality (CEQ) and APHIS-NEPA implementing regulations, this document and its Decision are being made available to the public through "Notices of Availability" (NOA) published in local media and through direct mailings of NOA to parties that have specifically requested to be notified. New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA should be revised or a Decision can be rendered.

1.8 AUTHORITY AND COMPLIANCE

1.8.1 Authority of Federal and State Agencies for WDM in Oklahoma

Wildlife Services. WS has legislative authority [2] to conduct WDM in Oklahoma. The primary statutory authorities for the APHIS-WS program are the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as

[2] See Chapter 1 of USDA 1997 for a complete discussion of federal laws pertaining to WS.

amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c). The Act of March 2, 1931, as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, provides that:

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

The Act of December 22, 1987 provides, in part:

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

WS has limited Federal authority in controlling deer damage in Oklahoma because deer are a State managed species in Oklahoma. However, under an MOU with ODWC, WS, in accordance with the provisions of Title 29, O.S.2001, §5-201, and 5-502, is authorized and permitted to take necessary action in assisting any landowner in the management and control of wildlife species on their property, within the State of Oklahoma.

The Oklahoma Department of Wildlife Conservation. In 1925 the Oklahoma Legislature created ODWC to oversee the management of wildlife, including deer, on all lands in the State. ODWC is authorized by Title 29, O.S.2001, §3-103, Part 9, to "*Prescribe the manner of cooperation with....any agency of the Federal government....any other agency or organization in the study of conservation and propagation of wildlife...*"

The Oklahoma Department of Agriculture, Food, and Forestry. ODAFF is authorized by Title 2, O.S.2001,§12-1, A, to enter into cooperative agreements for the purpose of "*…conducting wildlife damage management for…other wildlife species causing destruction to livestock, poultry, crops, range land, forests and other resources, including human health and safety*". It further states that "*Wildlife damage management of …other wildlife species causing damage shall include but not be limited to hunting, trapping, or other practical methods for the control of wildlife damage.*"

The Oklahoma Department of Health. OSDH has the authority to enter into an agreement with WS for conducting WDM for the protection of human health from wildlife threats.

The United States Fish and Wildlife Service. USFWS has statutory authority to manage Federally listed T&E species through the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531-1543, 87 Stat. 884), as amended. WS, under Section 7 of ESA, must consult with USFWS to ensure that federal activities do not impact T&E species or critical habitat.

1.8.2 Compliance with Other Federal and State Statutes

Several Federal and State laws, regulations, and Executive Orders guide WS WDM. WS complies with these laws and regulations, and consults and cooperates with other agencies as appropriate.

The National Environmental Policy Act. NEPA, of 1969, (42 USC Section 4231 et seq.) is implemented by Federal Agencies pursuant to Council on Environmental Quality (CEQ) Regulations (40 CFR Section 1500-1508) and agency implementing regulations. WS prepares analyses of the potential environmental impacts of program activities to meet procedural requirements of NEPA and to facilitate planning, decision-making, and public and interagency involvement.

NEPA and its supporting regulations require that an EA be a concise public document that provides sufficient evidence and analysis to determine if an EIS should be prepared, aids in WS's compliance with NEPA, describes the need for action, alternatives, and environmental impacts, and includes a list of agencies/persons consulted.

Environmental documents pursuant to NEPA must be completed before work plans consistent with the NEPA decision can be implemented. WS also coordinates specific projects and programs with other agencies. The purpose of these contacts is to coordinate any WDM that may affect resources managed by these agencies or affect other areas of mutual concern.

The Endangered Species Act. It is Federal policy, under ESA, that all Federal agencies seek to conserve T&E species and utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). Where appropriate, WS conducts Section 7 consultations with 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 shall use the best scientific and commercial data available*" (Sec.7(a)(2)). WS obtained a Biological Opinion (BO) from USFWS in 1992 describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F). WS is in the process of initiating formal consultation at the programmatic level to reevaluate the 1992 B.O. and to fully evaluate potential effects on T&E species listed or proposed for listing since the 1992 USFWS BO. In addition to these programmatic efforts to comply with the ESA, individual WS programs may confer with USFWS Ecological Services in the State of the proposed action to determine the presence of T&E species in project areas, and to identify potential impacts of proposed actions and alternatives on these species. In 1999, Oklahoma WS entered into an informal consultation with the USFWS to address T&E species impacts from WDM activities specifically in Oklahoma.

National Historic Preservation Act (NHPA). NHPA, of 1966, as amended, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. WS actions on tribal lands are only conducted at the tribe's request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties. WS activities as described under the proposed action do not cause ground disturbances nor do they otherwise have the potential to significantly affect visual, audible, or atmospheric elements of historic properties and are thus not undertakings as defined by the NHPA. WS has determined that DDM actions are not undertakings as defined by the NHPA because such actions do not have the potential to result in changes in the character or use of historic properties. A copy of this EA is being provided to each American Indian tribe in the State to allow them opportunity to express any concerns that might need to be addressed prior to a decision.

Executive Order 12898 - Environmental Justice. Executive Order 12898, entitled, "*Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*", 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. Environmental Justice is a

priority within APHIS and WS. 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. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS personnel use only legal, effective, and environmentally safe WDM methods, tools, and approaches. 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**.**

Executive Order 13045 - ***Protection of Children from Environmental Health and Safety Risks.*** Children may suffer disproportionately from environmental health and safety risks for many reasons, including their development, physical and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, WS has considered the impacts that this proposal might have on children. The proposed DDM activities would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impact analysis in Chapter 4 (Environmental Consequences), issues that have driven the development of SOPs, and issues that will not be considered in detail, with rationale. The affected environments will be incorporated into the discussion of the environmental impacts in Chapter 4. The affected environment includes not only the local wildlife populations within the area under consideration, but also native flora and human populations and their respective environments.

2.1 THE AFFECTED HUMAN ENVIRONMENT

NEPA requires federal agencies to determine if federal actions affect the quality of the "*human environment*." As defined by NEPA implementing regulations, the "*human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment*" (40 CFR 1508.14). Therefore, when a federal action agency analyzes its potential impacts on the "human environment," it is reasonable for that agency to compare the effects of the federal action against the human-caused effects that would occur or can be expected to occur in the absence of the federal action. This concept is applicable to situations involving federal assistance in managing damage associated with State-resident wildlife species or unprotected wildlife species. This section discusses the human environment that could or could not potentially be affected by WS DDM.

2.1.1 Aspects of the Human Environment Relevant to WS DDM Actions

In Oklahoma, WS DDM activities are conducted on a variety of land classes, primarily private and county owned lands (Section 1.1.2). WS DDM can be carried out in several kinds of habitats throughout the State including forests, rangeland, riparian areas, as well as suburban and urban areas. All of these habitats and lands have been impacted, and continue to be impacted, by humans in a variety of ways independent of actions or involvement by WS.

The natural and physical environment includes a multitude of native, as well as certain introduced and invasive, animal and plant species and the air, water, soils, terrain and human developments that make up their habitats. WS DDM in Oklahoma targets white-tailed deer (Section 1.1) and the potential exists to take other species as nontargets (Section 2.2.2), though, WS has not taken any during DDM. Impacts on these species are analyzed in the EA under 4 alternatives (Chapter 4). WS DDM can be conducted to protect natural resources, primarily habitat and plant species where deer overbrowsing has been identified as seriously impacting the environment when requested by other agencies or entities with management authority over the plant species involved (Section 1.2.3). The DDM methods (Section 3.1.1) used by WS that have the potential to affect the natural and physical environments include removing wildlife, physical exclusionary methods, and habitat alterations. The DDM methods that WS uses are legal and allowed under applicable laws and regulations. The primary methods used by WS include wildlife removal techniques. WS could operationally use physical exclusion methods (e.g., assistance in installing deer-proof fencing) and habitat alterations (e.g., brush removal near runways on an airport). Oklahoma laws allow property owners to conduct these activities in the absence of federal assistance. Thus, private individuals and other non-federal entities can conduct these activities with or without assistance from WS.

Human relationships with the natural and physical environment have resulted in the establishment and management of virtually all of the resources protected by WS DDM such as agricultural resources and property. For example, crops grown or airport operations on private and public lands in the State have been placed there, and are managed by, humans, and in most cases for en extended period of time. Thus, the crops or airports and their owners or managers are a long established part of the human environment. Farmers and airport operators are also primary groups requesting WS DDM assistance. Urban and suburban residential and commercial developments established and maintained by humans are also established components of the human environment. People living, working, and recreating in urban and suburban areas as well as in rural areas, including deer hunting, where wildlife and their habitats exist are also established components of the human environment. Threats to the health and safety of people as a result of interactions with deer can and do result in DDM actions by WS. These actions could also be conducted by private, or state or local government entities to reduce such threats, and those types of actions by such non-federal entities are also established components of the human environment.

It is common knowledge that humans have altered and continue to alter the natural and physical environment. WS DDM activities do not affect habitat to any substantial degree. On occasion, program personnel might perform minor habitat alterations in specific isolated situations to reduce the attractiveness of a site to problem-causing wildlife (e.g. removal of brush that serves as cover for deer near an airport runway, or direct assistance with the installation of a barrier fence to exclude deer from crops). However, most such alterations are not done by WS, but by the resource owner or manager, which means they are included among the human relationships that exist with the natural and physical environment. Larger actions that alter one habitat into another, such as housing developments, generally result in major shifts in wildlife species composition, diversity, and population levels. Deer, though, can thrive in these heavily human-altered environments. As a result, an increase in DDM may be needed in such areas to prevent damage to landscaping or reduce threats to human health and safety. All of these human-caused changes to the natural and physical environment are established components of the human environment.

The human environment also includes less concrete relationships between people and the environment, including the animal species found there. On the one hand, many people experience aesthetic appreciation or enjoyment of the outdoors (Section 2.2.4) or of wildlife viewing (Section 2.3.2). On the other hand, some people can be fearful of wildlife and may deem their experience with such wildlife as negative. Farmers, urban residents, airport operators, and other resource owners may not have a favorable opinion of deer because of the damage deer have caused or may cause. The relationship also includes the use of DDM methods and their potential risks to the public (Section 2.2.3). Most DDM methods used by WS can also be used by the public as allowed under State and local laws. Inherent dangers of use may increase for the public depending on who is conducting DDM and which methods are being used (analyzed in Section 4.1.4). All of these types of human relationships are established components of the human environment.

2.1.2 The Environmental Baseline

To determine impacts of federal actions on the human environment, an environmental baseline needs to be established with respect to the issues considered in detail so that the impacts of the alternatives can be compared against the baseline. Based on the existing human environment described above, and the numerous types of human relationships that are established components of that environment, it is quite apparent that the baseline appropriate to use for analysis in this EA is not a "pristine" or "non-human-influenced" environment, but one that is already heavily influenced by human actions and direct management.

DDM has been conducted in Oklahoma at least over the last 10 years and, thus, the environmental baseline could be considered as including the effects of the current ongoing WS program. Information necessary to determine the baseline for issues relevant to this EA include data on deer take in DDM, population numbers and general trends, effects on nontarget species, humans, and pets of DDM activities, and effects of DDM on sport hunting. For wildlife populations, definitive numbers are not often available but can be estimated from the best natural history information available regarding densities and occupied range or habitat types. For deer, the managing agency, ODWC, monitors their numbers and can provide estimates. Current and past harvest information can be used to compare impacts because wildlife populations are a renewable resource and a certain percentage can be taken from the population without adverse impacts. The analysis in Section 4. uses the best available information to determine the relative impacts of the proposed action and alternatives on the current "*environmental status quo*" (the human environment as it is today that includes ongoing WS DDM actions). The Current Program Alternative (i.e., a continuation of the *status quo*) can thus be viewed as an appropriate baseline for analysis in this EA.

The wildlife population baselines are those that are in place under the current condition of the human environment. This means that the baseline incorporates and reflects the populations as they have been and are being affected by humans. Effects by humans are caused by hunting take, road kill mortality, and loss of habitat to development such as construction, logging, and mineral and energy extraction activities, and poaching. Little or no information is available to quantify the effects of some of these actions on the different wildlife species populations. Nevertheless, such effects are already part of the existing human environment, and thus part of the *environmental status quo*.

Another way to evaluate impacts of the federal action in this situation is to compare against the status quo for the human environment that would exist with no federal involvement in DDM in Oklahoma. The *environmental status quo* in this context is expected to include DDM and other types of wildlife management by nonfederal entities. Deer are managed under different state, and, on occasion, local laws (Section 1.7). ODWC has the authority to issue permits in Oklahoma for the take of certain wildlife species causing damage (including deer). When a non-federal entity (i.e. ODWC, ODAFF, municipalities, counties, private companies, and individuals) takes a management action on a State-resident wildlife species, the action is not subject to NEPA compliance due to the lack of federal involvement in the action. Under such circumstances, the environmental *baseline* or *status quo* must be viewed as an environment that includes those species *as they are managed or impacted by non-federal entities in the absence of the proposed federal action*. Therefore, in those situations in which a non-federal entity has decided that a management action directed towards a state protected or unprotected wildlife species will occur and even the particular methods that will be used, WS's involvement in the action will not affect the *environmental status quo*. WS's decision-making ability in such situations is restricted to one of two alternatives - either taking the action using the specific methods as decided upon by the non-federal entity, or taking no action at all at which point the non-federal entity will take the same action anyway.

The inability to change the *environmental status quo* in the types of situations described above presents a clear question of whether there is enough federal control over the action to be taken to make direct assistance by WS a federal action requiring compliance with NEPA. This lack of federal control over the decision to be made is even clearer when the non-federal entity has committed to taking the same actions in the absence of any federal assistance from WS. Clearly, under these circumstances, by any analysis we can envision, WS would have virtually no ability to affect the *environmental status quo* by selecting any possible alternative, even the alternative of no federal action by WS.

Therefore, based on the discussion above, it is clear that in those situations where a non-federal cooperator has obtained the appropriate ODWC permit or authority, and has already made the decision to remove or otherwise manage deer to stop damage with or without WS assistance, WS participation in carrying out the action will not affect the *environmental status quo*. In some situations, however, certain aspects of the human environment may actually benefit more from WS's involvement than from a decision not to assist. For example, if a cooperator believes WS has greater expertise to selectively remove a target species than a non-WS entity; WS management activities may have less of an impact on target and nontarget species than if the non-federal entity conducted the action alone. Thus, in those situations, WS involvement may actually have a *beneficial* effect on the human environment when compared to the *environmental status quo* in the absence of such involvement.

2.1.3 Connected Actions

Connected actions are the activities necessary to meet the need for action. The need for action in this EA is to protect resources from deer. WS conducts WDM in the state for other wildlife species, but only deer are included within the scope of this EA. Other WS WDM programs are not connected to DDM and they are not necessary to achieve the need for action.

2.1.4 Cumulative Actions

"*Cumulative actions*" are defined in CEQ's NEPA regulations as "*actions which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement*." (1508.25(a)(2)). "*Cumulative impact*" is defined in those regulations as the "*impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions .. .*" (40 CFR 1508).

In its June 24, 2005 guidance memorandum to federal agencies on the consideration of past actions in cumulative effects analysis, CEQ advised that agencies should:

> *" . . . focus on the extent to which information is 'relevant to reasonably foreseeable significant adverse impacts,' is 'essential to a reasoned choice among alternatives,' and can be obtained without exorbitant cost. 40 CFR 1502.22. Based on scoping, agencies have discretion to determine whether, and to what extent, information about the specific nature, design, or present effects of a*

past action is useful for the agency's analysis of the effects of a proposal for agency action and its reasonable alternatives."

CEQ also advised in that guidance that:

> "*Agencies are not required to list or analyze the effects of individual past actions unless such information is necessary to describe the cumulative effect of all past actions combined. Agencies retain substantial discretion as to the extent of such inquiry and the appropriate level of explanation. Generally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions*."

Accordingly, cumulative actions are activities that when combined with the proposed federal action, can be additive to create impacts (cumulative impacts) on the resources that are affected by the proposed federal action and include past, present, and reasonably foreseeable future activities on those affected resources. Cumulative impacts on the environment affected by WS DDM actions in Oklahoma include sport hunting, vehicular kills, private DDM actions permitted by ODWC, and potential growth of WS DDM actions. These are discussed in relationship to each of the issues under the four alternatives. Of primary concern are the cumulative impacts to native wildlife species directly targeted or those species not targeted but directly affected by WS' DDM actions (i.e., the potentially affected nontarget species addressed in Section 2.2.2). Thus, the cumulative impacts that are analyzed are those that affect the same environmental wildlife resources as those affected by WS DDM actions in Oklahoma and that are caused by past, present, and reasonably foreseeable future activities, regardless of who undertakes such activities.

An issue has risen that claims impacts on wildlife resources caused by actions such as residential and commercial land development, oil and gas development, and timber harvesting are among the cumulative impacts that should be analyzed by WS as cumulative effects to be considered in reference to WS WDM actions in Oklahoma. We disagree since those actions typically do not directly affect the same wildlife resources that WS WDM actions affect. WS acknowledges that other types of actions may occasionally have some impacts on the wildlife species that WS impacts with its DDM actions but such impacts are usually only indirect and minor impacts. In the case of white-tailed deer in Oklahoma, neither WS DDM nor the cumulative impacts of developmental activities have impacted white-tailed deer populations attested by their increase in population in the past ten years (Figure 2).

2.1.5 Similar Actions

Actions similar to WS DDM, such as private landowners conducting DDM for themselves, are analyzed in this document where information is available. ODWC keeps take records on deer from sport harvest and depredation permits, including those taken by WS. Hunter harvest and private depredation take are considered in cumulative impacts analysis, and thus is not considered here. As far as other issues related to privately conducted DDM, much information is unknown such as incidents with people and pets, nontarget take, effects on sport hunting, and so on. Therefore, the potential effects of privately conducted DDM as a similar action to WS DDM can only be theorized from the best available information. For example, it has been well documented that landowners frustrated in attempts to resolve deer damage can resort to questionable or illegal techniques leading to potentially serious environmental impacts. This includes poaching (illegal hunting) and using illegal chemicals and methods. Obviously, accurate reports of the extent of illegal wildlife control activities are not available as persons engaging in them cannot be expected to readily volunteer such information even when asked about it. However, it is reasonable to expect that such activities would be likely to increase if professional government-provided assistance in resolving wildlife damage problems was reduced, eliminated, or rendered less effective by excessive restrictions (USDA 1997).

2.1.6 Resources Not Impacted by WS DDM

The following resources within Oklahoma are not expected to be impacted to any consequential degree under any of the alternatives analyzed in this EA: soils, geology, minerals, water quality and quantity, floodplains, wetlands and other aquatic resources, visual resources, air quality, prime and unique farmlands, timber, and rangeland. Neither the current program nor the other 3 alternatives will cause major ground disturbance, physical destruction, or damage to property. They will not cause more than minor alterations of property, wildlife habitat, or landscapes (except potentially beneficial effects in areas with overabundant deer populations), nor will they involve the sale, lease, or transfer of ownership of any property. Nor do the proposed methods have the potential to affect the character or use of historic properties through introduction of visual, atmospheric, or audible elements in area which they are used. These resources will not be analyzed further.

2.1.7 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.

2.2 ISSUES ANALYZED IN DETAIL

Following are issues that have been identified as areas of concern requiring consideration in this EA:

- Effects of DDM on White-tailed Deer Populations
- Effects on Nontarget Species, including Plants and T&E Species
- Impacts on Public Safety, Pets, and the Environment
- Humaneness of DDM Methods

2.2.1 Effects on White-tailed Deer Populations.

There are concerns that the proposed action or any of the alternatives would result in the loss of local white-tailed deer populations or could have a cumulative adverse impact on regional or statewide populations. In Oklahoma, where deer pose damage problems in various habitats and where numbers of damaging deer have exceeded acceptable levels, ODWC usually determines deer population management strategy to be that of reduction. In other instances, the presence of individual animals in a given locale can present unacceptable damage or risk to local habitats or humans. In these instances, ODWC considers reduction or elimination of damage or risk to be an integral part of its wildlife management program. The extent to which each of the alternatives contributes towards this strategy is considered a positive impact.

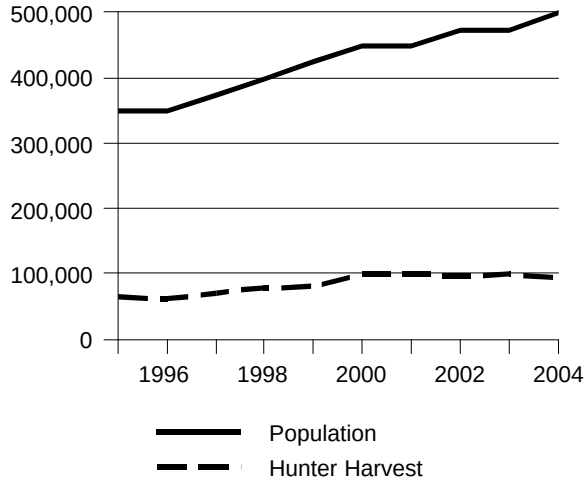


Figure 2. White-tailed deer population (prehunting estimate in fall) and hunter harvest in Oklahoma from 1995 to 2004.

White-tailed Deer Natural History. Populations of white-tailed deer have changed significantly during the past 100 years in the eastern United States (Halls 1984), including Oklahoma. After near extirpation in the eastern states by 1900, deer numbers increased during the first quarter of this century. Deer populations have increase from a low of half million or less throughout its range in the United States to current estimates of over 24 million (National Park Service 1999). During the last half of the 20th century, deer populations in the eastern United States have probably increased to more

than they ever had been. The effects of growing deer populations on forest regeneration and farm crops have been a concern to foresters and farmers for the past 50 years. More recently, deer populations in developed areas have become a great concern with a rise in deer damage to property, natural resources, and livestock health, and increases in human health and safety issues.

In Oklahoma, white-tailed deer were reduced to about 500 deer located in 4 isolated pockets of the State by 1916. Hunting was closed and did not reopen until 1933. From 1947 to 1972, about 9,000 deer were trapped and relocated within the State to repopulate areas where they had been extirpated. As a result of these efforts, established hunting seasons, and natural migration of deer from surrounding states, white-tailed deer can now be found in all 77 counties of Oklahoma. The white-tailed deer population and harvest (Figure 2) have increased significantly throughout the State and from 1995 to 2004 increased from an estimated 350,000 to 500,000 with harvest increasing from 66,000 to 100,000 (M. Shaw, ODWC, pers. comm. 2006). Deer numbers are managed by ODWC, primarily through regulated hunting seasons. However, deer numbers in developed areas where sports harvest is greatly restricted have risen significantly; this is mostly as a result of lower mortality rates in urban compared to rural areas due to a lack of hunting and predators.

White-tailed deer are primarily herbivorous. They graze on plants or parts of plants that are high in protein such as grass shoots, flowers, leaves, and mast. They can be found in a wide variety of areas where food, cover, and fresh water are found. As a result of their use of a wide variety of habitats, many suburban areas in the United Sates are virtual deer paradises consisting of small tracts of forested areas with nearby feeding and watering sites such as golf courses, parks, airports, and recreational fields with ponds and lakes.

The breeding season (the rut) in white-tailed deer typically begins in mid-October, peaks in late November, and ends by the beginning of January. Following a 6 ½ month gestation, typically twins are born (1-3) from May sometimes lasting to September (60% are born in June). Fawns are weaned in 4 months. With good health and habitat condition, white-tailed deer are prolific breeders. In a study conducted of 600 does in Nebraska, the Nebraska Game and Parks Commission (NGPC 2006) found that 60% of the fawns (½ year old) and almost all of the older does bred. Fawn does that bred had single fawns 90% of the time and the other 10% had twins. The older does had 67% twins, 21% single fawns, and 12% triplets. The fawn:doe ratio during the study was 140 fawns:100 does (NGPC 2006). Depending on the buck:doe ratio, the population could almost double yearly, barring mortality. In another study conducted in Michigan (McCullough 1979), 6 deer (2 bucks and 4 does) increased to more than 160 deer in a 6 year period which is almost 100% increase annually.

2.2.2 Effects on Nontarget Species, Including Plants and T&E Species

There are concerns among members of the public and wildlife professionals, including WS, that there is the potential for DDM methods used in the proposed action or any of the alternatives to inadvertently capture or remove nontarget animals or potentially cause adverse impacts to nontarget species populations, particularly T&E species. DDM methods do have the potential to take nontarget species, but WS implements measures to reduce those possibilities. To reduce the risks of adverse affects to nontarget species, WS Specialists select DDM methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of negatively effecting nontarget species. WS has not taken any nontarget species in DDM activities. The most likely nontarget species would be of similar weight and size to deer such as feral swine (*Sus scrofa*) caught with DDM methods that can be left unattended such as the large box cage traps for deer and use a lure that would be attractive to them.

On the other hand, DDM could benefit some species, especially in areas where deer are overabundant. As discussed in Section 1.2.3, deer can have a direct and indirect effect on the plants and animals in a given area. Therefore, some nontarget species may actually benefit from DDM, especially in areas that have been overbrowsed. However, even though some species could benefit from DDM, they would likely only truly benefit from DDM directed to protect them from deer in a given area.

T&E Species Impacts. Special efforts are made to avoid jeopardizing T&E Species through biological evaluations of the potential effects of WDM activities and the establishment of special restrictions or mitigation measures to minimize or negate those impacts. WS has consulted with the USFWS under Section 7 of the ESA concerning potential impacts of WDM control methods on T&E species and obtained

a Biological Opinion on potential impacts to T&E species (USDA 1997, Appendix F). In 1999, Oklahoma WS entered into an informal consultation with the USFWS to address T&E species in Oklahoma (Table 1), particularly those not covered in the Biological Opinion to assure that potential effects on T&E species have been adequately addressed and that any potential impacts could be avoided with the appropriate mitigation measures in place. DDM will have no effect on species listed since these consultations.

Table 1. Oklahoma Federally and State listed threatened and endangered species.

SPECIES	SCIENTIFIC NAME	Status	Okla. Locale	Habitat	Impacts	
		Federal (F)/State (S)			DDM methods	Deer Removal
MAMMALS						
Bat, gray	*Myotis grisescens*	FE/SE	NE	CF	0	0
Bat, Indiana	*Myotis sodalis*	FE/SE	East	CF	0	0
Bat, Ozark big-eared	*Corynorhinus townsendii ingens*	FE/SE	NE	CF	0	0
BIRDS						
Crane, whooping	*Grus americana*	FEH/SE	All	GW	0	0
Curlew, Eskimo	*Numenius borealis*	FE	All	GW	0	0
Eagle, bald	*Haliaeetus leucocephalus*	FT/ST	All	GL	0	0
Plover, piping	*Charadrius melodus*	FT/ST	All	LW	0	0
Prairie-chicken, lesser	*Tympanuchus pallidicinctus*	FC	SW	G	0	0
Tern, Interior least	*Sterna antillarum*	FE/SE	All	LW	0	0
Vireo, black-capped	*Vireo atricapillus*	FE/SE	Centr	FG	0	+
Woodpecker, red-cockaded	*Picoides borealis*	FE/SE	SE	F	0	0
FISHES						
Cavefish, Ozark	*Amblyopsis rosae*	FT/ET	NE	C	0	0
Darter, Arkansas	*Etheostoma cragini*	FC	North	LW	0	0
Darter, blackside	*Percina maculata*	ST	East	LW	0	0
Darter, longnose	*Percina nasuta*	SE	East	LW	0	0
Darter, leopard	*Percina pantherina*	FTH/ST	SE	W	0	0
Madtom, Neosho	*Noturus placidus*	FT/ST	NE	W	0	0
Shiner, Arkansas River	*Notropis girardi*	FTH/ST	West	LW	0	0
INVERTEBRATES						
Beetle, American burying	*Nicrophorus americanus*	FE/SE	East	FG	0	0
Crayfish, cave	*Cambarus tartarus*	SE	NE	C	0	0
Mucket, Neosho	*Lampsilis rafinesqueana*	FC/SE	NE	LW	0	0
Mussel, scaleshell	*Leptodea leptodon*	FE/SE	SE	W	0	0
Mussel, winged mapleleaf	*Quadrula fragosa*	FE	SE	L	0	0
Pocketbook, Ouachita rock	*Arkansia wheeleri*	FE/SE	SE	LW	0	0
PLANTS						
Orchid, Eastern prairie fringed	*Platanthera leucophaea*	FT	NE	W	0	0
Orchid, Western prairie fringed	*Platanthera praeclara*	FT	NE	W	0	0

STATUS
E *- Endangered*
T *- Threatened*
C *- Candidate*
H *– Design. Crit. Hab.*
******* *- Believed extirpated*

HABITAT
C *- Caves*
F *- Forests/riparian borders*
G *- Grassland/range/meadow*
L *- Lakes, Rivers*
W *- Wetland/marsh/creek*

DDM methods/Deer Removal Impacts
(-) *- Negative*
0 *- none*
(+) *- Positive*

The only species that DDM has the potential to affect would be the black-capped vireo from central Oklahoma, but this would potentially be beneficial for the species. The black-capped vireo resides in low, brushy dry country. It feeds and nests in dwarf oaks, dogwood, and other brushy thickets where deer can be abundant. Overabundant deer could reduce the suitability of the limited habitat available for this species. However, WS is not likely to produce beneficial effects for the vireo unless an effort was intentionally directed at restoring or enhancing areas where it is found, especially within a fenced (deer–proof) area where deer removal were more permanent. WS is currently not conducting any such activity and, therefore, has no effect on this species.

2.2.3 Impacts on Public Safety, Pets, and the Environment

A common concern is whether the proposed action or any of the alternatives pose an increased threat to public and pet health and safety and the environment from the use of DDM methods. In particular, there is concern that the methods of deer removal (i.e., cage-trapping, sharpshooting, immobilizing) may be hazardous to people and pets. These methods and others were included in a formal risk assessment (USDA 1997, Appendix P) which concluded low risks to humans. The primary method used by WS to remove deer has been sharpshooting with firearms. Firearm use is very sensitive and a public concern because of safety issues relating to the public and firearms misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties "will be provided safety and handling training as prescribed in the WS Firearms Safety Manual….and continuing education training on firearms safety and handling will be taken biennially by all employees who use firearms." (WS Directive 2.615). WS employees who use firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

On the other hand, public health and safety may be jeopardized by not having a full array of DDM methods for responding to complaints, especially those involving threats to human health and safety. High deer populations can pose a threat to human health and safety through the potential for deer-vehicle collisions, deer-aircraft collisions, and the spread of disease. WS often uses several DDM methods to take deer, depending on the specifics of the situation. DDM methods that may pose a slight public safety risk may be used effectively to eliminate a recognized public safety risk.

Additionally, it has been found that without the use of WS people will often resort to the unwise or illegal use of methods to resolve deer problems. WS operates to assist individuals with damage from deer where a need exists. In the absence of a program, or where restrictions prohibit the delivery of an effective program, it is most likely that DDM would be conducted by other entities such as private individuals. Private DDM activities are less likely to be as selective for target species, and less likely to be accountable. Additionally, private activities may include the use of unwise or illegal methods to control wildlife. For example, in Kentucky a corporation was fined for illegally using carbofuran to destroy unwanted wildlife including coyotes and raptors at a private hunting club (Porter 2004). Similarly, on a Georgia quail plantation, predatory birds were being killed by eggs that had been injected with carbofuran (the Federal Wildlife Officer 2000); in Oklahoma, Federal agents charged 31 individuals with illegally trapping and killing hawks and owls to protect fighting chickens (USFWS 2003). The Texas Department of Agriculture has a website and brochure devoted solely to preventing pesticide misuse in controlling agricultural pests (Texas Department of Agriculture 2006). Similarly, the Britain Department for Environment, Food and Rural Affairs has a "Campaign against Illegally Poisoning of Animals" (Health and Safety Executive 2006). Therefore, WS believes that it is in the best interest of the public, pets, and the environment that a professional DDM program be available because private resource owners could elect to conduct their own control rather than use government services and simply out of frustration resort to inadvisable techniques.

2.2.4 Humaneness of DDM Methods

The issue of humaneness, as it relates to the killing or capturing of wildlife is an important but complex concept. Kellert and Berry (1980) in a survey of American attitudes toward animals related that 58% of their respondents, *"* . . . *care more about the suffering of individual animals . . . than they do about species population levels."* Schmidt (1989) indicated that vertebrate pest control 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 has been described as a *"* . . . *highly unpleasant emotional response usually associated with pain and distress*." However, suffering *"* . . . *can occur without pain* . . . ," and *"* . . . *pain can occur without suffering* . . . *"* (American Veterinary Medical Association (AVMA) 1986). Because suffering carries with it the implication of a time frame, a case could be made for *"* . . . *little or no suffering where death comes immediately* . . . *"* (California Department of Fish and Game (CDFG) 1991), such as the WS technique of shooting.

Defining pain as a component of humaneness may be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying

the causes that elicit pain responses in humans would *"... probably be causes for pain in other animals ..."* (AVMA 1986). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991). Some WS damage management methods such as traps and snares, may thus cause varying degrees of pain in different animal species for varying time frames. At what point pain diminishes or stops under these types of restraint has not been measured by the scientific community.

Pain and suffering as it relates to a review of WS damage management methods to capture animals, has both a professional and lay point of arbitration. Wildlife managers and the public would both be better served to recognize the complexity of defining suffering, since *"... neither medical nor veterinary curricula explicitly address suffering or its relief"* (CDFG 1991).

Research suggests that with some methods, such as restraint in traps, changes in the blood chemistry of trapped animals indicate "*stress*" (USDA 1997: 3-81). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

Thus, the decision-making process involves tradeoffs between the above aspects of pain and humaneness. An objective analysis of this issue must consider not only the welfare of wild animals but also the welfare of humans if damage management methods were not used. Therefore, humaneness appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of suffering with the constraints imposed by current technology and funding.

WS has improved the selectivity and humaneness of management devices through research and is striving to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in those situations when nonlethal damage management methods are not practical or effective.

Oklahoma WS personnel are experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology and funding. Mitigation and SOPs used to maximize humaneness are listed in this EA. As appropriate, WS euthanizes live animals by methods recommended by the AVMA (Beaver et al. 2001) or the recommendations of a veterinarian, even though the AVMA euthanasia methods were developed principally for companion animals and slaughter of food animals, and not for free-ranging wildlife.

2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.3.1 WS's Impact on Biodiversity

Oklahoma WS DDM is not conducted to eradicate deer. WS operates according to Federal and State laws and regulations enacted to ensure species viability. Any reduction of a local population or group is frequently temporary because immigration from adjacent areas or reproduction replaces the animals removed. The impacts of the current WS program on biodiversity are minor and not significant nationwide, statewide, or region wide (USDA 1997). WS operates on a very small percentage of the land area in Oklahoma, and the WS take of deer analyzed in this EA is a small proportion of the total population and insignificant to the viability and health of the population. Even if take were increased several hundred-fold, it would still be a small percentage of the total population.

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

Some individuals might question whether preparing an EA for an area as large as the state of Oklahoma would meet the NEPA requirements for site specificity. If in fact a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared. In terms of considering cumulative impacts, one EA analyzing impacts for the entire state may provide a better analysis than multiple EA's covering smaller zones. In addition, Oklahoma WS only conducts DDM in a very small area of the State where damage is occurring or likely to occur.

2.3.3 Concerns that the Proposed Action May Be "Highly Controversial" and Its Effects May Be "Highly Uncertain," Both of Which Would Require That an EIS Be Prepared

The failure of any particular special interest group to agree with every act of a Federal agency does not create a controversy, and NEPA does not require the courts to resolve disagreements among various scientists as to the methodology used by an agency to carry out its mission (*Marsh vs. Oregon Natural Resource Council*, 490 U.S. 360, 378 (1989)[3]). As was noted in the 1996 FONSI: "The effects on the quality of the human environment are not highly controversial. Although there is some opposition to DDM, this action is not highly controversial in terms of size, nature, or effect." If in fact a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared.

2.3.4 Impacts of Deer Removal on the Public's Aesthetic Enjoyment

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 DDM 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. The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public is no exception and today a large percentage of households have pets. However, some people may consider individual wild animals and birds as "pets" or exhibit affection toward these animals, especially people who enjoy coming into contact with wildlife. Therefore, the public reaction is variable and mixed to DDM because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

WS DDM activities occur on a relatively limited percentage of the total land area in Oklahoma and only at a landowner's request. Most of the lands where DDM is conducted are inaccessible to the public, and therefore, the deer on these lands would not provide aesthetic benefits to the public. Additionally, in comparison to the total population, the portion of the deer population removed through WS DDM activities is very low (see Chapter 4), thus viewing opportunities will continue to exist. In localized areas where WS removes some portion of the deer population, dispersal of deer from adjacent areas typically contributes to repopulation of the area, depending on the level of deer removal and deer population levels in nearby areas. Deer are relatively abundant in Oklahoma, but may not be commonly observed because they are often secretive and nocturnal. The likelihood of getting to see a deer in some localized areas where DDM is conducted could be temporarily reduced, but, because deer are abundant, this temporary local reduction in public viewing opportunity would not likely be noticeable in most cases. Impacts of WS DDM on the overall deer population would be relatively low under any of the alternatives being considered in this EA, and opportunities to view or see evidence (tracks, droppings, and scrapes) of deer would still be available over the vast majority of Oklahoma since WS only conducts DDM on a very small percentage of lands.

On the other hand, overabundant deer, as discussed in Section 1.2.3, can reduce or extirpate other wildlife and plant species' populations in a given area and damage the vegetation and landscaping, thus affecting aesthetics for other people negatively. Thus, in these situations, DDM could have a positive impact on aesthetics. However, as discussed, WS DDM is generally conducted in localized areas, and thus aesthetics of viewing other wildlife and plants would be impacted minimally under the proposed action.

Therefore, aesthetics under the proposed action could be considered from two sides – the aesthetics of a reduced deer population as a result of DDM and effects to habitat and landscaping as a result of too many deer not being controlled. This issue has been discussed in other WS EAs and always found to have lower or equal impacts under the proposed action compared to the impacts under the other Alternatives. However, although deer damage and resulting management is increasing in Oklahoma with the increasing deer herd (~0.5 million), DDM involving lethal removal of deer will still likely be a very minor percentage of the population (<1%), and therefore will not have an effect on aesthetics one way or the other. Another

[3] Court cases not given in Literature Cited section.

point is that under the proposed action, deer are most likely going to be reduced in very local areas on private property where the public has little access, thus having little impact on any segment of the public. The habitat in that local area could flourish as a result of deer removal, but it, again, would be done on private property where the vast majority of the public would not notice the difference. The most likely scenario where the public could see a difference would be that if an overabundant deer population were culled to protect habitat over a fairly large area of public accessible land, species of plants and birds that had been affected by the overabundance could reappear after a few years providing mostly a positive benefit to aesthetics (depending on what a person wanted to see).

2.3.5 Concerns that Killing Wildlife Represents "Irreparable Harm"

Public comments have raised the concern that the killing of any wildlife represents irreparable harm. Although an individual or several deer in a specific area may be killed by WS DDM activities, this does not in any way irreparably harm the continued existence of this species. Wildlife populations experience mortality from a variety of causes, including human harvest and depredation control, and have evolved reproductive capabilities to withstand considerable mortality by replacing individuals that are lost. Oklahoma's historic and current populations of big game animals, game birds, furbearers and unprotected predators, which annually sustain harvests of thousands of animals as part of the existing human environment, are obvious testimony to the fact that the killing of wildlife does not cause irreparable harm. Populations of some of these species are in fact much higher today than they were several decades ago such as the current deer population, in spite of liberal hunting seasons and the killing of hundreds or thousands of these animals annually. The legislated mission of ODWC is to preserve, protect, and perpetuate all the wildlife of the State. Therefore, ODWC would be expected to regulate killing of protected wildlife species in the State to avoid irreparable harm. Our analysis herein shows that the deer WS takes in DDM actions are expected to sustain viable populations. Thus, losses due to human-caused mortality are not "irreparable."

2.3.6 Concerns that WS Reduces Sport Hunting Opportunities

Some people may be concerned that WS DDM involving deer removal would impact regulated deer hunting by significantly reducing local deer populations. Shooting of deer by WS employees under the Proposed Action Alternative would only occur after a permit had been issued by ODWC to remove deer that are causing damage or in those situations where deer are a potential human health and safety threat. This activity would result in reduced deer densities on project areas and may reduce densities in some project area deer management zones, hence slightly reducing the number of deer that may otherwise be available to hunters during hunting seasons. The impact of this, however, is expected to be minimal. First, the deer population in Oklahoma has increased substantially over the last century and ample opportunity exists for sport hunters to pursue deer (Figure 2) and WS deer take is a very minor percentage of the deer population. Secondly, hunters are typically not allowed access into areas where WS takes deer such as urban neighborhoods and airport operating areas due to safety concerns. Hunting programs are recommended as a potential DDM method to resolve deer damage problems in applicable areas (Section 3.2.3).

CHAPTER 3: ALTERNATIVES

3.1 INTRODUCTION

USDA (1997) developed 13 possible alternatives. Four of the alternatives were determined to be relevant by WS and cooperating agencies for conducting DDM activities in Oklahoma. This chapter consists of a description of DDM methods, a description of the four alternatives which will be analyzed in detail in Chapter 4 including the Proposed Action (Alternative 1), Alternatives considered but not in detail, and SOPs to minimize or nullify potential hazards to target and nontarget species, people, and pets associated with DDM methods.

The four alternatives analyzed in detail are:

- Alternative 1 – Integrated DDM Program (the Proposed Action/No Action)
- Alternative 2 – Nonlethal DDM Only
- Alternative 3 – Technical Assistance with DDM Only
- Alternative 4 – No Federal DDM Program

3.2 DDM Strategies and Methods

DDM can be implemented in different ways for each situation and would vary under the different alternatives. The two primary strategies are giving technical assistance or providing an operational DDM program. Under Alternative 4, WS would provide neither, but persons could likely get assistance from the State.

3.2.1 Technical Assistance Recommendations

"Technical assistance" is providing information, demonstrations, and advice on available and appropriate DDM methods to alleviate damage or a problem with deer. Technical assistance includes demonstrations on the proper use of management devices (pyrotechnics, exclusion devices, etc.), wildlife habits and biology, habitat management, exclusion, and animal behavior modification. Technical assistance may be provided following a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application. Technical assistance may require substantial effort by WS personnel in the decision making process, but the actual work is the responsibility of the requester.

Education is an important element of DDM activities because it is important to find a "balance" or co-existence 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 sustaining damage, lectures and demonstrations are provided to farmers, homeowners, and other interested groups. Additionally, technical papers are presented at professional meetings and conferences so that wildlife professionals and the public are updated on recent developments in damage management technology, laws and regulations, and agency policies.

3.2.2 Direct Operational Damage Management Assistance

This is the implementation or supervision of damage management activities by WS personnel. Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone, and when Agreements for Control or other comparable instruments provide for WS direct damage management. The initial investigation defines the nature, history, extent of the problem, species responsible for the damage, and methods that would be available to resolve the problem. Professional skills of WS personnel are often required to effectively resolve problems, if the problem is complex.

3.2.3 DDM Methods

DDM can be conducted with a variety of methods to prevent or correct a damage problem. A basic knowledge of these methods helps understand the methods that could be used under the different alternatives that will be analyzed. The following strategies and methodologies described include those that could be used or recommended under Alternative 1 and those that could potentially be used under Alternatives 2 and 3 depending on whether or not they are lethal or Nonlethal. Alternative 4 would terminate both WS technical assistance and operational DDM by WS, thus WS would not conduct DDM or use the associated methods.

Preventive Damage Management is applying DDM strategies before damage occurs, based on historical problems and data. Most nonlethal methodologies, whether applied by WS or resource owners, are employed to prevent damage from occurring. For example, fencing is often used to keep wildlife such as deer out of crop fields or off runways and prevent damage from occurring. Unfortunately, many nonlethal DDM techniques are only effective for a short time before wildlife habituate to them (Pfeifer and Goos 1982, Conover 1982) and are generally only 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). When requested, WS personnel provide information and conduct demonstrations, or take action to prevent additional losses from recurring. The rationale for conducting preventive damage management to reduce damage differs little in principle from holding controlled hunts for deer in areas where agricultural damage has been a historical problem. By reducing the number of deer near threatened agricultural fields, or adjacent to a runway, the likelihood of damage can be reduced before it occurs.

Corrective Damage Management is applying DDM to stop or reduce current losses. As requested and appropriate, WS personnel in Oklahoma would provide information, conduct demonstrations, or take action to prevent additional losses. For example, in areas where verified and documented damage to residential landscaping and other property has been occurring, WS may provide information about fencing, chemical repellents, or non-palatable landscaping, or conduct operational damage management such as sharpshooting to stop the losses. The U.S. General Accounting Office (1990) concluded that, according to available research, localized lethal damage management is effective in reducing damage.

Methods Available for Use

WS personnel use a wide range of methods in DDM and strategies are based on applied IWDM principles. WS employs or recommends three general strategies to reduce wildlife damage: resource management, physical exclusion, or wildlife management. Each of these approaches represents a general strategy or recommendation for addressing wildlife damage situations. Within each approach, specific methods or tactics are available for DDM, including many that are specific to individual species. Technical assistance may include providing advice, information, recommendations, and materials to others for use in resolving wildlife-caused damage. Assistance is most often provided for use of DDM methods associated with resource management and physical exclusion DDM methods, and potentially a few wildlife management techniques such as harassment with pyrotechnics. This may require on-site instruction on the use of some DDM techniques (for example harassment techniques). WS operational damage management efforts can include any of the DDM methods, but primarily involve site-specific "hands-on" wildlife management techniques that are difficult for much of the public to implement or involve safety concerns when being implemented by the public.

WS in Oklahoma uses or recommends a wide variety of methods for DDM. Some techniques suggested for use by resource owners, by other entities or individuals, to stop deer damage may not be considered by WS if they are biologically unsound, legally questionable, or ineffective. DDM methods fall under different categories depending on the method. Following are the categories that DDM methods fall under.

- Resource Management
    - Habitat Management
    - Modification of Human Behavior

- . Physical Exclusion
    - Fencing
    - Sheathing
- Wildlife Management
    - Frightening Devices
    - Chemical Repellents
    - Capture Methods (lethal and nonlethal)
    - Immobilization/Euthanasia
    - Chemical Medications/Immunocontraceptives

Resource Management

Resource management includes a variety of practices that may be used by agriculture producers and other resource owners to reduce their exposure to potential deer 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 WS, 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). WS could assist producers in implementing changes to reduce problems. WS has the potential for using the following techniques in DDM, but are more likely to recommend their use.

Habitat Management. Modifying or eliminating habitat utilized by deer may change deer behavior and reduce deer damage. This could include reducing vegetative cover, forage crops, or using less palatable landscape plants. Localized habitat management is often an integral part of DDM. The type, quality, and quantity of habitat are directly related to the wildlife produced or attracted to an area. Habitat can be managed not to attract or produce deer. Habitat management is typically aimed at eliminating cover used by deer at specific sites. Limitations of habitat management as a method of reducing deer damage are determined by the nature of the damage, economic feasibility, and other factors. Legal constraints may also exist which preclude altering particular habitats (e.g., a T&E species may be present). Most habitat management recommended by WS in DDM is aimed at reducing wildlife aircraft strike hazards at airports (i.e., managing brush and grass cover at airports to reduce cover). Also, opening the area allows for better monitoring and increases the value of shooting. WS provides recommendations at airports to modify the habitat, but generally does not engage in habitat management directly.

Modification of Human Behavior. WS often tries to alter human behavior to resolve potential conflicts between humans and wildlife. For example, WS may talk with residents of an area to eliminate the feeding of deer that occurs in parks, recreational sites, or residential areas to reduce deer attracted to the area and, thereby, their damage. Many wildlife species, including deer, adapt well to human settlements and activities, but their proximity to humans may result in damage to landscaping and other resources. However, many people who are not directly affected by problems caused by wildlife enjoy wild animals and engage in activities that encourage their presence.

Additionally, deer crossing signs that alert drivers to watch for deer, have not been effective at reducing collisions (Reed 1985). It has been suggested that signs equipped with infrared sensors and light warning signals when deer are in the area would be more effective (Danielson and Hubbard 1998).

Physical Exclusion

Physical exclusion methods restrict the access of wildlife to resources. These methods can provide effective prevention of wildlife damage in many situations. These are often recommended for use rather than used by WS.

Fencing. Fences are widely used to prevent damage from deer. Exclusionary fences constructed of woven wire or multiple strands of electrified wire can be effective in keeping deer from some areas such as an airport or crop field. The size of the wire grid and height of the fence (usually 8 feet) must be able to keep the deer out. There are several types of fences that can inhibit deer access including: temporary electric,

high tensile electric, woven wire, chain-link, and solid wall fencing. Temporary electric fences are simple, inexpensive fences used in protecting gardens and agricultural crops during the growing season. Permanent high-tensile electric fences provide year-round protection from deer and are used around high-value specialty crops. Permanent woven-wire fences provide the ultimate deer barrier. They require little maintenance but are more expensive to build than the previous designs. Deer pressure, crop value, field size, and cost-benefit analysis are often the best determinants of fence design (Craven and Hygnstrom 1994). In addition, an underground apron (i.e., 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 animals from digging crawl holes under the fence that deer can use. 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, deer in the enclosed area have to be removed to make it useful. Some fences inadvertently trap, catch or affect the movement of nontarget wildlife and may not be practical or legal in some areas (e.g. restricting access to public land).

Fences are the most effective method of reducing deer-vehicle collisions (Putnam 1997, Romin and Bisonnette 1996). Highway fences often have accessible underpasses and overpasses where deer are funneled to allow access to cross the road, but not be struck.

Sheathing. Sheathing consists of using hardware cloth, tubing, solid metal flashing, or other materials to protect trees from deer. These are commonly used to protect new seedlings that have been planted from deer. Seedlings often are desirable browse for deer, depending on the tree/bush species.

Wildlife Management

Reducing wildlife damage through wildlife management is achieved through the use of many techniques. The objective of this approach is to alter the behavior of or repel the target species with frightening devices, dogs, or chemical repellents, remove specific individuals from the population with shooting or trapping, or reduce or suppress local population densities with shooting, trapping, or immunocontraceptives.

Disposition of Deer. DDM methods can result in different outcomes, primarily the relocation of deer to new areas or lethal removal of the deer. The disposition of the deer by WS would vary under the different alternatives analyzed in Chapter 4.

Relocation is the capturing of an animal with one of the nonlethal take methods and translocating the animal to a new site, far enough away so that the animal will not return. WS typically does not recommend relocation of common wildlife for reasons discussed further in Section 3.4.4.1. Relocation is an important method for wildlife management, especially for the propagation of T&E or sensitive species. ODWC would establish policies and make most decisions relating to wildlife relocation taking into account population goals for the different species. Since white-tailed deer have become so abundant, WS would not likely relocate a deer unless it was in the immediate area of capture (e.g., caught inside a breeched deer-proof fence).

Euthanasia is administering a relatively painless death to captured deer that are caught in a control operation. Captured deer, as practical for the situation, would be euthanized by methods recommended by the AVMA (Beaver et al. 2001) or a local veterinarian. Standard euthanasia methods include a gunshot to the brain or the use of euthanasia drugs. The AVMA (Beaver et al. 2001) recognize that field conditions do not always warrant use of these methods.

Frightening Devices. 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. Frightening devices are used to repel deer from areas where they are a damage risk (i.e., airport, crop fields). 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 are operated by private individuals or WS Specialists working in the field. However, several of these devices, such as scarecrows and propane

exploders, are automated. Motion-activated devices such as propane cannons that detonate only when deer approach the area to be protected, have been shown to be effective up to 6 weeks whereas propane cannons that detonated systematically at 8-10 minute intervals were only effective for two days (Belant et al. 1996, 1998).

A number of sophisticated techniques have been developed to scare or harass wildlife from an area. The use of noise-making devices (electronic distress sounds, alarm calls, propane cannons, and pyrotechnics) is the most popular. Other methods include harassment with visual stimuli (e.g. flashing or bright lights, scarecrows, human effigies, balloons, mylar tape, wind socks), vehicles, or people. Some methods such as the Electronic Guard use a combination of stimuli (siren and strobe light). As with other DDM efforts, these techniques tend to be more effective when used collectively in a varied regime rather than individually. Most frightening devices, though, have been found to be ineffective at keeping deer from preferred feeding areas (Belant et al. 1996, 1998). The continued success of these methods frequently requires reinforcement by limited shooting (see Shooting).

Dogs can be used as a frightening method in DDM to keep deer from fenced areas. In areas that are not fenced, a dog can be tethered with a long cable near the resource to be protected. For example, home owners can use dogs, usually their pets, to keep deer from gardens and landscaping by enclosing them in the fenced area or tethering the dog into the damage prone area. Dogs will often keep deer from feeding in an area or can alert the resource owner of a deer's presence.

Chemical Repellents. Chemical repellents are nonlethal chemical formulations used to discourage or disrupt particular wildlife behaviors. Chemical repellents are categorized by their delivery mechanism: olfactory, taste, and tactile. Olfactory repellents must be inhaled to be effective. These are normally gases, or volatile liquids and granules, and require application to areas or surfaces that need protecting. Taste repellents are compounds (i.e., liquids, dusts, granules) that are normally applied to trees, shrubs, and other materials that are likely to be eaten or gnawed by the target species. Tactile repellents are normally thick, liquid-based substances which are applied to areas or surfaces to discourage travel of wildlife by causing irritation such as to the feet. Most repellents are ineffective or are short-lived in reducing or eliminating damage caused by wildlife. Several repellents are available for deer and are unrestricted chemicals such as ammonium soaps (i.e., Hinder®), putrescent egg solids (i.e., Deer-Away®), thiram (i.e., Shotgun Deer and Rabbit Repellent®), and capsaicin from hot pepper (i.e., Hot Sauce®, Miller®) that are sold over-the-counter to the general public to repel deer from areas where they are not wanted (i.e., flower beds, gardens). Oklahoma WS has not used any repellents in DDM, but often recommends them. Additionally, chemical repellents for the most part are nontoxic to the intended target species, nontargets, and the environment.

Capture or Take Methods. Methods are available to capture or take damaging deer. The appropriateness and efficacy of any technique will depend on a variety of factors. Most live capture methods can be used nonlethally (relocate/release) or lethally (euthanize following capture). Under Alternatives 2 and 3, these could be used depending on the outcome of the deer.

Cage Traps come in a variety of styles which target different species. The most commonly known cage traps used in the current WS program are box traps. Large box traps have been used for deer, but rarely. Many other methods are available that are easier and less cumbersome to use. Oklahoma WS will not likely use these.

Drop Nets are nets rigged to drop over deer that have entered an area under the net that is usually baited. These are good for small operations to target a few individual deer and research.

Rocket Nets are normally used for larger birds such as waterfowl, but can be used to capture deer, especially for research or disease surveillance activities. The rockets (a heavy steel tube attached to a large net) are mortar projectiles that propel a net up and over deer which have been baited to a particular site. The bait site can be monitored for use by nontarget species and the operator is present when the rockets are fired, thus minimizing nontarget species take.

Net Guns have occasionally been used by WS, primarily for research purposes, to catch target deer from aircraft or on the ground. These 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 for disease or equipped with radio telemetry devices.

Drive Traps are pens that deer are herded into a corral to be captured. A drive-trap consists typically of wire panels that are erected into large area, depending on the number of deer to be captured. Target deer are herded to the pen, usually guided by wings made of fencing that funnel towards the pen, at each site with people on foot, riding ATVs and horses, or in helicopters or other vehicles, depending on the terrain. These are used mostly for trap and transport operations and research but can be used lethally. These have limited use in DDM as the time and expense involved in setting these up outweigh the benefits.

Shooting or sharp-shooting would be conducted by WS personnel with center-fire rifles, during daylight or at night using spotlights or night-vision equipment. Rifles are often used at airports or in residential areas to cull deer herds to a manageable level or remove them from a particular area (fenced air operating area). Rifles can be equipped with noise suppressors in residential areas or at airports to avoid disturbance to residents or airport users and to facilitate success by minimizing the tendency of deer to flee from the sound of gunfire. Shots would be taken from elevated positions in tree stands or in the beds of trucks. Elevated positions cause a downward angle of trajectory, so that any bullets that inadvertently miss or pass through targeted deer, will hit into the ground or into earthen embankments to minimize the risk of stray bullets presenting a safety hazard to people, pets, or property. WS personnel would strive for head and neck shots when shooting deer to achieve quick, humane kills. Bait may be used to attract deer to safe sites for shooting and to enhance success and efficiency. The venison from deer killed by WS would be processed and donated for consumption at one or more charitable organizations. WS will be responsible for properly preparing deer and the delivery to a USDA approved meat processor. Only WS personnel that have completed firearms safety training, have demonstrated skill and proficiency with the firearms used for deer removal, and have been approved for sharp-shooting by the State Director in Oklahoma will participate in sharp-shooting deer.

Firearm use is very sensitive and a public concern because of safety issues relating to the public and misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years afterwards (WS Directive 2.615). A WS employee that carries a firearm as an employment condition is required to sign a form certifying that he/she meets the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence. Shooting is very selective for the target species. Shooting is limited to locations where it is legal and safe to discharge firearms. Shooting is rarely used as the sole DDM method in a control operation because opportunities to shoot target animals can be random and unpredictable.

Frightening devices often require lethal reinforcement through shooting for frightening programs to continue to be successful. Animals that associate frightening devices with shooting often do not become as habituated to the frightening devices, though this is most often used for flocking birds rather than deer.

Regulated Sport Hunting can be effective method of reducing local deer populations to a desirable level. State agencies, including ODWC, use sport hunting to manage deer populations. WS may recommend the use of state regulated firearm and archery deer hunting programs to reduce deer damage in local areas. A hunting program can only be recommended at those sites where public safety is not compromised by such an action. For example, sport hunting programs cannot usually be conducted in urban and developed areas.

Chemical Immobilizing Drugs are used to capture animals after an animal succumbs to being given an immobilization drug in a drug delivery system. Under certain circumstances, WS personnel are involved in the capture of animals where the safety of the animal, personnel, or the public are compromised and chemical immobilization provides a good solution to reduce these risks. For example, chemical immobilization has often been used to take deer in residential areas where public safety is at risk. WS employees that use immobilizing drugs are certified for their use and follow the guidelines established in the APHIS-WS Field Operational Manual for the Use of Immobilization and Euthanasia Drugs. Telazol® (tiletamine) and Ketamine/Xylazine are two drugs commonly used by WS to immobilize larger animals. Ketamine, an anesthetic, is often combined with xylazine, a sedative, to make it more effective for use. Telazol® is a much more powerful anesthetic and usually used for larger animals such as deer. The drugs

are usually delivered to the target animal with a dart gun, blow gun, or syringe pole depending on the circumstances. These are typically used in urban, recreational, and residential areas where the safe removal of a problem animal is most easily accomplished with a drug delivery system. If the drugs are delivered via a dart, the dart is retrieved. Immobilization can sometimes be followed by release, relocation, or euthanasia. Immobilizing drugs are monitored closely and stored in locked boxes or cabinets according to APHIS-WS policies, and Department of Justice or Drug Enforcement Administration guidelines. Most drugs fall under restricted-use categories and must be used under the appropriate license from the U.S. Department of Justice, Drug Enforcement Administration. Since the use of immobilizing drugs requires the user to be in close quarters to the target animal, the take of nontargets is nullified.

Chemical Euthanasia. After an animal is captured, it potentially may be euthanized with different methods and sometimes these are chemicals. Euthansia is usually performed with drugs such as Beuthanasia-D® or Fatal-Plus® which contain forms of sodium phenobarbital. Deer euthanized with these drugs are disposed of by incineration, deep burial, or other approved method to avoid secondary hazards. WS employees that use euthanasia drugs are certified for their use and follow the guidelines established in the APHIS-WS Field Operational Manual for the Use of Immobilization and Euthanasia Drugs. Euthanasia drugs are monitored closely and stored in locked boxes or cabinets according to APHIS-WS policies, and Department of Justice or Drug Enforcement Administration guidelines. Most drugs fall under restricted-use categories and must be used under the appropriate license from the U.S. Department of Justice, Drug Enforcement Administration. Since the use of euthanasia drugs requires the user to be with the target animal and inject the drug via syringe directly into a deer, the take of nontargets is nullified. Appropriate disposal nullifies secondary hazards.

Chemical Medication Drugs. APHIS-WS has become much more involved in conducting disease surveillance, treatment, and monitoring throughout the nation. As part of this effort, APHIS-WS nationally has been treating animals that are infected with a disease or other malady, contain or prevent the spread of a disease (e.g. rabies). APHIS-WS is involved in disease surveillance, monitoring, and management programs to assist in minimizing the spread of disease and reduce the potential for humans to be infected. This may require that medication be given to wildlife through injections, or via oral or topical applications. Oral treatments, if not administered directly by a tube, are often disguised in baits acceptable by the target animal. Risk assessments on drugs being used in the field are completed prior to their use. This includes potential side-effects to people, pets, and nontarget and T&E species found in the range of their use. No drugs are currently being used in Oklahoma for deer, but could be should a disease be treatable through this method.

Chemical Immunocontraception. A new method recently developed, but not registered yet for field use is a method of contracepting deer to limit their ability to produce offspring (birth control) in developed areas. Several immunocontraceptives have been tested by the WS National Wildlife Research Center and other researchers for white-tailed deer. The two most promising drugs are GonaCon™ Immunocontraceptive Vaccine and Porcine Zona Pellucida. Both are suited for use in developed urban and suburban areas where hunting cannot be used to keep herds at an ideal level. If chemicals are registered for use in the United States, these would be used according to label requirements which would consider risks to people, pets, and nontarget wildlife including T&E species. Since these vaccines are administered directly to target animals, nontarget species will not be affected. Additionally, since the drug is a vaccine, secondary hazards are nullified as the vaccine. Once injected, the vaccine itself disappears quickly in the body and is assimilated by the deer. The vaccine, basically, is rapidly transformed into antibodies in the subject which are only specific to that individual animal and cannot be transferred to other animal species by consumption. As a result, consumption and blood to blood contact with treated deer is not expected to have any impact on nontarget species including humans. If a deer were killed immediately after injection before the vaccine had time to work and the meat were consumed, it still would not cause problems for an animal or person consuming the meat. These have the potential to be used in developed areas (urban, suburban, industrial areas where hunting is not allowed) where deer are wanted to be maintained at a desirable level. To reach the desirable level, culling with sharpshooting or other removal method is often necessary prior to the administration of the drug to maintain that level.

Use and effectiveness of reproductive control as a wildlife population management tool is limited by population dynamic characteristics (longevity, age at onset of reproduction, population size and biological/cultural carrying capacity, etc.), habitat and environmental factors (isolation of target population, cover types and access to target individuals, etc.), socioeconomic and other factors. 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 1988). However, a contained deer population culled to a given level and then given contraception would slow the rate of population growth and postpone the need for additional DDM.

3.3 ALTERNATIVES ANALYZED IN DETAIL

3.3.1 Alternative 1. Integrated DDM Program (the Proposed Action/No Action)

This is the Proposed Action in this EA. This is also the "No Action" Alternative as defined by CEQ for ongoing programs. This alternative would allow the current program to continue as conducted. Under this alternative, WS would conduct an Integrated DDM program to alleviate white-tailed deer damage to agriculture, property, natural resources, and human health and safety. An IWDM approach would be implemented on all private and public lands where a need exists (a request is received) in Oklahoma, an *Agreement for Control* or other comparable document has been completed, and funding is available. After consulting with ODWC, an IWDM strategy would be recommended and used, encompassing the use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, other species, and the environment.

Most operational DDM assistance thus far provided by WS has been at airports and airbases in Oklahoma where deer have been struck by aircraft or are a risk to aircraft and their passengers. WS has also provided technical assistance to agricultural producers and property owners. All take of deer has been under ODWC permits. Under this Alternative, WS would continue to provide these services and implement IWDM as described below.

3.3.1.2 IWDM. WS has been conducting WDM in the United States for more than 85 years. WS has modified WDM activities to reflect societal values and minimize impacts to people, wildlife, and the environment. The efforts have involved research and development of new field methods and the implementation of effective strategies to resolve wildlife damage. 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 control of damage caused by wildlife based on local problem analyses and the informed judgment of trained personnel; this is the application of DDM by WS Specialists (WS Directive 2.105) to reduce damage through the WS Decision Model (Slate et. al. 1992) described in USDA (1997) and Section 1.7.4.

The philosophy behind IWDM is to implement effective management techniques in a cost effective manner while minimizing potentially harmful effects on humans, target and nontarget species, and the environment. IWDM draws from the largest possible array of options to create a combination of techniques appropriate for the specific circumstances. IWDM may incorporate habitat modification, animal behavior (i.e., scaring), local population reduction, or any combination of these, depending on the characteristics of the specific damage problems. USDA (1997) describes the procedures used by WS personnel to determine management strategies or methods applied to specific damage problems. As depicted in the Decision Model (Figure 1), consideration is given to the following factors before selecting or recommending control methods and techniques:

- Species responsible for damage
- Magnitude, geographic extent, frequency, and duration of the problem
- Status of target and nontarget species, including T&E species
- Local environmental conditions
- Potential biological, physical, economic, and social impacts
- Potential legal restrictions
- Costs of control options
- Prevention of future damage (lethal and nonlethal techniques)

WS personnel provide information, demonstrations, and advice on available DDM techniques. Technical assistance includes demonstrations on the proper use of some management devices and information on wildlife habits, habitat management, and animal behavior modification. Technical assistance is generally provided following an on-site visit or verbal consultation with the requestor. Several management

strategies are often described to the requestor for short and long-term solutions to damage problems. These strategies are based on the level of risk, need and practical application. Technical assistance recommendations do not constitute a federal action other than giving people advice on methods that could be used to resolve a problem. Under APHIS NEPA Implementing regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving wildlife damage problems.

Operational damage management assistance is implemented when the problem cannot be resolved through technical assistance. The initial investigation defines the nature and history of the problem, extent of damage, and the species responsible for the damage. Professional skills of WS personnel are often required to resolve problems effectively if the problem is complex. WS considers the biology and behavior of the damaging species and other factors using the WS Decision Model (Slate et al. 1992). The recommended strategy(ies) may include any combination of preventive and corrective actions that could be implemented by the requester, WS, or other agency personnel, as appropriate. These strategies are preventive or corrective in character.

3.3.2 Alternative 2. Nonlethal DDM Only

This alternative would require WS to only use and recommend nonlethal methods to resolve all deer damage problems. Requests for information regarding lethal management approaches would be referred to ODWC. Persons receiving deer damage could still resort to lethal methods or other methods not recommended by WS, use contractual services of private businesses that were available to them, or take no action. Section 3.23 describes a DDM methods available for use by WS under this alternative and all but shooting and euthanasia drugs could be used nonlethally.

3.3.3 Alternative 3. Technical Assistance with DDM Only

This alternative would allow WS to provide technical assistance with DDM techniques, such as frightening devices, shooting, fencing, exclusion, modification of human behavior, habitat modification, cage traps, and chemical repellents available for the public. WS would also loan equipment used for nonlethal control. Technical assistance may assist some resource owners in implementing DDM safely, but lethal DDM methods for the protection of different resources could be applied by persons with little or no training or experience.

3.3.4 Alternative 4. No Deer Damage Management by WS (No Action)

This alternative would eliminate WS involvement in all DDM activities. WS would not provide direct operational or technical assistance and requesters of WS services would have to conduct their own DDM without WS input.

3.4 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

Several alternatives were considered but not analyzed in detail. These were not considered because of problems associated with their implementation as described below.

3.4.1 Compensation for Deer Damage Losses

The compensation alternative would require the establishment of a system to reimburse resource owners for deer losses. Currently, ODWC does not compensate farmers or others for deer losses, but often will issue permits for take. This alternative for all losses associated with deer has been eliminated from further analysis because no federal laws currently exist to authorize such action, though ODWC could implement such an action. Under such an alternative, WS would not provide any direct control to reduce deer damage because losses would be compensated when damage was verified to be caused by deer. Aside from lack of legal authority, analysis of this alternative in USDA (1997) indicated that the concept has many drawbacks including the overwhelming cost of such a program.

3.4.2 Bounties

Bounties are the payment of funds for killing deer in a given area. Bounties have not been supported by Oklahoma State agencies (ODWC and ODAFF) or most wildlife professionals for many years (Latham 1960). WS concurs because bounties are generally not effective in abating damage, especially over a wide area such as Oklahoma, but are good at removing surplus animals. A standard problem with bounties is that the circumstances surrounding the take 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. Finally, WS does not have the authority to establish a bounty program and would rely on the State to do such and ODWC would likely never support such a program for white-tailed deer.

3.4.3 Eradication and Long Term Population Suppression

An eradication and long term population suppression alternative would direct all WS efforts toward total long term elimination of deer in entire cooperating areas or larger defined areas in Oklahoma. The eradication of deer is not a desired goal of state or federal agencies. Some landowners would prefer that deer be eradicated, especially in areas where they have become overabundant and caused damage without intervention from wildlife agencies (International Association of Fish and Wildlife Agencies 2004). However, eradication as a general objective for DDM will not be considered by WS in detail because WS, ODWC, and ODAFF, and most members of the public oppose eradication of any native wildlife species. Additionally, the eradication of a native species or local population would be extremely difficult, if not impossible to accomplish, and cost-prohibitive in most situations. Population suppression could not be accomplished by WS except at a very local level (e.g., at an airport), but this would likely only be temporary condition.

Suppression would direct WS efforts toward managed reduction of certain problem populations or groups. In localized areas where damage can be attributed to predation by specific groups, ODWC has the authority to increase hunting seasons and bag limits. If a large number of requests for DDM are generated from a localized area, WS would consider suppression of the local population or groups of deer, if appropriate. It is not realistic, practical, or allowable under present WS policy to consider large-scale population suppression. Typically, WS activities in Oklahoma are conducted on a very small portion of the area inhabited by the problem species, and therefore, eradication or long term population suppression is unrealistic.

3.4.4 Lethal DDM Only. A lethal DDM only alternative would allow WS to only use capture and euthanize or kill DDM methods. This would not allow the full array of DDM methods to be used. Though, some resource owners may prefer this, WS may determine that lethal control was neither necessary nor the best DDM method to abate a damage problem. Some nonlethal techniques such as fencing can be very effective at eliminating problems without need for lethal control. WS Policy gives preferential use of nonlethal DDM methods where they are effective. Therefore, this alternative will not be considered in detail.

3.4.5 DDM Methods Not Considered by WS

3.4.5.1 Live Trap and Relocation. Under this alternative method, after consultation with ODWC and adequate funding/resources had been acquired, WS would capture deer alive using live traps, nets, or immobilization drugs and then relocate the captured deer to another area. Numerous studies have shown that live-capture and relocation of deer is relatively expensive, time-consuming and inefficient (Ishmael and Rongstad 1984, O'Bryan and McCullough 1985, Diehl 1988, Jones and Witham 1990, Ishmael et al. 1995). Population reduction achieved through capture and relocation is labor intensive and would be costly ($273-$2,876/deer) (O'Bryan and McCullough 1985, Bryant and Ishmael 1991). Additionally, relocation frequently results in high mortality rates for deer (Cromwell et. al. 1999, O'Bryan and McCullough 1985, Jones and Witham 1990, Ishmael et. al. 1995). Deer frequently experience physiological trauma during capture and transportation, (capture myopathy) and deer mortality after relocation, from a wide range of causes within the first year, has ranged from 25-89% (Jones and Witham 1990, Mayer et al. 1993). O'Bryan and McCullough (1985) found that only 15% of radio-collared black-tailed deer that were live-captured and relocated from Angel Island, California, survived for one year after relocation. Although relocated deer usually do not return to their location of capture, some do settle in familiar suburban habitats and create nuisance problems for those communities (Bryant and Ishmael 1991). High mortality rates of

relocated deer, combined with the manner in which many of these animals die, make it difficult to justify relocation as a humane alternative to lethal removal methods (Bryant and Ishmael 1991). A primary limitation of darting, the limited range at which deer can be effectively hit, is generally less than 40 yards. With modern scoped rifles, however, a skilled sharpshooter can hit the head or neck of a deer for a quick kill out to 200 yards and beyond. Thus, chemical capture is far less efficient, more labor intensive, and much more costly than lethal removal with rifles

Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, potential for disease transfer and difficulties in adapting to new locations or habitats.

3.4.5.2 Population Stabilization through Mechanical Birth Control. Under this alternative deer would be captured and surgically sterilized to limit the ability of deer to produce offspring. This would be cost-prohibitive and time consuming because the deer would have to be captured and a licensed veterinarian would have to conduct the procedure, potentially on hundreds of deer for just a small project. Other contraception methods are being developed that, while still labor intensive at a large scale, would be much more efficient for particular situations, especially in fenced communities where immigration would be minor. The immunocontraceptive vaccines being developed were discussed in Section 3.2.3 and these would be used rather than capturing the animal for surgical sterilization.

3.5 WS SOPs INCORPORATED INTO DDM TECHNIQUES

An SOP is any aspect of an action that serves to prevent, reduce, or compensate for negative impacts that otherwise might result from that action. The current program, nationwide and in Oklahoma, uses many such SOPs. Many WS SOPs are discussed in depth in USDA (1997, Chapt. 5). The key SOPs are incorporated into all alternatives as applicable, except the no federal program alternative (Alternative 2). Most SOPs are instituted to abate specific issues while some are more general and relate to the overall program. SOPs include those recommended or required by regulatory agencies such as EPA and these are listed where appropriate. Additionally, specific measures to protect resources such as T&E species that are managed by WS's cooperating agencies (USFWS and ODWC) are included in the lists below.

3.5.1 General SOPs Used by WS in DDM

- WS DDM activities in Oklahoma are consistent with USDA (1997) SOPs.
- WS complies with all applicable laws and regulations that pertain to working on federally managed lands.
- WS coordinates with Tribal officials for work on Tribal lands to identify and resolve any issues of concern with DDM.
- The use of DDM methods such as cage traps and immobilization drugs conform to applicable rules and regulations administered by the State.
- WS personnel adhere to all label requirements for DDM methods involving chemicals. EPA and FDA approved labels provide information on preventing exposure to people, pets, and T&E species along with environmental considerations that must be followed. These restrictions invariably preclude or reduce exposure to nontarget species, the public, and pets.
- The WS Decision Model (Slate et al. 1992) thought process as discussed in Chapter 1, which is designed to identify effective WDM strategies and their impacts, is consistently used.
- WS does not anticipate conducting DDM in National Parks or other specially designated areas. The potential exists that a request could come from the National Park Service, ODWC, or other agency for responding to damage abatement for natural resources or a threat to human health and safety. DDM would be conducted by all applicable laws and regulations.

3.5.2 WS SOPs Specific to the Issues

The following is a summary of the SOPs used by WS that are specific to the issues listed in Chapter 2 of this document.

3.5.2.1 Effects of DDM on White-tailed Deer Populations

- DDM is directed toward localized populations or individual offending animals, depending on the species and magnitude of the problem, and not an attempt to eradicate any native wildlife population in a large area or region.

- WS Specialists use specific trap types, lures, and placements that are most conducive for capturing the target animal.

- WS DDM kill is monitored. Both "Total Harvest" and estimated population numbers of key species are used to assess cumulative effects of harvest. WS DDM is designed to maintain the level of harvest below that which would impact the viability of populations of native species (see Chapter 4). WS provides data on total take of target animal numbers to other agencies such as ODWC as appropriate.

- Decisions to kill problem deer are made by WS under the authority of ODWC. Decisions to relocate any species is coordinated with the ODWC. ODWC would be notified in a timely manner of all take.

- WS currently has agreements for DDM on less than 1% of the land area of Oklahoma. In a typical year, WS takes target deer on far less than 1% of the land area, and therefore, should have no impact on deer more than 99% of the land area in Oklahoma.

- The use of newly developed, proven nonlethal methods would be encouraged when and where appropriate.

- Where feasible (areas with public access), WS would recommend that a cooperator consider allowing sport hunters to harvest deer on their property rather than lethal removal of deer by WS.

3.5.2.2 Effects on Nontarget Species Populations, Including Plants and T&E Species

- WS personnel are highly experienced and trained to select the most appropriate DDM method(s) for taking problem animals with little impact on nontarget species.

- WS personnel work with research programs such as the WS National Wildlife Research Center to continue to improve the selectivity of management devices.

- Nontarget animals captured in a cage trap or other device used in DDM are released at the capture site unless it is determined by WS Specialists that the animal is not capable of self maintenance.

- DDM could potentially be conducted to protect T&E species or vegetation. WS personnel will know how to apply DDM methods so that T&E species would not be threatened.

- WS will abide by all applicable reasonable and prudent alternatives, measures, and terms and conditions required as a result of findings in any ESA consultations between WS and USFWS for T&E species.

3.5.2.3 Impacts on Public Safety, Pets, and the Environment

- A formal risk assessment (USDA 1997, Appendix P, Q) concluded that hazards to the public from DDM devices and activities are low.

- All chemicals used by WS are registered with EPA, ODAFF, and FDA. WS employees will comply with each drug's directions and labeling, in addition to agency rules and regulations.

- WS Specialists who use restricted use chemicals (i.e., drugs) are trained and certified by program personnel or other experts in the safe and effective use of these materials under EPA, ODAFF, and FDA approved programs. WS employees who use chemicals participate in continuing education programs to keep abreast of developments and to maintain their certifications.

3.5.2.4 Humaneness of DDM Methods Used by WS

- Chemical immobilization and euthanasia procedures that do not cause pain or undue stress are used by certified personnel when practical and where safe.

- WS personnel attempt to kill captured target animals that are slated for lethal removal as quickly and humanely as possible. In most field situations, a shot to the brain with a small caliber firearm is performed which causes rapid unconsciousness followed by cessation of heart function and respiration. A well placed shot to the head is in concert with the American Veterinary Medical Association's (1987) definition of euthanasia (Beaver et al. 2001). In some situations, accepted chemical immobilization and euthanasia methods are used.

- Traps are set and inspected according to ODWC regulations and WS policy.

- Research continues with the goal of improving the humaneness of DDM devices.

- WS take is monitored. Total deer take is considered in relation to the estimated population numbers of key species. These data are analyzed by WS and given to ODWC to assess cumulative effects of harvest so as to maintain the level of harvest below that which could impact the viability of a population.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides the information needed for making informed decisions in selecting the appropriate alternative for meeting the purpose of the proposed action. This chapter analyzes the environmental consequences of each alternative discussed in Chapter 3 in relation to the issues identified for detailed analysis in Chapter 2. Each of the alternatives is compared to the proposed action, the No Action Alternative that provides the environmental baseline as discussed in Section 2.1.2 for each issue to determine if real or potential impacts are greater, lesser, or remain about equal.

4.1 ISSUES ANALYZED IN DETAIL

NEPA requires federal agencies to determine whether their actions have a "significant impact on the quality of the human environment." The environmental consequences of the 4 alternatives are discussed below with emphasis on the issues presented in Chapter 2. The comparison of alternatives will be used to make a selection of the most appropriate alternative for WS DDM activities in Oklahoma. The alternatives selected for detailed assessment provide the best range of alternatives that could potentially meet the purpose and the need of DDM in Oklahoma as identified in Chapter 1.

4.1.1 Effects of DDM on White-tailed Deer Populations

The authority for management of resident wildlife species is the responsibility of the ODWC and deer are classified as protected game animals. ODWC collects and compiles information on white-tailed deer population trends and take to use the information to manage the white-tailed deer population in Oklahoma. This information has been provided to WS to assist in the analysis of potential impacts of WS activities on the deer herd in Oklahoma. Harvest by sportsmen in Oklahoma has continued to increase (Figure 2) as the population has increased. To adequately determine the magnitude of impacts in relation to white-tailed deer and their population in Oklahoma, WS data and cumulative take will be analyzed. ODWC (M. Shaw, pers. comm. 2006) currently estimates the white-tailed deer population in Oklahoma at about 500,000 or about 7.3 deer/mi^2.

An aspect, perhaps overriding, that is germane to the determination of "significance" under NEPA is the effect of a federal action on the *status quo* for the environment. The States have the authority to manage populations of resident wildlife species with the exception of migratory and T&E species as they see fit without oversight or control by federal agencies. Management direction for a given species can vary among states, and state management actions are not subject to NEPA compliance. Therefore, the *status quo* for the environment with respect to state-managed wildlife species is the management direction established by the States. Federal actions that are in accordance with State management have no effect on the *status quo*. ODAFF has stated in a letter to WS that they would continue WDM in the State should WS not be able to fulfill this responsibility. Thus, even if WS does not carry out DDM, ODAFF will. Therefore, the status quo with regard to the effects on deer will be similar under the proposed action or other alternatives. Additionally, wildlife populations, particularly white-tailed deer, are typically dynamic and can fluctuate without harvest or control by humans. Therefore, the *status quo* for wildlife populations is fluctuation, both within and among years, which complicates determining the significance of human impact on such populations.

4.1.1.1 Alternative 1. Integrated DDM Program (the Proposed Action/No Action).

ODWC determines the desired deer population level for the State (remain stable, decrease, or increase). As a result of abundant deer in many areas of the State, ODWC has established fairly liberal deer hunting seasons (e.g. allowing hunters to harvest several deer and longer doe seasons) to try to maintain the population at least stable. However, in areas where hunting is not allowed (e.g., urban, developed, and airport operating areas), increased deer damage complaints are often received. WS has received about 10 damage occurrence requests for DDM assistance annually from FY03 to FY05. But requests for assistance, though few, have steadily increased over the last few decades and WS expects that this number will continue to increase with the increasing white-tailed deer population.

The current WS DDM program removes only a very small number of deer statewide, an average of 28 from FY01 to FY05 (Table 2). WS take has been minimal and much less than 0.1% of the population. WS has

had a very minor impact on the deer population. Take by WS to resolve damage problems with deer could increase substantially.

The number of deer taken in Oklahoma by sportsmen and depredation permit (includes WS take) combined averaged 21% of the deer population (Table 2). A sustainable harvest level for deer is about 33% (USDA 1997). Thus, cumulative take has been below this level of magnitude. Harvest has remained fairly consistent over the last 5 hunting seasons at about 100,000 deer taken annually. Overall cumulative take could increase 50% over the current harvest, or about an additional 50,000 deer could be taken annually in Oklahoma to keep the deer population relatively stable. Thus, this indicates, along with the population increase over the last 10 years (Figure 2), WS and cumulative harvest have not had an adverse impact on the deer population. ODWC may want to decrease the deer population at some point; the harvest would have to exceed the 33% allowable harvest level, likely much higher to accomplish this. WS adheres to the management direction of ODWC.

Table 2. Cumulative white-tailed deer kill in Oklahoma by WS and other depredation take and sportsmen harvest for FY01 to FY05.

White-tailed Deer Population Impact Analysis in Oklahoma						
	FY01	**FY02**	**FY03**	**FY04**	**FY05**	**Ave.**
Est. Population	450,000	450,000	475,000	475,000	500,000	470,000
WS Take	28	20	35	32	25	28
WS Take % Population	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Total Take*	102,100	101,635	98,581	100,602	94,689	99,521
% Population	23%	23%	21%	21%	19%	21%
Allowable Harvest (AH) %	33%	33%	33%	33%	33%	33%
AH Less Total Take	46,400	46,865	58,169	56,148	70,311	55,579

*includes all depredation and sportsmen harvest

WS could increase DDM substantially before reaching the sustainable harvest level. However, WS does not anticipate or envision ever having to take more than 1% of the white-tailed deer population barring a disease outbreak where deer needed to be culled over a large area to prevent spread of the disease. ODWC (M. Shaw, pers. comm. 2006) has concurred with WS that WS DDM activities will have no adverse effect on the statewide deer populations.

4.1.1.2 Alternative 2. Nonlethal DDM Only. WS would provide assistance with nonlethal techniques under this alternative to reduce, prevent, or discourage damage. No deer would be killed by WS under this alternative, but potentially deer could be taken alive and relocated. For many damage situations, this would be no different than the proposed action because many damage requests are resolved with nonlethal techniques. However, where nonlethal DDM methods would be ineffective, this alternative would reduce WS's ability to quickly address some deer damage problems. Based on experience, a WS Specialist may already be able to predict whether the use of nonlethal DDM methods will successfully resolve a particular depredation problem. WS policy already specifies that WS Specialists use nonlethal methods first, as appropriate. For example, using the WS Decision Model (Slate et al. 1992), a WS Specialist may determine that a lethal DDM method such as shooting may be necessary to abate a current problem. But they would also provide the landowner information on nonlethal techniques to reduce the likelihood of recurring damage. Since nonlethal DDM methods do not always prevent or reduce deer damage to acceptable levels, State or local agencies, and private organizations or individuals would likely assume responsibility for implementing the lethal DDM methods necessary to adequately deal with these problems. Some resource owners may kill deer, or allow other hunters access to kill deer during the legal harvest season or obtain ODWC permits to shoot deer outside of the regular season and in those areas where regulated hunting is not allowed. Private citizens, though, may be less effective than WS Specialists at resolving deer damage problems with lethal means, and may become frustrated at resolving the problem. Frustration by resource owners that could not resolve a problem acceptably could lead to illegal activities as described in Section 2.2.3. Additionally, if no agency, groups, or individuals were able to respond to damage complaints, much of the public could also become intolerant of wildlife as a whole (International Association of Fish and Wildlife Agencies 2004).

WS would have a lesser impact on target deer under this alternative, but others would likely initiate lethal control where it may or may not be warranted and possibly take more deer than under Alternative 1. The

effects on deer populations would most likely stay the same as Alternative 1 because ODWC would have to issue permits to take deer. Under this alternative, agricultural and property resource losses are expected to be greater than under the current program alternative due to restrictions placed on WS personnel.

4.1.1.3 Alternative 3. Technical Assistance with DDM Only. Under this alternative, WS would only provide advice or guidance on DDM techniques and methods. WS would not conduct any direct operational DDM in attempting to resolve damage complaints, and therefore, would not have any impact on deer in Oklahoma. As discussed under the Nonlethal DDM Only Alternative, similar DDM would likely be conducted by private individuals, State agencies and organizations in proportion to federal services lost. It is therefore likely that impacts on deer populations would be about the same as Alternative 2. Similar negative impacts as discussed under Alternative 2 would likely occur (improper use of DDM methods, illegal use of chemicals, and public intolerance towards wildlife).

4.1.1.4 Alternative 4. No Federal DDM Program. Under this alternative, neither WS nor any other federal agency would provide assistance with DDM and, therefore would not have any effect on target deer populations in Oklahoma. As discussed under the Nonlethal DDM Only Alternative, similar DDM would likely be conducted by private individuals, State agencies and organizations in proportion to federal services lost. It is therefore likely that impacts on deer populations would be about the same as Alternative 2 and 3. Similar to higher negative impacts as discussed under Alternative 2 would likely occur (improper use of DDM methods, illegal use of chemicals, and public intolerance towards wildlife) and possibly be much greater depending on the response to deer damage from others agencies and organizations. Since other agencies, organizations, and individuals are not associated with a federal program, accountability, records maintenance, regulatory and policy compliance and coordination with other agencies would not always be required or adhered to. However, the white-tailed deer population would not likely be impacted by a No Federal Program Alternative.

4.1.2 Effects on Nontarget Species, Including Plants and T&E Species

Nontarget species can be impacted by DDM whether implemented by WS, other agencies, or the public. Impacts can range from direct take while implementing DDM methods to indirect impacts resulting from implementing DDM methods (e.g., deer entangled in fences meant only to keep them out of an area) and reduction of deer in a given area (positive impact on vegetation and other wildlife as discussed in Section 1.2.3). Measures are often incorporated into DDM to reduce impacts to nontarget species. Various factors may, at times, preclude use of certain methods, so it is important to maintain the widest possible selection of DDM tools for resolving deer damage problems. However, the DDM methods used to resolve deer damage must be legal and biologically sound. Often, but not always, impacts to nontarget species can be minimized. Where impacts occur, they are mostly of low magnitude in terms of nontarget species populations. Following is a discussion of the various impacts under the Alternatives.

4.1.2.1 Alternative 1. Integrated DDM Program (the Proposed Action/No Action). WS personnel are trained and experienced to select the most appropriate tools and methods for taking target animals and excluding nontargets. Under the Proposed Action Alternative, WS take of nontarget species is expected to be minimal to nonexistent. Other wildlife populations would not be negatively affected by DDM, except for the occasional scaring effect from the sound of gunshots and potentially the entrapment of an animal in a cage trap set for deer. In the case of the use of frightening devices, birds and other mammals may temporarily leave the immediate vicinity of shooting, but would most likely return after conclusion of the action. Cage traps set for one species often can attract others that are attracted by the bait, and, if they weigh enough to activate the trap, they can be captured. In the case of cage traps for deer, animals with similar feeding behavior and weight in Oklahoma are feral swine (invasive species) found almost statewide and black bears found in eastern Oklahoma. WS has not used cage traps in DDM, but potentially could. If a nontarget was captured in a cage trap, it almost invariably could be released unharmed. To date, no nontarget animals have been killed by WS conducting DDM activities in Oklahoma, thus the WS program has not adversely affected nontarget species populations.

T&E Species are of concern for any WDM activity. Nationally, WS has consulted with the USFWS regarding potential impacts of control methods on T&E species, and abides by reasonable and prudent alternatives or measures established as a result of that consultation (USDA 1997). WS and USFWS did not expect DDM methods used by WS to have an adverse impact on T&E species and came to a "no effect"

conclusion. WS also consulted with USFWS in Oklahoma in 1999, and it was concluded that WDM would have no effect on newly listed T&E species. No new T&E species have been listed since that consultation. WS could positively benefit T&E species by reducing deer browsing damage to listed plant species and to habitat that is being used by T&E species such as the black-capped vireo. However, WS is currently not conducting any such activities and would consult with USFWS prior to such activities. Therefore, under the current program, WS has no effect on T&E species, but has the potential to have a positive effect on a few species with DDM.

Plants and habitat can be positively benefited by DDM as discussed in Section 1.2.3 where deer are reduced enough to allow vegetative undergrowth to regenerate. Overabundant deer can severely damage the habitat, which can impact both the vegetation (plant species) and wildlife. This alternative would reduce the damaging effects that deer have on native flora and fauna in very local areas. The beneficial effects would be most noticeable where deer were removed from a deer-proof fenced area.

4.1.2.2 Alternative 2. Nonlethal DDM Only.

Under the Nonlethal DDM Only Alternative, the full array of DDM methods would not be used by WS and therefore, WS would have less impact than under the proposed action, though this is minimal to nonexistent. Lethal DDM methods would likely be implemented by others where WS could not resolve deer damage with nonlethal means alone. ODWC would not likely want deer relocated and, therefore, DDM methods used by WS would be limited further. Some methods used by WS such as immobilization, chemical euthanasia, and shooting in urban areas would be legally unavailable to most private citizens, but other agencies could potentially use them. In the absence of an integrated DDM program by WS, some resource owners with little or no experience with DDM methods such as shooting would attempt to remove deer. These resource owners would be more likely than WS personnel to take a non-target species which would likely be unreported. Additionally, frustration as a result of the inability to resolve a problem could lead to the use of illegal DDM methods which could result in problems discussed in Section 2.2.3. These could potentially have serious effects on nontarget species. However, it is likely that nontarget species impacts would still be low, but potentially much greater, than under Alternative 1.

WS would have no effect on T&E species under this alternative. DDM conducted by private citizens has the potential to impact T&E species, especially with the use of illegal or ill-advised methods. However, the potential is still minimal.

Private citizens, and other agency and organization personnel could still conduct DDM in areas to protect plants and habitat. DDM conducted, especially in closed or fenced areas where immigration was reduced and where the vegetation and habitat had been severely damaged by deer, the vegetation and habitat could be restored. Therefore, it is likely that effects under the nonlethal alternative would be about the same for plants and habitat.

4.1.2.3 Alternative 3. Technical Assistance with DDM Only. Alternative 3 would not allow WS to conduct direct operational DDM. Therefore, WS would not have any direct impact on nontarget, T&E species, or plants and habitat. Under this alternative, ODWC would likely provide some level of professional assistance with DDM. However, private, agency, and organization DDM efforts would likely increase in proportion to any reduced effort in DDM by WS. Although technical support from WS might lead to more selective use of DDM methods by private parties than that which could occur under the No Federal Program Alternative, private efforts to reduce or prevent depredations could result in less experienced persons implementing DDM methods leading to greater take of nontarget wildlife and potentially T&E species as discussed under Alternative 2. This alternative would have the potential for increased adverse impacts resulting from WS not providing quality DDM and the compensatory actions of private individuals. Presumably, many service recipients would become frustrated with WS's failure to resolve their wildlife damage, and would go elsewhere for assistance or take illegal actions as described in Section 2.2.3. These actions could result in real, but unknown effects on the environment including nontarget wildlife, including T&E species. This alternative would protect plants and habitat similar to Alternative 2.

4.1.2.4 Alternative 4. No Federal DDM Program. Under this alternative, neither WS nor any other federal agency would provide assistance with DDM and, therefore, would not have an effect on nontarget,

T&E species, or plant species. USDA (1997) demonstrated that under the no federal program alternative, more nontarget animals would be affected. ODWC would provide some level of professional DDM assistance, but could be limited by resources (ie., personnel, etc.) without federal assistance,. Private efforts to reduce or prevent depredations would increase the most under this alternative. This would result in less experienced persons implementing DDM methods leading to a greater take of nontarget wildlife (potentially including T&E species) than under the current program or any of the other Alternatives. This is partially due to the lack of using SOPs to minimize nontarget take such as WS's self-imposed restrictions and policies to minimize or nullify nontarget take. As described in 2.2.3, the hypothetical use of chemical toxicants and illegal DDM methods could impact nontarget species populations, including T&E species, under this alternative. It is, therefore, likely that more impacts to nontarget species would occur under this alternative than the current program.

4.1.3 Impacts on Public Safety, Pets, and the Environment

4.1.3.1 Alternative 1. Integrated DDM Program (the Proposed Action/No Action). WS poses minimal threat to people, pets and the environment with DDM methods such as shooting, trapping, and use of chemicals (USDA 1997-Appendix P&Q). All firearm safety precautions are followed by WS when conducting DDM and WS complies with all applicable laws and regulations governing the lawful use of firearms. Shooting with shotguns or rifles is used to reduce deer damage when lethal methods are determined to be appropriate. Shooting is selective for target species. WS could use firearms to humanely euthanize deer captured in live traps. WS traps are strategically placed to minimize exposure to the public and pets. Appropriate signs are posted on all properties where traps are set to alert the public of their presence. WS personnel that use immobilization and euthanasia drugs are trained and certified to use them. WS personnel abide by WS policies and SOPs, and Federal and State laws and regulations when using DDM methods that have potential risks. The same would apply to immunocontraceptives should they become registered for use in Oklahoma. USDA (1997) conducted a risk assessment on WS's use of DDM methods and concluded that they had minimal hazards to the public, pets, and the environment.

Firearm use is very sensitive and a public concern because firearms can be misused. To ensure safe use and awareness, WS employees who use firearms to conduct official duties "*will be provided safety and handling training as prescribed in the WS Firearms Safety Manual and continuing education training on firearms safety and handling will be taken biennially by all employees who use firearms.*" (WS Directive 2.615). WS employees who use firearms as a condition of employment, are required to certify that they meet the criteria as stated in the *Lautenberg Amendment.*

This alternative would reduce threats to public health and safety by removing deer from sites where they pose a potential strike hazard to aircraft, and potentially vehicles, or have the potential of transmitting a disease.

Thus, WS poses minimal risks to public and pet health and safety when implementing DDM. In fact, WS can reduce public safety hazards; many WS DDM projects in Oklahoma have been to reduce the potential for deer strikes at airports.

4.1.3.2 Alternative 2. Nonlethal DDM Only. WS would have minimal potential to impact public and pet health and safety, or the environment under this alternative because many of the DDM methods with the potential to risk public and pets such as firearms and euthanasia drugs would not be used by WS. Depending on whether ODWC would allow relocation of deer or not, several other wildlife management methods may not be used. However, nonlethal DDM methods used by WS under this alternative would not always be sufficient or successful in resolving deer damage situations. The reduced effort by WS would likely be implemented by others, either private individuals or agency and organization personnel. Their efforts would likely result in similar or higher negative impacts on public and pet safety as the Proposed Action. It is likely that private efforts would result in the highest potential hazards because persons with little or no training could implement DDM. Additionally, frustration as a result of the inability to resolve a deer damage problem could lead to the use of illegal DDM methods which could result in problems discussed in Section 2.2.3. These could potentially have serious effects on the public, pets, and the environment. Finally, if deer populations continue to increase as the current trend indicates (Figure 2), public safety problems would escalate, though some would be resolved by other agencies, organizations

and individuals conducting DDM. This alternative has the potential for greater negative risks to the public, pets, and the environment than under the Proposed Action Alternative.

4.1.3.3 Alternative 3. Technical Assistance with DDM Only. The effects of implementing this alternative on public safety would be similar to, but somewhat more than, Alternative 2. Although there would be no potential for adverse impacts to humans from federal use of DDM methods, risks would likely increase from untrained and less experienced persons implementing DDM methods and the hypothetical use of illegal methods. However, the increased risks under this Alternative would be somewhat less than under Alternative 4, No Federal Program Alternative, since some individuals would receive technical assistance from WS and act in accordance with the safety advice given.

4.1.3.4 Alternative 4. No Federal DDM Program. Under this alternative, neither WS nor any other federal agency would provide assistance with DDM and, therefore would not have any effect on public and pet safety, or the environment. ODWC or ODAFF would probably still provide some reduced level of DDM without federal assistance. Private efforts to reduce damage would likely increase. Compared to the current program alternative, private individuals would likely increase negative effects on the environment and human safety. This would result from untrained and unlicensed individuals using DDM methods, both legal and illegal. As discussed in section 2.2.3, it is possible that frustration caused by the inability to reduce losses could lead to illegal methods with unknown impacts on public safety. In addition, private individuals are not accountable and could conduct DDM legally or illegally. Of the alternatives, this alternative would have the greatest potential for negative impacts on public safety, pets, and the environment. In addition to some of the problems noted, the federal portion of WS would not be able to respond to deer complaints involving human health and safety. Depending on their level of effort, others may be able to address human health and safety complaints adequately. It is suspected, though, that human health and safety problems associated with deer would increase slightly, but some damage problems could either go unresolved or be handled by private individuals with similar risks described above.

4.1.4 Humaneness of DDM Methods

4.1.4.1 Alternative 1. Integrated DDM Program (the Proposed Action/No Action). WS personnel are experienced and professional in their use of DDM methods, and methods are applied as humanely as possible. Under this alternative, deer would be shot or trapped as humanely as possible by experienced WS personnel using the best method available. Most all deer live-captured in traps would be euthanized. Some individuals may perceive this method as inhumane because they oppose all lethal methods of damage management. However, this alternative allows WS to consider nonlethal methods, and WS would implement nonlethal DDM methods when and where appropriate.

4.1.4.2 Alternative 2. Nonlethal DDM Only. This alternative would be considered humane by many people because WS would not use lethal DDM methods. WS would likely resolve some deer damage problems with nonlethal DDM methods. However, some problems may go unresolved without using the full array of DDM methods. This could lead to others implementing lethal DDM methods and persons with little or no experience with DDM methods may try to implement them with greater potential for using DDM methods such as shooting and trapping inhumanely. Nonlethal control techniques are generally considered more humane by animal welfare groups. However, nonlethal control techniques such as cage traps and nets must be used in a proper fashion. For example, cage traps can be potentially inhumane if the trap is not attended to regularly and a caught animal is exposed to the elements such as being left out in the sun or animals trapped in nets must be restrained quickly so they do not injure themselves. For the most part, the effects of this alternative with regards to the issue of humaneness would be similar to those under Alternative 1, but have slightly higher potential for DDM methods being used inhumanely.

4.1.4.3 Alternative 3. Technical Assistance with DDM Only. Impacts regarding the issue of humaneness under this alternative would likely be similar to those under Alternative 2, except that all persons with deer damage would have to implement DDM techniques on their own. This would lead to slightly more problems with humaneness than under Alternative 2. Technical assistance would lead to better training for the general public on the appropriate procedures for using different methods than under Alternative 4, but damage may go unresolved. Persons with unresolved damage problems may resort to the use of illegal and inhumane DDM methods as has been discussed. Thus, this alternative would lead to slightly less humane use of DDM methods then under Alternative 2, but more humane than Alternative 4.

4.1.4.4 Alternative 4. No Federal DDM Program. WS would not use any DDM methods and, therefore, would not have an impact in the area of humaneness. Similar to Alternative 3, persons less experienced would use DDM methods and have a higher likelihood of using DDM methods inhumanely. More resource and property owners could use lethal and nonlethal methods without training to reduce deer damage with correspondingly greater potential for using methods inhumanely. In addition, some resource and property owners may take illegal action against localized populations of deer out of frustration of continued damage. Some of these illegal actions may be less humane than methods used by experienced WS personnel. The result would likely be a much higher incidence of pain and suffering by animals under this Alternative.

4.4 SUMMARY OF IMPACTS

No significant environmental impacts are expected from any of the 4 alternatives except that highest potential for negative impacts would occur under Alternative 4. Under the Proposed Action, the lethal removal of deer would not have a significant impact on overall deer populations in Oklahoma with the exception of very local reductions. This is supported by the ODWC, which is the agency with responsibility for managing wildlife in the State. Minimal risk to public safety is expected when WS' services are provided to requesting individuals in Alternatives 1, 2, and 3, since only trained and experienced wildlife biologists would conduct and recommend DDM activities. There is a slight increased risk to public safety under Alternative 4 and when a person rejects WS assistance and recommendations in Alternatives 1, 2, and 3. Although some persons will likely be opposed to WS participation in DDM activities, the analysis in this EA indicates that the WS DDM program will not result in significant cumulative adverse impacts on the quality of the human environment.

Table 3. Comparisons of the issues and impacts under the different alternatives for DDM in Oklahoma.

Issues/Impacts	*Alternative 1*	*Alternative 2*	*Alternative 3*	*Alternative 4*
Effects on White-tailed Deer Population	Very local populations of deer would be reduced and sustained at a lower levels. No effect on statewide deer population.	Populations would not be affected by WS. Resource owners or others would have similar effects on deer as WS would under Alternative 1.	Populations would not be affected by WS. Resource owner or others would have similar effects on deer as WS would under Alternative 1.	Populations would not be affected by WS. Resource owner or others would have similar effects on deer as WS would under Alternative 1.
Effects on Nontarget Species, including Plants and T&E Species	No adverse impacts by WS. Positive impact to those species that are being negatively impacted by deer.	No adverse impacts by WS. Positive impact to those species that are being negatively impacted by deer if nonlethal methods are effective.	No adverse impacts by WS. Positive impact to those species that are being negatively impacted by deer if DDM is effectively used by other agencies.	No impact by WS. Positive impact to those species that are being negatively impacted by deer if resource owner implements damage reduction program.
Impacts on Public Safety, Pets, and the Environment.	No probable direct negative effect. Positive effect from reduced deer strikes and disease transmission.	No probable direct negative effect. Slight positive effect from reduced deer strikes and disease transmission.	No probable direct negative effect. Moderate positive effect from reduced deer strikes and disease transmission.	No impact by WS. Probable increase in risks associated from deer strikes and disease transmission. If resource owners conducts DDM, effect would be variable .
Humaneness of methods to be used.	Some would view as inhumane. Others would view as more humane than deer injured or killed by an aircraft or vehicle collisions.	Most would view as humane. If resource owners conduct lethal deer management activities, effects would be similar to Alternative 4.	Some would view as inhumane. Others will view as more humane than deer injured of killed by an aircraft or vehicle collisions.	No impact by WS. Most would view as humane. If resource owners conduct deer management activities, effects would be variable.

CHAPTER 5 - LIST OF PREPARERS, PERSONS CONSULTED, AND LITERATURE CITED/REFERENCES

5.1 LIST OF PREPARERS

Philip Robinson, USDA/APHIS/WS, Wildlife Biologist/Staff Biologist, Oklahoma City, OK
Thomas C. Hall, USDA/APHIS/WS, Wildlife Biologist/Environmental Coordinator, Ft. Collins, CO
Kevin Grant, USDA/APHIS/WS, Wildlife Biologist/State Director, Oklahoma City, OK

5.2 LIST OF PERSONS OR AGENCIES CONSULTED

State of Oklahoma

Oklahoma Department of Agriculture, Food, and Forestry
Kurt Atkinson, Forester, Oklahoma City, OK

Oklahoma Department of Wildlife Conservation
Michael Shaw, Wildlife Biologist, Oklahoma City, OK

U.S. Department of Agriculture
Animal and Plant Health Inspection Service, Wildlife Services

U.S. Department of the Interior
Fish and Wildlife Service, Ecological Services, Tulsa, OK

Private Person/Organization

Oklahoma State Farm Insurance
H. Lewis, Oklahoma City, OK

5.3 LITERATURE CITED AND REFERENCES

American Veterinary Medical Association (AVMA), 1987. Journal of the American Veterinary Medical Association. Panel Report on the Colloquium on Recognition and Alleviation of Animal Pain and Distress. J. Amer. Vet. Med. Assoc. 1991:1186-1189.

Anderson, J. F., R. C. Johnson, L. A. Magnarelli, F. W. Hyde, and J. E. Myers. 1987. Prevalence of *Borrelia burgdorferi* and *Babesia microti* in mice on islands inhabited by white-tailed deer. Appl. Environ. Microbiol. 53:892-894.

Anderson, J. F., and L. A. Magnarelli. 1980. Vertebrate host relationships and distribution of ixodid ticks (Acari: Ixodidae) in Connecticut, USA. J. Med. Entomol. 17:314-323.

Animal and Plant Health Inspection Service (APHIS). 2006. Wildlife Services' Mission. USDA- APHIS website @ http://www.aphis.usda.gov/ws/mission.html. *Last visited 04/19/06.*

Arhart, D. K. 1972. Some factors that influence the response of starlings to aversive visual stimuli. M.S. Thesis. Oregon State Univ., Corvallis.

Beaver, B.V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B. T. Bennett, P. Pascoe, E. Shull, L.C. Cork, R. Francis-Floyd, K.D. Amass, R. Johnson, R.H. Schmidt, W. Underwood, G.W. Thornton, and B. Kohn. 2001. 2000 Report of the AVMA panel on euthanasia. Journal of the American Veterinary Medical Association 218:669-696.

Belant, J. L., T. W. Seamans, and C. P. Dwyer. 1996. Evaluation of propoane exploders as white-tailed deer deterrents. Crop Prot. 15:575-578.

Belant, J. L., T. W. Seamans, and L. A. Tyson. 1998. Evaluation of electronic frightening devices as white-tailed deer deterrents. Proc. Vertebr. Pest Conf., Davis, CA 18:107-110.

Berryman, J. H. 1991. Animal damage management: responsibilities of various agencies and the need for coordination and support. Proc. East. Wildl. Damage Control Conf. 5:12-14.

Blouch, R. I. 1986. Northern Great Lakes States and Ontario forests. Pp. 391-411 *in* L. K. Halls, ed. White-tailed deer ecology and management. Stackpole Books, Harrisburg, Pa.

Bomford, M. 1990. Ineffectiveness of a sonic device for deterring starlings. Wildl. Soc. Bull. 18:151-156.

Bryant, B. K. and W. Ishmael. 1991. Movement and mortality patterns of resident and translocated suburban white-tailed deer. Pages 53-58 in L. W. Adams and D. L. Leedy, eds. Wildlife conservation in metropolitan environments. Natl. Inst. Urban Wildl. Symp. Ser. 2, Columbia, MD.

CDFG (California Department of Fish and Game). 1991. California Department of Fish and Game. Final Environmental Document - Bear Hunting. Sections 265, 365, 366, 367, 367.5. Title 14 Calif. Code of Regs. Cal F&G, State Of California, April 25, 1991. 13pp.

Campa, H., III, J. B. Haufler, and S. R. Winterstein. 1993. Effects of white-tailed deer and elk browsing on regenerating aspen: a ten year evaluation. Pp. 304-311 *in* I. D. Thompson, ed. Proc. Internat. Union Game Biol. XXI Congress. Vol. 2. Halifax, Nova Scotia, Canada.

Campa, H., III, S. R. Winterstein, R. B. Peyton, G. Dudderar and L. A. Leefers. 1997. An evaluation of a multidisciplinary problem: ecological and sociological factors influencing white-tailed deer damage to agricultural crops in Michigan. Trans. N. Amer. Wildl.& Nat. Res. Conf. 62:431-440.

Center for Disease Control (CDC). 2003. Lyme disease. CDC, Div. Vector-Borne Disease. website @ www.cdc.gov/ncidod/dvbid/lyme/index.htm. *Last visited 04/19/06.*

Cleary, E. C., S. E. Wright, and R. A. Dolbeer. 1997. Wildlife strikes to civil aircraft in the United States 1992-1996. U.S. Dept. of Trans., FAA, Washington D.C. 30pp.

Conover, M.R. 1982. Evaluation of behavioral techniques to reduce wildlife damage. Proc Wildl.-Livestock Relation Sym. 10:332-344.

Conover, M.R. 1994. Perceptions of grass-roots leaders of the agricultural community about wildlife damage on their farms and ranches. Wildl. Soc. Bull. 22:94-100.

Conover, M.R. 1997. Monetary and intangible valuation of deer in the United States. Wildl. Soc. Bull. 25(2):298-305.

Conover, M.R. 2002. Resolving human-wildlife conflicts: the Science of Wildlife Damage Management. Lewis Publ., New York, New York.

Conover, M. R., and D.J. Decker. 1991. Wildlife damage to crops; perceptions of agricultural and wildlife professionals in 1957 and 1987. Wildl. Soc. Bull. 19:46-52.

Conover, M. R., W. C. Pitt, K. K. Kessler, T. J. DuBow, and W. A. Sanborn. 1995. Review of human injuries, illnesses, and economic losses caused by wildlife in the United States. Wildl. Soc. Bull. 23:407-414.

Courteau, J., N. E. Tar, B. Hotaling, K. Thomson, S. Moody, A. Ward and E. Nietering. 1998. A report by the Audubon/botanical study subcommittee to the Huron-Clinton metropolitan authority (HCMA) wildlife management advisory committee. 15pp.

Craven, S. R., and S. E. Hygnstrom. 1994. Deer. Pp D-25-40 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson, Eds., Prevention and Control of Wildlife Damage. Univ. Nebr. Coop. Ext., USDA-APHIS-ADC, and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

Cromwell, J.A., R.J. Warren, and D.W. Henderson. 1999. Live-capture and small-scale relocation of urban deer on Hilton Head Island, South Carolina. Wildl. Soc. Bull. 27(4):1025-1031.

Danielson, B. J., and M. W. Hubbard. 1998. A literature review for assessing the status of current methods of reducing deer-vehicle collisions. Animal Collision Task Force, Iowa Dept. Transp. & Dept. Natural Resources. 25 pp.

Deblinger, R. D., M. L. Wilson, D. W Rimmer, and A. Spielman. 1993. Reduced abundance of immature *Ixodes dammini* (Acari: Ixodidae) following incremental removal of deer. J. Med. Entomol. 30:144-150.

DeCalesta, D.S. 1994. Effect of white-tailed deer on songbirds within managed forests in Pennsylvania. J. Wildl. Manage. 58:711-718.

DeCalesta, D. 1997. Deer and ecosystem management. Pp. 267-279 *in* W. J. McShea, H. B. Underwood, and J. H. Rappole, eds. The science of overabundance: deer ecology and population management. Smithsonian Inst. Press, Wash., DC. 402 pp.

Decker, D. J., and G. R. Goff. 1987. Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder, Colorado, p. 424.

Diehl, S. R. 1988. The translocation of urban white-tailed deer. Pages 238-249 *in* L. Nielsen and R. D. Brown, editors. Translocation of wild animals. Wisconsin Humane Society, Inc., Milwaukee, and Caesar Kleberg Wildlife Research Institute, Kingsville, TX.

Dolbeer, R. A. 1988. Population dynamics: the foundation of wildlife damage management for the 21st century. Proc. Vertebr. Pest Conf., Davis, CA 18:2-11.

Dolbeer, R. A., P. P. Woronecki, and R. L. Bruggers. 1986. Reflecting tapes repel blackbirds from millet, sunflowers, and sweet corn. Wildl. Soc. Bull. 14:418-425.

Dolbeer, R. A., S. E. Wright, and E. Cleary. 1995. Bird and other wildlife strikes to civilian aircraft in the United states, 1994. U.S. Dept. of Agric., APHIS, ADC, Denver Wildl. Res. Cent. Sandusky, OH. Interim Report DTFA01-91-A-02004. 38pp.

Etter, D. R., T. R. VanDeelen, D. R. Ludwid, S. N. Kobal, R. E. Warner. 2000. Management of white-tailed deer in Chicago, Illinois forest preserves. Proc. Vertebr. Pest Conf. 19:190-196.

Federal Wildlife Officer, The. 2000. Macon, GA, investigations. Fed. Wildl. Officers Assoc. Fall Newsletter 13(4):1.

Gage, L. L., R. S. Ostfield, and J. G. Olson. 1995. Nonviral vectorborne zoonoses associated with mammals in the United States. J. Mammal. 76:695-715.

Graves, G. E., and W. F. Andelt. 1987. Prevention and control of woodpecker damage. Service in Action, Colo. St. Univ. Coop. Ex. Serv. Publ. no 6.516. Ft. Collins, Colo. 2 pp.

Halls, L. K., ed. 1984. White-tailed Deer: Ecology and Management. Stackpole Books, Harrisburg, PA. 870 pp.

Health and Safety Executive. 2006. Pesticides 2005: Chapter 2.5. The Campaign Against Illegal Poisoning. Website @ http://www.hse.gov.uk/pesticides/bluebook/parta.htm#Chapter2_5. *Last visited 04/19/06.*

Insurance Institute for Highway Safety. 2004. Deer collisions. Status Report 39(1):5-7.

International Association of Fish and Wildlife Agencies. 2004. The potential costs of losing hunting and trapping as wildlife management tools. Animal Use Committee, IAFWA, Wash., DC. 46 pp.

Ishmael, W. E., D. E. Katsma, T. A. Isaac, and B. K. Bryant. 1995. Live-capture and translocation of suburban white-tailed deer in River Hills, Wisconsin. Pp. 87-96 *in* J. B. McAninch, ed., Urban Deer: A Manageable Resource? Proc. 1993 Symp., N. Central Sect., Wildl. Soc., St. Louis, MO.

Ishmael, w. E. and O. J. Rongstad. 1984. Economics of an urban deer-removal program. Wildl. Soc. Bull. 12:394-398.

Jones, J. M. and J. H. Witham. 1990. Post-translocation survival and movements of metropolitan white-tailed deer. Wildl. Soc. Bull. 18:434-441.

Jones, J. M., and J. H. Witham. 1995. Urban deer "problem"-solving in Northeast Illinois: and overview. Pages 58-65 *in* J. B. McAninch, ed., Urban Deer: A Manageable Resource? Proc. Symp. 55th Midwest Fish & Wildl. Conf. 1993, St. Louis, Mo. North Cent. Sect., The Wildl. Soc.

Kellert, S.R., and J.K. Berry. 1980. Knowledge, affection and basic attitudes toward animals in American society. U.S. Fish and Wildlife Service and US Dept. of Commerce, Springfield, VA.

Knowlton, F.F., E.M. Gese and M.M. Jaeger. 1999. "Coyote depredation control: an interface between biology and management." J. Range Manage. 52:398_412.

Latham, R. M. 1960. Bounties Are Bunk. Nat. Wildl. Federation, Wash., D.C. 10 pp.

Leopold, A. S. 1933. Game Management. Charles Scribner & Sons, NY, NY. 481 pp.

Magnarelli, L. A., J. F. Anderson and W. A. Chappell. 1984. Antibodies to spirochetes in white-tailed deer and prevalence of infected ticks from foci of Lyme disease in Connecticut. J. Wildl. Disease 20: 21-26.

Main, A. J., H. E. Sprance, K. O. Kloter, and S. E. Brown. 1981. *Ixodes dammini* (Acari: Ixodidae) on white-tailed deer *(Odocoileus virginianus)* in Connecticut. J. Med. Entomol. 18:487-492.

Marquis, D. A. 1981. Effect of deer browsing on timber production in Allegheny hardwood forests of northwestern Pennsylvania. NE For. Exp. Stn., Broomall, PA. 10pp.

Marquis, D. A., and R. Brenneman. 1981. The impact of deer on forest vegetation in Pennsylvania. NE For. Exp. STN., Broomall, PA. 7pp.

Mayer, K. E., J. E. diDonato, and D.R. McCullough. 1993. California urban deer management: two case studies. Urban Deer Symposium. St. Louis, MO.

McCullough, D. R. 1979. The George Reserve Deer Herd: Population Ecology of a K-selected Species. Univ. Michigan Press, Ann Arbor. 268 pp.

McLean, R. G. 1994. Wildlife diseases and humans. Pp. A25-A41 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson, eds. Prevention and Control of Wildlife Damage. Univ. Nebr., Lincoln.

Mitchell, B. R., M. M. Jaeger, and R. H. Barrett. 2004. Coyote depredation management: Current methods and research needs. Wildl. Soc. Bull. 32:1209-1218.

Mladenoff, D. J., and F. Stearns. 1993. Eastern hemlock regeneration and deer browsing in the northern Great Lakes region: a re-examination and model simulation. Conserv. Biol. 7:889-900.

Mott, D. F. 1985. Dispersing blackbird-starling roosts with helium-filled balloons. Proc. East. Wildl. Damage Cont. Conf. 2:156-162.

National Park Service (NPS). 1999. White-tailed deer in National Parks. NPS Fact Sheet.

Nebraska Game and Parks Commission (NGPC). 2006. The white-tailed deer. NGPC website @ www.ngpc.state.ne.us/wildlife/wtdeer.asp.

O'Bryan, M. K., and D. R. McCullough. 1985. Survival of black-tailed deer following relocation in California. J. Wildl. Manage. 49:115-119.

Oliver, J. H., M. R. Owsley, H. J. Hutcheson, A. M. James, C. S. Chen, W. S. Irby, E. M. Dotson and D. K. McClain. 1993. Conspecificity of the ticks *Ixodes scapularis* and *Ixodes dammini* (Acari, Ixodidae). J. Med. Entomol. 30: 54-63.

Pfeifer, W. K., and M. W. Goos. 1982. Guard dogs and gas exploders as coyote depredation control tools in North Dakota. Proc. Vertebr. Pest Conf. 10:55-61.

Piesman, J., A. Spielman, P. Etking, T. K. Ruebush, II, and D. D. Juranek. 1979. Role of deer in the epizootiology of *Babesia microti* in Massachusetts, USA. J. Med. Entomol. 15:537-540.

Porter, S. 2004. Corporation fined for poisoning bald eagle in KY. Wildl. Law News Q. 2:14.

Putnam, R. J. 1997. Deer and road traffic accidents: Options for management. J. Environ. Manage. 51:43-57.

Raymer, D. F. 1996. Current and long-term effects of ungulate browsing on aspen stand characteristics in northern lower Michigan. Thesis, Mich. St. Univ., East Lansing, MI.

Raymer, D. F. 2000. Effects of elk and white-tailed deer browsing on aspen communities and wildlife habitat quality in northern lower Michigan: an 18-year evaluation. Dissertation, Mich. St. Univ., East Lansing, MI.

Reed, D. F. 1985. Efficacy of methods advocated to reduce cervid-vehicle accidents: Research and rationale in North America. Conf. lors du colloque international "Route et faune sauvage," Strasbourg, Counsiel del Europe. June.

Romin, L. A., and J. A. Bissonette. 1996. Deer-vehicle collisions: status of state monitoring activities and mitigation efforts. Wildl. Soc. Bull. 24:276-283.

Rossbach, R. 1975. Further experiences with the electroacoustic method of driving starlings from their sleeping areas. Emberiza 2:176-179.

Schmidt, R. H. 1989. Vertebrate pest control and animal welfare. Pp.63-68 *in* Verteb. Pest Control and Manage. Materials. 6th Vol., ASTM STP 1055, K. A. Fagerstone and R. D. Curnow, Eds., Amer. Soc. Material and Testing, Philadelphia.

Schmidt, R. H., and R. J. Johnson. 1984. Bird dispersal recordings: an overview. ASTM STP 817. 4:43-65.

Schulze, T. L., M. F. Lakat, G. S. Bowen, W. E. Parkin, and J. K. Shisler. 1984. *Ixodes dammini* (Acari: Ixodidae) and other ixodid ticks collected from white-tailed deer in New Jersey, USA. I. Geographical distribution and its relation to selected environmental and physical factors. J. Med. Entomol. 21:741-749.

Science Applications International Corporation (SAIC). 2002. Protected Species Management Strategy for NASA Glenn Research Center at Lewis Field and Plum Brook Station. III Vols. 4990 Balzer Parkway, Dublin, Ohio 43017.

Shirota, Y. M., M. Sanada, and S. Masake. 1983. Eyespotted balloons are a device to scare gray starlings. Appl. Ent. Zool. 18:545-549.

Shivak, J. A., and D. J. Martin. 2001. Aversive and disruptive stimulus applications for managing predation. Proc. Wildl. Damage Manage. Conf. 9:111-119.

Slate, D. A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for wildlife damage management. Trans. North Am. Wildl. Nat. Res. Conf. 57:51-62.

Stine, M. L. 2002. Michigan TB update report. Mich. Conf. of Bovine Tuberculosis. Lansing, MI.

Strole, T. A., and R. C. Anderson. 1992. White-tailed deer browsing: species preferences and implications for central Illinois forests. Nat. Areas J. 12:139-144.

Swihart, R. K., P. M. Picone, A. J. DeNicola, G. S. Kania, and L. Cornicelli. 1995. Pp. 35-44 *in* J. B. McAninch, ed. Urban deer: a manageable resource? Proc. Symp. 55th Midwest Fish & Wildl. Conf., Dec. 1993, St. Louis, MO. N. Cent. Sect., Wildl. Soc.

Texas Department of Agriculture. 2006. Preventing pesticide misuse in controlling animal pests. Agriculture Department, Austin, TX website @ http://www.agr.state.tx.us/pesticide/brochures/. *Last visited 4/19/06.*

Tobin, M. E, P. P. Woronecki, R. A. Dolbeer, and R. L. Bruggers. 1988. Reflecting tape fails to protect ripening blueberries from bird damage. Wildl. Soc. Bull. 16:300-303.

U.S. Department of Agriculture (USDA). 1997. Animal Damage Control Program Final Environmental Impact Statement. (*Revision*) USDA-APHIS-WS, Operational Support Staff, 6505 Belcrest Rd., Room 820 Federal Bldg, Hyattsville, MD 20782. 314 pp + App.

U.S. Fish and Wildlife Service (USFWS). 2003. Service agents issue citations in Oklahoma. USFWS News Release Nov. 4, 2003. @ http://news.fws.gov. 2pp. *Last visited 4/19/06.*

U.S. Government Accounting Office. 1990. Wildlife Management: Effects of Animal Damage Control Program on Predators. U.S. GAO Report to the Hon. Alan Cranston, U.S. Senate. GAO/RCED-90-149. 31 pp.

Virginia Department of Game and Inland Fisheries (VDGIF). 1999. Virginia deer management plan. VDGIF, Wildl. Div., Wildl. Inf. Publ. No. 99-1. Richmond, VA. 68 pp.

Waller, D. and W. Alverson. 1997. The white-tailed deer: a keystone herbivore. Wildl. Soc. Bull. 25(2):217-226.

Warren, R. J. 1991. Ecological justification for controlling deer populations in eastern national parks. Trans. North Am. Wildl. Nat. Resour. Conf. 56:56-66.

Wildlife Society, The. 1992. Conservation policies of The Wildlife Society: A stand on issues important to wildlife conservation. The Wildlife Society, Bethesda, Md. 24pp.

Wilson, M. L., G. H. Adler, and A. Spielman. 1985. Correlation between abundance of deer and that of the deer tick, *Ixodes dammini* (Acari: Ixodidae). Ann. Entomol. Soc. Amer. 78:172-176.

Wilson, M. L., S. R. Teflford, III, J. Piesman, and A. Spielman. 1988. Reduced abundance of immature *Ixodes dammini* (Acari: Ixodidae) following elimination of deer. J. Med. Entomol. 25:224-228.