ENVIRONMENTAL ASSESSMENT

White-tailed Deer Damage Management in Illinois

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WILDLIFE SERVICES

In Consultation with

Illinois Department of Agriculture
Illinois Department of Natural Resources
Illinois Department of Public Health
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ACRONYMS

AMDUCA	Animal Medical Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CSA	Cooperative Service Agreement
CWD	Chronic Wasting Disease
DOA	Illinois Department of Agriculture
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FLIR	Forward Looking Infrared
FY	Fiscal Year
HD	Hemorrhagic Disease
ICLS	Illinois Compiled Statutes
IDNR	Illinois Department of Natural Resources
IDOT	Illinois Department of Transportation
IWDM	Integrated Wildlife Damage Management
JTF	Joint Task Force
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NWRC	National Wildlife Research Center
SOP	Standard Operating Procedures
T&E	Threatened and Endangered
TA	Technical Assistance
TB	Tuberculosis
US	United States
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WAC	Wildlife Acceptance Capacity
WDDM	White-tailed Deer Damage Management
WS	Wildlife Services

CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

1.1 PURPOSE

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program continues to receive requests for assistance to resolve human conflicts with white-tailed deer (*Odocoileus virginianus*) in Illinois. This Environmental Assessment (EA) documents the analysis of the potential environmental effects of a proposed Illinois WS integrated white-tailed deer damage management (WDDM) program to alleviate damage to agriculture, property, natural resources, human health, and human safety.

WS is the federal agency directed by law and authorized to protect American resources from damage associated with wildlife. 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, wildlife damage management is not based on punishing offending animals but on reducing damage and is used as part of the WS Decision Model (Slate et al. 1992). 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.

Normally, individual wildlife damage management projects conducted by the WS program could be categorically excluded from further analysis under the National Environmental Policy Act (NEPA), in accordance with APHIS implementing regulations for the NEPA (7 CFR 372.5(c), 60 FR 6000-6003). However, the purpose of this EA is to evaluate cumulatively the individual projects conducted by WS to manage damage and threats to agricultural resources, property, industrial natural resources, and threats to humans caused by white-tailed deer. This EA will assist in determining if the proposed cumulative management of deer damage could have a significant impact on the environment for both humans and other organisms, based on previous activities conducted and based on the anticipation of receiving additional requests for assistance. Because the goal of WS is to conduct a coordinated WDDM program in accordance with plans, goals, and objectives developed to reduce damage, and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates those additional efforts and the analyses would be intended to apply to actions that may occur in any locale and at any time within Illinois as part of a coordinated program.

More specifically, WS is preparing this EA to: 1) facilitate planning, 2) promote interagency coordination, 3) streamline program management, 4) clearly communicate to the public the analysis of individual and cumulative impacts of proposed activities; and 5) evaluate and determine if there would be any potentially significant individual or cumulative adverse effects from the implementation of a damage management program.

WS is a cooperatively funded, service-oriented program from which other governmental agencies or private entities may request assistance. Before any wildlife damage management is conducted on public or private land, Cooperative Service Agreements (CSA) or other comparable documents are in place. WS cooperates with state, federal, and local land and wildlife management agencies to reduce wildlife damage effectively and efficiently according to applicable federal, state, and local laws and Memorandums of Understanding (MOUs) between WS and other agencies/entities.

Wildlife damage management is the science of reducing damage or other problems caused by wildlife and is recognized as an integral part of wildlife management (The Wildlife Society 1992). WS uses an Integrated Wildlife Damage Management (IWDM) approach, also known as Integrated Pest Management (WS Directive 2.105[1]), in which a combination of methods may be used or recommended to reduce wildlife damage. These methods may include alteration of cultural practices and habitat and behavioral modification to prevent or reduce damage. The reduction of wildlife damage may require that the local populations of offending animal(s) be reduced through lethal means.

Both sociological and biological carrying capacities must be considered when resolving wildlife damage problems. The wildlife acceptance capacity (WAC), or cultural carrying capacity, is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations. Biological carrying capacity is the land or habitat's ability to support healthy populations of wildlife without degradation to the species' health or their environment during an extended period of time (Decker and Purdy 1988). When this number is exceeded, the health of the population begins to suffer, reproduction declines, parasitism and disease increase, and habitat quality and diversity decrease due to over browsing of plant species preferred as food by deer (Kroll et al. 1986). Those phenomena are especially important because they define the sensitivity of a person or community to a wildlife species. For any given damage situation, there are varying thresholds of tolerance exhibited by those people directly and indirectly affected by the species and any associated damage. This damage threshold determines the WAC. While the biological carrying capacity of habitat may support higher populations of wildlife, in many cases, the wildlife acceptance capacity is lower or has been met. Once the WAC is met or exceeded, people begin to implement population or damage management to alleviate damage or address threats to human health and human safety.

1.2 NEED FOR ACTION

Within Illinois and across the United States (U.S.), wildlife habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with wildlife thereby increasing the potential for conflicting human/wildlife interactions. In addition, segments of the public desire protection for some or all wildlife which may increase populations and create localized conflicts between human and wildlife activities. Wildlife has either positive or negative values, depending on varying human perspectives and circumstances. Wildlife is generally regarded as providing economic, recreational and aesthetic benefits and the mere knowledge that wildlife exists is a positive benefit to many people. However, the activities of some wildlife may result in economic losses to agriculture and damage to property. Sensitivity to varying perspectives and value is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well.

White-tailed deer (hereto referred to simply as "deer") in Illinois are managed by the Illinois Department of Natural Resources (IDNR) under guidance from the Joint Task Force (JTF) on Deer Population Control, which was created in 2007 by House Joint Resolution 65 of the 95th Illinois General Assembly. The resolution that created the JTF characterized Illinois' deer herd as:

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

"rampant in some counties….causing accidents on our highways, increasing crop damage… and making it easier for disease and starvation to afflict our deer populations" (IDNR 2014).

In 2008, the JTF recommended that IDNR use the rate of deer-vehicle collisions as the indicator of success or failure of deer management policy and to assess the trend of the state deer population, and IDNR adopted this approach. County-based deer-vehicle collision statistics allow for targeted deer harvest goals for counties with higher rates, as opposed to setting statewide limitations. As of the beginning of 2014, the statewide deer population is near the goal level, although some counties are still well above the goal (IDNR 2014). However, the deer-vehicle collision objectives are not used for counties that have implemented Chronic Wasting Disease (CWD) management strategies.

Deer occupy a broad range of habitats and reproduce rapidly under the right conditions, resulting in a sharp population increase throughout their range (Rooney and Waller 2003). With the expansion of human populations into rural environments, and the historic decline of natural deer predators (e.g., gray wolf and cougar), the potential for human-deer encounters will inevitably increase. Unfortunately, these encounters are often in the form of deer-vehicle collisions, deer-aircraft encounters, and damage to landscaping, natural resources, horticulture, and agricultural commodities. While hunting is still an effective tool to manage deer populations in rural environments, other options must be considered to manage overabundant deer herds in non-traditional settings (i.e., airports, city parks, suburban areas, etc.). Both lethal and non-lethal options need to be assessed to minimize the potential negative impact that overabundant deer may have on the human environment.

1.2.1 Deer-Vehicle Collisions

Deer-vehicle collisions are a serious concern nationwide because of losses to property and the potential for human injury and death (Conover et al. 1995, Romin and Bissonette 1996, Conover 1997). The economic costs associated with deer-vehicle collisions include vehicle repairs, human injuries and fatalities, and picking up and disposing of deer. Annually, there are estimated to be more than 1,000,000 deer-vehicle collisions nationwide, but the 2011 statistics show a 7% decrease in the total over the previous year and a 9% decrease over the previous three years (Williams et al. 2012). Williams et al. (2012) estimated that there were more than 200 human deaths attributable to deer-vehicle collisions annually. Damage costs associated with deer-vehicle collisions in 2011 were estimated at $3,171 per incident, which was an increase of 2.2% over the 2010 estimate (State Farm Mutual Automobile Insurance Company 2011). Often, deer-vehicle collisions, in which a deer carcass was not recovered or little vehicle damage occurred, go unreported. A Cornell University study estimated that the actual number of deer-vehicle collisions could be as high as six times the reported number (Decker et al. 1990). In Illinois, there were 15,499 deer-vehicle collisions reported to law enforcement agencies in 2012; a 36% decrease from the 24,209 deer-vehicle collisions reported in 2008 (Figure 1) (IDOT 2008, 2009, 2010, 2011, 2012). This drastic decrease is due to a change in the reporting

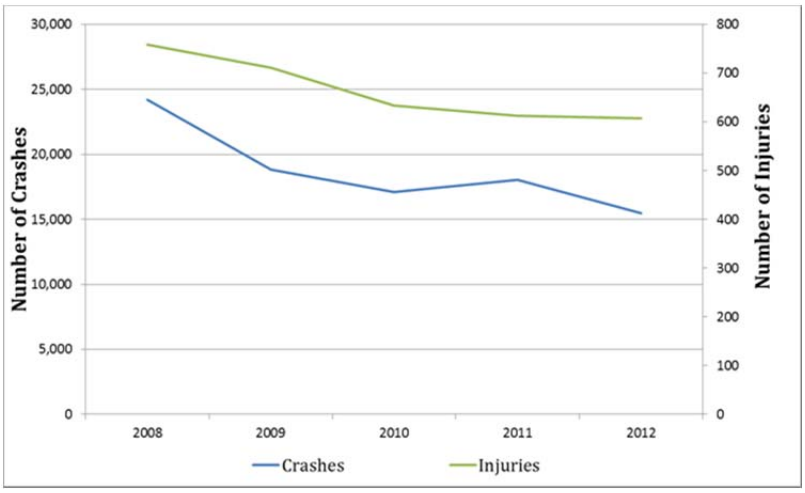

Figure 1. Illustration of Deer-vehicle Collision and Injury Trend from 2008 through 2012.

requirements for deer-vehicle collisions to the Illinois Department of Transportation (IDOT). The minimum dollar amount of a crash that must to be reported was increased from $500 to $1,500, resulting in a sharp decline in the apparent number of collisions reported from 2008 to 2009, while the subsequent years' reporting trends appear more stable (IDNR 2014). Between 2008 and 2012, there were 28 fatalities reported from deer-vehicle collisions, with the highest number being ten in 2010 (IDOT 2008, 2009, 2010, 2011, 2012).

1.2.2 Deer Damage at Airfields

White-tailed deer populations have increased in the U.S. from approximately 350,000 in 1900 to over 28 million in 2010 (VerCauteren et al. 2011), and the expanding population may bring more deer into the vicinity of airfields. Deer were involved in 37% of the reported mammal-aircraft strikes and in 88% of the damaging strikes involving terrestrial mammals from 1990 through 2012 (Dolbeer et al. 2013). Of the 356 reported instances of human injury due to wildlife-aircraft strikes in the Federal Aviation Administration (FAA) database, deer were involved in 19 of the strikes, causing 27 injuries. In Illinois, from 1990 through 2013 a total of 6,289 wildlife strikes to aircraft were reported to the FAA with 28 of these strikes involving deer (FAA 2014).

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 and landing, can cause the aircraft to crash or sustain physical damage (FAA 1997). Mammals, especially deer, are characteristically 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, resulting in a strike. The majority of deer strikes occur at night and in the fall during the breeding season (Dolbeer et al. 1995).

Deer commonly pose a threat to aviation safety at airfields in Illinois. Illinois has a total of 108 airports (T. Schaddel, IDOT, Pers. Comm. 2014). Airports provide ideal conditions for deer and other wildlife due to the large grassy areas adjacent to brushy, forested habitat. Airport habitats provide deer excellent feeding and bedding sites and are usually protected from hunting and other human disturbance. Collisions between deer and aircraft have caused millions of dollars of damage over the past decade and can threaten public safety (FAA 2001). Serious consequences are also possible if pilots lose control of the aircraft while attempting to avert a collision with deer. In January 2001, an aircraft owned by a professional team organizer struck a deer while landing at the Troy, Alabama airport. The pilot and passengers were injured and the aircraft was destroyed (Blackley 2001). More recently, a U.S. Customs jet was destroyed on landing at a South Carolina airport after striking a deer. All crew members escaped unharmed, but the jet was a total loss (Dolbeer et al. 2013).

Wildlife collisions with aircraft are a serious economic and safety problem (Dolbeer et al. 2013). Dolbeer et al. (2013) estimated that between 1990 and 1998 wildlife strikes cost the U.S. civil aviation industry a minimum of 583,175 hours/year of aircraft down time and $957 million/year in direct and other monetary losses. In a recent study which ranked the hazard to aviation for wildlife species commonly involved in aircraft strikes, deer were ranked as the most hazardous species group (DeVault et al. 2011). This study found that 87% of reported deer-aircraft collisions resulted in damage. While there does not have to be contact between aircraft and wildlife for a strike report to be filed (near-misses are counted as strikes), 68% of deer-aircraft strike reports noted a negative effect on the flight (aborted take-off, engine shutdown, etc.) (DeVault et al. 2011).

Annual reporting of wildlife strikes has increased markedly over the years, and it is now estimated that 39% of all wildlife strikes at certificated airports are reported, leaving 61% of strikes unreported (Dolbeer et al. 2013). Additionally, many reports received by the FAA are 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 under represent the magnitude of the risk and problem (Cleary et al. 1997).

1.2.3 Damage to Natural Resources, Urban Areas, and Landscaping

Urban Areas and Landscaping

Deer are prolific and adaptable, allowing them to prosper and exploit most suitable habitat near urban areas, including residential areas (Jones and Witham 1995). High deer population densities can result in over-browsing, which may damage or destroy 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). Although damage to landscaping and ornamental plants has not been quantified in and around urban parks, deer have caused significant and costly property damage to individual homeowners. For fiscal year (FY) 08 through FY13, $3,000 in damage to landscaping from deer browsing in Illinois was reported to WS. While this number is low, it's likely only a fraction of damage that occurs in the state, as not all damage is reported to WS. 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.

Natural Resources

Deer have been identified as a keystone species in forest ecosystems; meaning their feeding activities directly or indirectly affect many other species (Rawinski 2008). Deer overabundance can affect native vegetation and natural ecosystems in addition to ornamental landscape plantings. Deer often select the most preferred species, reducing plant diversity, and creating a monoculture (Rawinski 2008). Ecosystem alterations caused by deer can lead to adverse impacts on other wildlife species, which depend on these plants for food and/or shelter. Deer consume seeds that may remain viable in the feces, resulting in the spread/germination of plants. A study in Connecticut showed that seeds from 57 different plant species found in deer feces remained viable. Of those, 32 were exotic species with some being highly invasive species such as autumn olive and wine raspberry (Rawinski 2008).

Over-browsing by deer can have a dramatic impact upon other wildlife communities (e.g., Neotropical migrant songbirds, insects, and small mammals). Numerous studies have shown that over-browsing by deer can decrease tree reproduction, understory vegetation cover, plant density, and plant diversity (Warren 1991, Horsley et al. 2003, DiTommaso et al. 2014, Nuttle et al. 2011). Deer often select for woody species, as well as native and non-native herbs, resulting in a depressed seed bank in secondary successional systems, such as recovering old-field communities (DiTommaso et al. 2014). In Pennsylvania, De Calesta (1994a) reported that deer browsing affected vegetation that songbirds need for foraging surfaces, escape cover, and nesting. Also, species richness and abundance of intermediate canopy nesting songbirds was reduced in areas with higher deer densities (De Calesta 1994b). 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/mi^2 and another two disappeared at 63.7 deer/mi^2. 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.

High deer densities result in over-browsing, which can have substantial impacts on certain herbaceous and woody species and on overall plant community structure (Waller and Alverson 1997). A study published in 2011 on herbivore pressure on ecosystems documented long term changes in the trophic levels in forest canopies over a 30 year period (Nuttle et al. 2011). Over-browsing by ungulates resulted in the reduction of foliage and canopy herbivore (caterpillar) densities, which resulted in the decline of insectivorous birds. The authors concluded that changes documented lasted well beyond the time when over-browsing occurred, affecting the environments for at least 20 years, if not until full stand replacement occurs (>100 years) (Nuttle et al. 2011). One study of an unchecked deer population in Ohio showed that 150 vascular plants were extirpated when deer densities reached greater than 110 deer/mi^2 (Rooney and Waller 2002). Deer populations in the Chicago-area have been managed for many years to protect natural resources including threatened and endangered species found in forest preserves around Chicago (Engeman et al. 2014). In a county forest preserve near Chicago, over-abundant deer caused 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 (Etter et al. 2000). This response was the result of cumulative deer harvests and a subsequent decline in deer populations. Over-abundant deer populations were identified as one of the greatest threats to plant communities in the Chicago area (Engeman et al 2014). Deer were identified as a "native invasive species" with the following reasoning:

> *"Included among the three circumstances where native species function as invaders, according to Carey et al. (2012), are when "human-mediated environmental change facilitates population growth of native species via elevated survivorship and reproduction" and when "habitat modifications or other changes in the environment may increase the per capita effect of native species on the resident community." Both of these circumstances directly apply to white-tailed deer in urbanized settings. Populations thrive and reproduce in the absence of large predators (including hunting), while natural habitats are restricted by urbanization to reserves and open spaces, placing greater pressure on the plant communities within them, especially rare species. Negative interactions with humans also increase in urbanized settings holding high numbers of deer"* (Engeman et al. 2014).

1.2.4 Threats to Wildlife and Livestock Health and Safety from Disease Transmission

Chronic Wasting Disease. Chronic Wasting Disease (CWD) is a nervous system disease affecting members of the Family Cervidae, including Rocky Mountain elk (*Cervus canadensis*), red deer (*Cervus elaphus*), mule deer (*Odocoileus hemionus)*, black-tailed deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), sika deer (*Cervus nippon*), and Moose (*Alces alces*) (USDA 2014) . It belongs to the family of diseases known as transmissible spongiform encephalopathies (TSE's) or prion diseases. Though it shares certain features with other TSE's like bovine spongiform encephalopathy ("Mad Cow Disease") or scrapie in sheep, it is a distinct disease apparently affecting only species of the family cervidae. CWD originally occurred in wild deer and elk primarily in northeastern Colorado, and adjacent parts of Wyoming, Nebraska, and South Dakota. However, CWD has been detected in 14 northern Illinois counties (P. Shelton, Pers. Comm. IDNR 2014).

CWD attacks the brains of infected deer, causing the animal to become emaciated, display abnormal behavior, lose bodily functions, and die. Signs identified in captive deer include excessive salivation, loss of appetite, progressive weight loss, excessive thirst and urination, listlessness, teeth grinding, holding the head in a lowered position, and drooping ears. CWD is a slowly progressive disease and clinical signs

may manifest anywhere from months to years after infection. Clinical signs are usually not seen until the animal is 18 months of age or older. Once clinical signs are observed, death normally occurs within weeks or months, and CWD is always fatal (IDNR 2012).

There is no evidence that CWD can be transmitted under natural conditions to humans or cattle (USDA 2001). The mode of transmission between deer is not completely understood. It is thought that the disease can be passed between animals in a herd and also from close contact between mother and offspring (USDA 2001). Infectious prions are not easily killed by environmental factors, heat, or disinfection, so transmission from a contaminated environment may also be possible (WDNR 2002b, Miller et al. 2004). Since monitoring began in 2002, more than 66,045 samples have been tested, with a total of 372 positives. Samples are collected from hunter harvested deer, under special depredation permits for CWD surveillance, and upon receipt of calls for sick deer (Shelton and McDonald 2013).

WS may be asked by IDNR to assist with population control to manage CWD prevalence in wild populations of deer in portions of Illinois. It is also possible that a captive deer herd could become infected, and that WS could be asked to assist regulatory authorities depopulate the herd. Depopulation efforts are more intense than those used to manage a wild population, in that it requires all individuals in a population be removed.

Bovine Tuberculosis. Tuberculosis (TB) is a contagious disease of both animals and humans and can be caused by three specific types of the Mycobacterium bacteria (USDA 1995). Bovine TB, caused by *Mycobacterium bovis*, primarily affects cattle and other bovine-like animals (e.g., bison, deer, and goats) but can be transmitted to humans and other animals (USDA 1995). 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 when an infected deer coughs near another (e.g., nose to nose) and droplets of saliva, in aerosol form, containing the bacteria are transmitted to a nearby deer (McGinness 1998). 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 bait/feed piles.

Pathogenesis of *M. bovis* infection in 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 the tonsil 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.

The USDA Cooperative State-Federal Tuberculosis Eradication Program, which began in 1917, is responsible for the near-eradication of the disease from the Nation's livestock population. Under the previous USDA rules governing state bovine TB status, at the end of 2013, 48 states were in "Accredited Free" status and two states were in "Modified Accredited" status (USDA Veterinary Services 2013). Under the new USDA rules governing state bovine TB status, Illinois' status maintained its "Accredited Free" status (USDA Veterinary Services 2013). This means the state has no TB prevalence in cattle, bison, and goat herds and no TB in the past three years from the time the last infected herd was depopulated or from the time of surveillance indicating no risk of TB spreading. Since human occupational and recreational activities involving deer have been occurring for so long, it appears that the risk of tuberculosis in humans from this situation is low.

Tick Borne Diseases. The Illinois Department of Public Health (IDPH) documents and tracks several tick-borne diseases, in addition to Lyme disease, including babesiosis, ehrlichiosis and Rocky Mountain spotted fever. The same tick that carries the Lyme disease bacterium also carries these pathogens. Research has shown a direct 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 adult deer ticks (Conover 1997). Lyme disease incidence has also been linked to landscape features such as urban developed areas versus wooded residential areas (Montgomery County Pennsylvania Health Department 2000). In Illinois, Lyme disease is reportable to the IDPH and should be reported within seven days to a county health office.

1.2.5 Deer Damage to Agriculture

Conover (1997) estimates 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). A 2011 survey of Illinois residents and farmers showed that 47 percent of farmers experienced moderate to severe damage to crops by deer, while only 8% said they experienced no deer damage (IDNR 2013b). The IDNR does not track the value of damage to agriculture in the state, but does track the number of deer removal permits issued each year to individuals attempting to reduce damage (Figure 2). Spikes in the number of permits issued (2007 and 2012) coincide with drought years, where crop damage is more visible due to lower growth rates (P. Shelton, Pers. Com. 2014).

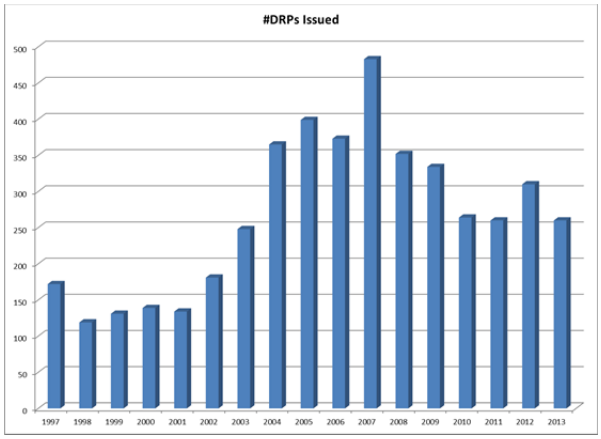

Figure 2. Number of deer removal permits issued by IDNR by year (P. Shelton, Pers Comm. 2014).

1.3 DECISION TO BE MADE

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

- Should WS continue the current WDDM program in Illinois to alleviate damage to agriculture, property, natural resources, human health, and human safety or select one of the other proposed alternatives?

- Would the proposed action have significant impacts on the quality of the human environment requiring preparation of an Environmental Impact Statement (EIS)?

1.4 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS

1.4.1 Actions Analyzed

This EA evaluates WS involvement in WDDM to protect property, agricultural resources, natural resources, human health, and human safety in the State of Illinois.

1.4.2 Period for which this EA is Valid

If it is determined that an EIS is not needed, this EA would remain valid until the WS program in Illinois and 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. Review of the EA would be conducted each year to ensure that the EA adequately addresses current and anticipated program activities.

1.4.3 Site Specificity

This EA analyzes and addresses the potential impacts of WS WDDM management activities on all private and public lands in Illinois under MOU, Cooperative Agreement, and in cooperation with the appropriate public land management agencies. It also addresses the impacts of WS WDDM on areas where additional agreements may be signed in the future. Because the proposed action is to reduce damage and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional wildlife damage management efforts could occur anywhere in Illinois. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program. Planning for the management of deer damage must be viewed as being conceptually similar to other federal or agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they would occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, and insurance companies. 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 standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in Illinois (see Description of Alternatives for a description of the Decision Model and its application).

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

1.4.4 Public Involvement/Notification

This EA has been made available to the public for a comment period for 30 days. A notice of availability has been published in *The State Journal Register* and has also been emailed to stakeholders via the APHIS Stakeholder Registry. The notice of availability has also been posted on the WS web site at http://www.aphis.usda.gov/wildlifedamage/nepa. Public notification procedures have been conducted in compliance with WS' NEPA implementation procedures published in the Federal Register March 21, 2007 (Vol. 72, No. 54: 13237-13238).

1.5 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

USDA 2008 Environmental Assessment: An Integrated Wildlife Damage Management Approach for the Management of White-tailed Deer Damage In the State of Illinois.

WS has previously developed an EA that analyzed the need for action to manage damage associated with deer (USDA 2008). Changes in the need for action and the affected environment have prompted WS and cooperating agencies to initiate this new analysis to address the need for deer damage management. This EA will address more recently identified changes and will assess the potential environmental impacts of

program alternatives based on a new need for action. Since activities conducted under the previous EA will be re-evaluated under this EA to address the new need for action and the associated affected environment, the previous EA that addressed deer will be superseded by this analysis and the outcome of the Decision issued based on the analyses in this EA. However, the need for action associated with the previous EA continues to be appropriate until superseded by this EA.

1.6 AUTHORITY AND COMPLIANCE

1.6.1 Wildlife Services Legislative Authority

The primary statutory authorities for the WS program are the Act of March 2, 1931 (46 Stat. 1468; 7 USC 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 USC 426c). The WS program is the lead federal authority in managing damage to agricultural resources, natural resources, property, and threats to human safety associated with wildlife. WS' directives define program objectives and guide WS' activities to manage wildlife damage management.

Additionally, MOU's among WS and other governmental agencies also define WS responsibilities in wildlife damage management. For example, a MOU between the Federal Aviation Administration (FAA) and WS recognizes WS role and expertise in providing wildlife hazard management assistance to the aviation community. It states, that the "FAA or the certificated airport may request technical and operational assistance from WS to reduce wildlife hazards."

1.6.1.1 U.S. Department of Interior, Fish and Wildlife Service Legislative Authority

The US Fish and Wildlife Service (USFWS) is the primary federal agency responsible for conserving, protecting, and enhancing the nation's fish and wildlife resources and their habitats. The USFWS mission is to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. Responsibilities are shared with other federal, state, tribal, and local entities; however, the USFWS has specific responsibilities for threatened and endangered (T&E) species protection under the ESA, migratory birds, inter-jurisdictional fish, and certain marine mammals, as well as for lands and waters that the USFWS administers for the management and protection of those resources.

1.6.1.2 Authority of State Agencies in Wildlife Management in Illinois

In 1925 the Illinois Legislature created the State Department of Conservation, later renamed the IDNR, to oversee the management of wildlife in the state of Illinois. The IDNR is responsible for the management of wildlife on all lands throughout the State of Illinois. The IDNR authority in wildlife management is given under Illinois Complied Statutes (ILCS) Chapter 520 of the Wildlife Code for managing most wildlife species in the State. Article II, 5/2.1 states in part: the regulation and licensing of the taking of wildlife in Illinois are exclusive powers and functions of the state.

1.6.1.3 Compliance with Other Federal and State Statutes

Several federal laws regulate WS' wildlife damage management actions. WS complies with these laws and regulations, and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act (NEPA). All federal actions are subject to NEPA (Public Law 91-190, 42 U.S.C. 4321 et seq.). WS follows the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500 et seq.), USDA NEPA implementing regulations (7 CFR 1b), and the APHIS Implementing Procedures (7 CFR 372) as a part of the decision-making process. NEPA sets forth the requirement that Federal actions with the potential to significantly affect the human environment be evaluated in terms of their impacts for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. Federal activities affecting the physical and biological environment are

regulated, in part, by CEQ through regulations in Title 40, CFR, Parts 1500-1508. In accordance with CEQ and USDA regulations, APHIS NEPA Procedures, as published in the Federal Register (44 CFR 50381-50384) provide guidance to APHIS regarding the NEPA process.

Pursuant to NEPA and CEQ regulations, this EA documents the analysis of a proposed federal action's impact, informs decision-makers and the public of reasonable alternatives, and serves as a decision-aiding mechanism to ensure that the policies and goals of NEPA are infused into Federal agency planning and decision making. An EA is prepared by integrating as many of the natural and social sciences as may be warranted based on the potential effects of the proposed action. The direct, indirect, and cumulative impacts of the proposed action are analyzed. If it is determined that the action may result in significant impacts, an WIS may be prepared.

Endangered Species Act (ESA). It is federal policy, under the ESA, that all federal agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act (Sec. 2(c)). WS conducts Section 7 consultations, as necessary, with other federal agencies to use their expertise 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)).

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; P.L. 92-583, October 27, 1972; 86 Stat. 1280). This law established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to federal approval of their plans, grants would be awarded for implementation purposes. In order to be eligible for federal approval, each state's plan was required to define boundaries of the coastal zone, to identify uses of the area to be regulated by the state, the mechanism (criteria, standards or regulations) for controlling such uses, and broad guidelines for priorities of uses within the coastal zone. In addition, this law established a system of criteria and standards for requiring that federal actions be conducted in a manner consistent with the federally approved plan. The standard for determining consistency varied depending on whether the federal action involved a permit, license, financial assistance, or a federally authorized activity. Wildlife Services will consult with the Illinois Coastal Management Program regarding consistency of the proposed program with the State Coastal Zone Management Plan in accordance with the provisions of the Act.

The Clean Water Act (33 U.S.C. 1344). The Clean Water Act provides regulatory authority and guidelines for the EPA and the U.S. Army Corps of Engineers (USACE) related to wetlands. Several sections of the Clean Water Act pertain to regulating effects on wetlands. Section 101 specifies the objectives of this Act, which are implemented largely through Subchapter III (Standards and Enforcement), Section 301 (Prohibitions). The discharge of dredged or fill material into waters of the United States is subject to permitting specified under Subchapter IV (Permits and Licenses) of this Act. Section 401 (Certification) specifies additional requirements for permit review particularly at the State level. WS consults with appropriate regulatory authorities when wetlands exist in proximity to proposed activities or when such activities might impact wetland areas. Such consultations are designed to determine if any wetlands will be affected by proposed actions.

The Native American Graves and Repatriation Act of 1990. The Native American Graves Protection and Repatriation Act requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal

projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

National Historic Preservation Act (NHPA) of 1966 as amended. The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that have the potential to cause effects on historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the Advisory Council on Historic Preservation (i.e. State Historic Preservation Office, Tribal Historic Preservation Officers), as appropriate. 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.

Each of the white-tailed deer management methods described in this EA that might be used operationally by WS do not cause major ground disturbance, do not cause any physical destruction or damage to property, do not cause any alterations of property, wildlife habitat, or landscapes, and do not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

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

Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations (Environmental Justice and Executive Order 12898). Executive Order 12898 promotes the fair treatment of people of all races, income levels, and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. 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 wildlife damage management methods, tools, and approaches. WS follows standard operating procedure and minimization measures that ensure chemical methods are selective to target individuals or populations, and such use has negligible impacts

on the environment. The WS operational program properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the proposed action may benefit minority or low-income populations by reducing deer damage such as threats to public health and safety.

Protection of Children from Environmental Health and Safety Risks (Executive Order 13045). Children may suffer disproportionately from environmental health and safety risks for many reasons, including their developmental, 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 WDDM program would only occur by using 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.

Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360). This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the Food and Drug Administration.

Controlled Substances Act of 1970 (21 U.S.C. 821 et seq.). This law requires an individual or agency to have a special registration number from the federal Drug Enforcement Administration (DEA) to possess controlled substances, including those that are used in wildlife capture and handling.

Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA). The AMDUCA and its implementing regulations (21 CFR Part 530) establish several requirements for the use of animal drugs, including those used to capture and handle wildlife in rabies management programs. Those requirements are: (1) a valid veterinarian-client-patient relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under the proposed action. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (i.e., a period of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified. WS establishes procedures in each state for administering drugs used in wildlife capture and handling that must be approved by state veterinary authorities in order to comply with this law.

Illinois Food Service Sanitation Code. In some cases, deer harvested by IL WS may be donated to charitable organizations. WS, or the cooperator, will be responsible for delivering the deer to an Illinois Department of Agriculture (DOA) approved meat processor. Section 750.110 of the Illinois Food Service Sanitation Code (77 IL Adm. Code 750) states that: Field-dressed wild game animals donated under the Good Samaritan Food Donor Act shall:

A) Receive a postmortem inspection by a veterinarian, veterinarian's designee, professional biologist or other person familiar with the conditions, parasites and diseases of the species, approved by the regulatory agency that has animal health jurisdiction;

B) Have been field dressed and transported according to requirements specified by the regulatory agency that has animal health jurisdiction; and

C) Be processed according to laws governing meat and poultry as determined by the regulatory agency that has animal health jurisdiction and conducts the inspection program.

Animals found to be unsuitable or undesirable for human consumption will be disposed of in accordance with federal, state, and local regulations.

CHAPTER 2. AFFECTED ENVIRONMENT AND ISSUES

Chapter 2 contains a discussion of the issues, including the issues that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences). Those issues were also used to develop standard operating procedures (SOPs) and Alternatives in Chapter 3. Issues that were identified but were not considered in detail are also discussed with rationale in this chapter. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop minimization measures.

2.1 AFFECTED ENVIRONMENT

The affected environment includes not only the local wildlife populations within the area under consideration, but also native flora, native fauna, and human populations and their respective environments. The areas of the proposed action include farms and areas where deer are causing damage to agriculture through feeding and antler rubbing; public and private properties in urban/suburban areas where deer cause damage to landscaping and natural resources; urban/suburban and rural areas where deer cause damage to property during deer-vehicle collisions and are a threat to human safety through deer-vehicle collisions; and areas where deer have the potential to spread diseases to humans and/or livestock. The area of the proposed action would also include airports and military airbases where deer are a threat to human safety and to property.

2.2 ENVIRONMENTAL STATUS QUO

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 not only the effects of the federal action, but also the potential impacts that occur or will occur in the absence of the federal action by a non-federal entity. This concept is applicable to situations involving federal assistance to reduce damage associated with wildlife species.

For deer management in Illinois, the IDNR has the authority to manage and authorize the taking of deer for damage management purposes. In those situations where a non-federal entity has obtained the appropriate permit or authority, and has already made the decision to remove, depopulate (captive deer), 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' 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 non-target 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.

2.3 ISSUES ANALYZED IN DETAIL

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

1. Effects on white-tailed deer populations, regulated deer hunting, and aesthetics;
2. Effects on non-target and other wildlife species, including threatened and endangered species;
3. Effects on human health and human safety.

2.3.1 Effects on White-tailed Deer Populations

There are concerns that the proposed action or any of the alternatives would result in the reduction of local deer populations or could have a cumulative adverse impact on regional or statewide populations. In Illinois, where deer pose damage problems in various habitats and where populations of damaging species have exceeded acceptable levels, IDNR supports a deer population management strategy of reduction rather than extirpation. In other instances (e.g., at airports), the presence of individual animals in a given locale can present unacceptable damage or risk to local habitats or humans. In these instances, IDNR considers reduction or elimination of risk of damage to be an integral part of wildlife management programs. The extent to which each of the alternatives contributes towards this strategy is considered a positive impact.

2.3.1.1 Effects on Regulated White-tailed Deer Hunting

Some people may be concerned that WS conducted deer removal activities would affect regulated deer hunting by significantly reducing local deer populations. Areas where WS is requested to assist with WDDM are generally areas where hunting is not allowed, even where hunting may be legal in accordance with IDNR regulations. Local ordinances may restrict hunting or firearm use, while landowners may restrict all or some hunting on their own properties. While WS may recommend that land owners utilize hunters to reach their populations goals in certain situations, it is the land owner/manager's prerogative whether or not to allow hunting on their land. Impacts to the deer population, on the whole, will be evaluated under each alternative in Chapter 4.

2.3.1.2 Effects on Aesthetic Values

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 in contact with wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

There is some concern that the proposed action or the alternatives would result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty or the appreciation of beauty. Therefore, aesthetics are truly subjective in nature, dependent on what an observer regards as beautiful and/or desirable.

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife-related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Direct benefits are derived from a user's personal relationship with animals and may take the form of direct consumptive use (using up the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefitting from activities or contributions of animals such as their use in research (Decker and Goff

1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Illinois WS recognizes that all wildlife has aesthetic value and benefit. WS only conducts WDDM at the request of the affected home/property owner or resource manager. If WS received requests from an individual or official for WDDM, WS would address the issues/concerns and consideration would be made to explain the reasons why the individual damage management actions would be necessary. Management actions would be carried out in a humane and professional manner in accordance with applicable local, state and federal regulations/laws.

2.3.2 Effects on Non-target and other Wildlife Species, including Native Flora and Threatened and Endangered Species

There are concerns among members of the public and wildlife professionals, including WS, that there is the potential for control methods used in the proposed action or any of the alternatives to inadvertently capture or harm non-target animals or potentially cause adverse impacts to non-target species populations, particularly T&E species. Special efforts are made to avoid affecting T&E species through biological evaluations of the potential effects and the establishment of SOPs. WS's SOPs include measures intended eliminate or reduce the effects on non-target species populations and are described in other sections of this EA. IDNR's Endangered Species Protection Board has provided a list of both state listed T&E species that occur in Illinois (Appendix C). A current list of federal listed species can be found online (USFWS 2014).

The Endangered Species Act (ESA) states that all federal agencies *"...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* [Sec. 7(a)(1)]. WS conducts Section 7 consultations under the ESA with the U.S. Fish and Wildlife Service (USFWS) to ensure compliance and 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)].

To reduce the risks of adverse effects to non-target species, including T&E species, WS would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of negatively affecting non-target species.

Many property owners experience substantial damage to landscaping and vegetation from deer. These people are concerned whether the proposed action would reduce such damage to more acceptable levels. Some people are also concerned that high deer populations cause excessive damage to the native vegetation and subsequently adversely impact the natural ecosystem and other species of wildlife, including state and federally listed threatened and endangered species, whose habitat is destroyed by deer over-browsing. These people are concerned as to whether the proposed action or any of the alternatives would reduce such damage to acceptable levels.

2.3.3 Effects on Human Health and Human Safety

A common concern is whether the proposed action or any of the alternatives pose an increased threat to public and pet health and safety. In particular, there is concern that the methods of deer removal (e.g., sharpshooting) may be hazardous to people and pets. Another concern is that high deer populations pose a threat to human health and human safety through the potential for deer-vehicle collisions, deer-aircraft collisions, and the spread of disease.

Firearm use is a very sensitive issue that could raise public concern because of public safety issues related to firearms misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an annual firearms safety and use training program prior to the use of firearms in the conduct of official duties (WS Directive 2.615). WS employees are also tested annually through the IDNR Sharpshooter Testing Procedures before they are allowed to remove deer under Deer Population Control Permits issued by the IDNR. 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. Drug testing is also conducted prior to employment and at random intervals throughout employment.

2.4 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.4.1 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 Illinois would meet the NEPA requirements for site specificity. Wildlife damage management falls within the category of federal or other regulatory agency actions in which the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to accurately describe such locations or times in an EA or EIS. Although WS can predict some of the possible locations or types of situations and sites where some kinds of wildlife damage will occur, the program cannot predict the specific locations or times at which affected resource owners will determine a damage problem has become intolerable to the point that they request assistance from WS.

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

In terms of considering cumulative effects, one EA analyzing impacts for the entire State of Illinois will provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination is made through this EA that the proposed action or the other alternatives might have a significant impact on the quality of the human environment, then an EIS would be prepared. Based on previous requests for assistance, the WS program in Illinois would continue to conduct WDDM in a very small area of the state where damage is occurring or likely to occur.

2.4.1 Cost Effectiveness of Deer Damage Management

A formal, monetized cost benefit analysis is not required to comply with the NEPA requirements for EAs. Consideration of this issue may not be the driving factor when developing site-specific management strategies. The cost of management may sometimes be secondary because of overriding environmental, legal, human health, human safety, animal welfare, and/or other concerns. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs. However, the cost effectiveness of methods and the effectiveness of methods are linked. Methods determined to be most

effective to reduce damage and threats to human safety caused by deer and that prove to be the most cost effective would generally receive the greatest application. As part of an integrated approach, evaluation of methods would continually occur to identify those methods that are most effective at resolving damage for specific circumstance where deer are causing damage or pose a threat.

2.4.2 Effects on Human Health from Consumption of Meat Donated by WS

Of recent concern is the potential for lead and other contaminants to be present in meat that has been processed for human consumption. The potential for the spreading of zoonotic diseases in animals processed and donated for human consumption is also a concern. Under the proposed action alternative, meat from deer lethally taken during damage management activities could be donated to charitable organizations for human consumption. The meat from deer lethally removed would be disposed of as directed by the IDNR in the Deer Population Control Permit. WS could recommend the donation or consumption of meat under the technical assistance (TA) only alternative, but would not be directly involved with damage management activities under that alternative.

If WS donates wild meat for human consumption, WS' policies pertaining to the testing or labeling would be followed in order to address potential health concerns. Wild game donated for human consumption may be tested for exposure to substances such as organophosphate and carbamate insecticides, lead, mercury, arsenic, organochlorines, and organic chemicals prior to distribution. The entity selecting the capture/euthanize and donation for charitable consumption program would be responsible for all costs associated with legal and appropriate donation for human consumption.

Stewart and Veverka (2011) documented that white-tailed deer that were shot with lead ammunition in the head or extreme upper neck in sharpshooting situations showed no deposition of lead fragments in the meat of the animals that would have been processed for human consumption. Lower neck shots do frequently experience lead fragmentation in the loin muscle and the authors recommend removing the loins prior to processing to ensure that these fragments were not ingested. WS' personnel are trained to shoot and target the head and upper neck of white-tailed deer when practical.

2.4.3 Effects on Migratory Birds from the Use of Lead (Pb) Ammunition

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to remove deer. As described in Appendix B, the lethal removal of mammals with firearms by WS to alleviate damage or threats could occur using a handgun, rifle, or shotgun. In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996).

The removal of mammals by WS using firearms in Illinois would occur primarily with the use of rifles. However, the use of shotguns or handguns could be employed to remove deer in limited situations. Deer that are removed using firearms would occur within areas where retrieval of carcasses for proper disposal is highly likely (e.g., at an airport or forest preserve). With risks of lead exposure occurring primarily from ingestion of bullet fragments, the retrieval and proper disposal of deer carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead that may be contained within the carcass.

Since those deer removed by WS using firearms could be lethally removed by other entities using the same method in the absence of WS' involvement, WS' assistance with removing deer would not be additive to the environmental status quo. The proficiency training received by WS' employees in firearm use and accuracy would increase the likelihood that deer were lethally removed humanely in situations

that ensure accuracy and that misses occur infrequently, which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. Based on current information, the risks associated with lead projectiles that could be deposited into the environment from WS' activities due to misses, the projectile passing through the carcass, or from deer carcasses that may be irretrievable would be below the level that could pose risk of lead exposure to migratory birds.

2.4.4 WS's Impact on Biodiversity

Illinois WS WDDM is not conducted to eradicate native deer populations. WS operates according to international, federal, and state laws and regulations enacted to ensure species viability. In addition, 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. WS operates on a relatively small percentage of the land area of the state, and the WS take of deer analyzed in this EA is a small portion of the total population and insignificant to the viability and health of the population.

2.4.5 Humaneness of Methods to be Employed

Humaneness, in part, is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife, is an important and very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns, if " ... the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process." Suffering is described as a " . . . highly unpleasant emotional response usually associated with pain and distress." However, suffering " . . . can occur without pain . . . ," and "... pain can occur without suffering . . ." (American Veterinary Medical Association (AVMA) 2013). Because suffering carries with it the implication of a time frame, a case could be made for " . . . little or no suffering where death comes immediately . . ." (CDFG 1991), such as shooting.

Pain obviously occurs in animals, but assessing pain experienced by animals can be challenging (AVMA 2007, CDFG 1991). The AVMA defines pain as being, "that sensation (perception) that results from nerve impulses reaching the cerebral cortex via ascending neural pathways" (AVMA 2013). The key component of this definition is the perception of pain. The AVMA (2013) notes that "pain" should not be used for stimuli, receptors, reflexes, or pathways because these factors may be active without pain perception. For pain to be experienced, the cerebral cortex and subcortical structures must be functional. If the cerebral cortex is nonfunctional because of hypoxia, depression by drugs, electric shock, or concussion, pain is not experienced.

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

AVMA (2013) notes, "While recommendations are made, it is important for those utilizing these recommendations to understand that, in some instances, agents and methods of euthanasia identified as

appropriate for a particular species may not be available or may become less than an ideal choice due to differences in circumstances. Conversely, when settings are atypical, methods normally not considered appropriate may become the method of choice. Under such conditions, the humaneness (or perceived lack thereof) of the method used to bring about the death of an animal may be distinguished from the intent or outcome associated with an act of killing.

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

Illinois 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. SOPs (Section 3.6.1) used to maximize humaneness are listed in this EA. As appropriate, WS euthanizes live animals by methods recommended by the AVMA (2013) 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.

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

2.4.6 WDM Should Not be Taxpayer Responsibility

There may be concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based. Federal, state, and local officials have decided that wildlife damage management should be conducted by appropriating funds. WS was established by Congress as the agency responsible for providing wildlife damage management to the people of the US. Wildlife damage management is an appropriate sphere of activity for government programs, because aspects of wildlife damage management are a government responsibility and authorized by law. In Illinois, funds to implement wildlife damage management activities and programs are derived from a number of sources, including, but not limited to federal, state, county and municipal governments/agencies, private organizations, corporations and individuals, homeowner/property owner associations, and others, under CSAs and/or other agreement documents and processes. A minimal federal appropriation is allotted for the maintenance of a WS program in Illinois. The remainder of the WS program is mostly fee-based. Technical assistance is provided to requesters as part of the federally-funded activities, but the majority of direct management assistance in which WS' employees perform damage management activities is funded through CSAs between the requester and WS.

2.4.7 Global Climate Change/Greenhouse Gas Emissions

The WS program activities that may result from the alternatives would have a negligible effect on atmospheric conditions including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur as a result of any of the alternatives. The alternatives would meet requirements of applicable federal laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance.

CHAPTER 3. ALTERNATIVES

3.1 INTRODUCTION

This chapter consists of six parts: 1) an introduction, 2) description of alternatives considered and analyzed in detail, 3) a description of Integrated Wildlife Damage Management, 4) WDDM methods available for use or recommendation by WS in Illinois, 5) alternatives considered but not in detail with rationale, and 6) SOPs for WDDM.

Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992), and a review of the previous white-tailed deer EA *"An Integrated Wildlife Damage Management Approach for the Management of White-tailed Deer Damage In the State of Illinois."* The three alternatives analyzed in detail are:

Alternative 1 – Integrated Deer Damage Management Program (Proposed Action/No Action)
Alternative 2 – Non-lethal Deer Damage Management only by WS
Alternative 3 – No Deer Damage Management by WS

3.2 ALTERNATIVES CONSIDERED, INCLUDING THE PROPOSED ACTION

3.2.1 Alternative 1. Integrated Deer Damage Management Program (Proposed Action/No Action)

Under this alternative, WS would continue the current program that administers an Integrated Wildlife Damage Management (IWDM) approach to alleviate deer damage to agriculture, property, natural resources, human health, and human safety in Illinois. An IWDM approach would be implemented on all private and public lands of Illinois where a need exists, a request for assistance 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 TA and operational damage management, including non-lethal and lethal management methods, by applying the WS Decision Model (Figure 2, Section 3.3.6) (Slate et al. 1992). When appropriate, habitat modifications, harassment, repellants, and physical exclusion could be recommended and utilized to reduce deer damage. In other situations, deer would be removed as humanely as possible, by sharpshooting or live-capture followed by euthanasia, under permits issued by the IDNR. In determining the damage management strategy, preference would be given to practical and effective non-lethal methods. However, non-lethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of non-lethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. Appendix B describes the methods available for recommendation and use by WS under this alternative. All WDDM would be consistent with other uses of the area and would comply with appropriate federal, state, and local laws and necessary permits.

3.2.2 Alternative 2. Non-lethal Deer Damage Management Only by WS

This alternative would require WS to use and recommend non-lethal methods only to resolve all deer damage problems. Requests for information regarding lethal management approaches would be referred to IDNR, local animal control agencies, or private businesses or organizations. Persons experiencing 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. Property owners or managers may choose to implement WS' non-lethal recommendations on their own or with the assistance of WS, implement lethal methods on their own, or request assistance (non-lethal or lethal) from a private or public entity other than WS. Appendix B describes a number of non-lethal methods available for recommendation and use by WS under this alternative.

3.2.3 Alternative 3. No Deer Damage Management by WS

This alternative would eliminate WS involvement in all WDDM activities. WS would not provide operational WDDM or TA, and requestors of WS services would have to conduct their own WDDM without WS input. Information on WDDM methods would still be available to producers and property owners through other sources such as IDNR, extension service offices, or pest control organizations. Persons experiencing deer damage could continue to resolve damage by employing those methods legally available. All methods described in Appendix B would be available for use by persons experiencing deer damage. Lethal methods require permitting from the IDNR.

3.3 DEER DAMAGE MANAGEMENT STRATEGIES AND METHODOLOGIES AVAILABLE TO WS

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1 and 2. Alternative 3 would terminate both TA and operational WDDM by WS. Appendix B is a more thorough description of the methods that could be used or recommended by WS.

3.3.1 Integrated Wildlife Damage Management

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement the best combination of effective management methods in a cost-effective[2] manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (e.g., no feeding policy), habitat modification (e.g., exclusion), animal behavior modification (e.g., scaring), removal of individual offending animals, local population reduction, or any combination of these techniques, depending on the circumstances of the specific damage problem. WS supports and implements the IWDM approach (WS Directive 2.105) to reduce damage through the WS Decision Model (Slate et al. 1992).

3.3.2 Technical Assistance (TA) Recommendations

TA is information, demonstrations, and advice on available and appropriate wildlife damage management methods. TA is generally provided during on-site visits or verbal consultations with the requester. WS personnel may provide TA such as general information, instructional sessions and demonstrations on available WDDM techniques. TA may include information on the proper use of devices (e.g., pyrotechnics, exclusion devices, etc.), habits and biology, habitat management, exclusion, and animal

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

behavior modification. In some cases, WS provides supplies or materials that are of limited availability for non-WS entities to use. Generally, several management strategies are described to the requestor 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. TA may require substantial effort by WS personnel in the decision making process, but the actual work is the responsibility of the requestor.

Under APHIS NEPA implementing regulations, TA 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.

3.3.3 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 TA 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 conflicts.

3.3.4 Educational Efforts

Education is an important element of WS's program activities because wildlife damage management is about finding "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. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are updated on recent developments in damage management technology, laws and regulations, and agency policies.

3.3.5 Research and Development

The National Wildlife Research Center (NWRC) functions as the research arm of WS by providing scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. NWRC scientists work closely with wildlife managers, researchers, field specialists and others to develop and evaluate wildlife damage management techniques. NWRC scientists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

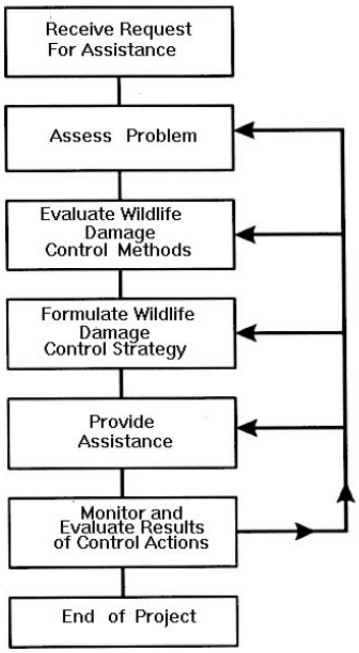

Figure 3. WS Decision Model, as presented by Stale et al. (1992), for developing a strategy to respond to a request for assistance with human-wildlife conflicts.

3.3.6 WS Decision Making

WS personnel use a methodical thought process for

evaluating and responding to damage complaints and requests for assistance that are depicted by the WS Decision Model described by Slate et al. (1992) (Figure 3). WS personnel are frequently contacted after requesters have tried or considered nonlethal methods and found them to be impractical, too costly, or inadequate for reducing damage to an acceptable level. WS personnel assess the problem, and then evaluate the appropriateness and availability (legal and administrative) of other strategies and methods based on biological, economic, and social considerations. Following this evaluation, the methods deemed to be practical for the situation are developed into a management strategy. After the management strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management may be ended. In some cases, continual application of effective wildlife damage management activities is necessary to relieve damage. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the ongoing damage management strategy. The Decision Model is not necessarily a written process, but a mental problem-solving process common to most, if not all professions.

3.3.7 Community Based Selection of a WDDM Program

The WS program in Illinois follows the "co-managerial approach" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS provides TA regarding the biology and ecology of deer and effective, practical, and reasonable methods available to reduce deer damage to local requesters. This includes non-lethal and lethal methods. WS and other state and federal wildlife or wildlife damage management agencies may facilitate discussions at local community meetings when resources are available. Resource owners/managers and others directly affected by deer damage or conflicts in Illinois have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Local authorities decide which methods should be used to solve a wildlife/human conflict. These decision makers include community leaders, private property owners/managers, and public property owners/managers.

The authority that selects damage management actions for the local community might be a mayor, city council, common council, park board, or for a homeowner or civic association would be the President or the President's or Board's appointee. These individuals are often elected residents of the local community who oversee the interests and business of the local community. These individuals would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision making. Identifying the authority that selects damage management actions for local business communities is more complex because the lease may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing board. WS would provide TA to the local community or local business community authority and recommendations to reduce damage. Direct damage management would be provided by WS if requested by the local community authority, funding was provided, and the requested direct damage management was consistent with WS recommendations, policy, and federal and state laws.

3.4 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

3.4.1 Lethal Deer Damage Management Only By WS

Under this alternative, WS would not use or recommend any non-lethal WDDM methods, but would only conduct lethal WDDM. This alternative was eliminated from further analysis because many conflicts with deer can be resolved effectively through non-lethal means. Additionally, lethal methods may not always be available for use due to safety concerns, such as the discharge of firearms.

3.4.1.1 Live Trap and Relocation

Under this alternative WS could live capture deer using cage-type live traps or immobilizing drugs administrated by dart gun and then relocate the captured deer to another area. Due to concerns about spread of disease, specifically CWD, IDNR will not authorize the relocation of deer. Therefore, since IDNR will not authorize the action, WS will not consider it further.

3.4.2 Use of Immunocontraceptives

Since the completion of the 2008 EA, an immunocontraceptive for deer has been developed and federally registered under the trade name GonaCon™. GonaCon™ is an immunocontraceptive vaccine registered for use in female white-tailed deer at least one year of age or older that targets the production of the GnRH hormone. GonaCon™ is not registered for use in Illinois and not authorized for use by IDNR (520 ILCS 5/2.33(g)), so WS will not consider it further at this time.

3.5 STANDARD OPERATING PROCEDURES FOR WILDLIFE DAMAGE MANAGEMENT TECHNIQUES

3.5.1 Standard Operating Procedures (SOPs)

Some key SOPs pertinent to the proposed action and alternatives include:

- The WS' Decision Model thought process is used to identify effective WDDM strategies and their effects.
- Drugs are used according to the Drug Enforcement Administration (DEA), FDA, and WS' program policies and directives and procedures are followed that minimizes pain.
- All controlled substances are registered with DEA or FDA, as appropriate.
- WS' employees would follow approved procedures outlined in WS' Field Manual for the Operational Use of Immobilizing and Euthanizing Drugs (Johnson et al. 2001).
- WS' employees that use controlled substances are trained to use each material and are certified to use controlled substances under Agency certification program.
- Controlled substance use, storage, and disposal conform to label instruction and other applicable laws and regulations, and Executive Order 12898.
- Material Safety Data Sheets for controlled substances are provided to all WS' personnel involved with specific WDM activities.
- Research is being conducted to improve WDDM methods and strategies so as to increase selectivity for target species, to develop effective non-lethal control methods, and to evaluate non-target hazards and environmental effects.
- Management actions would be directed toward localized populations or groups and/or individual offending animals, dependent on the magnitude of the problem.

3.5.2 Additional Standard Operating Procedures Specific to the Issues

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

Effects on Target Deer Populations, Regulated Hunting, and Aesthetics

- WS' take is monitored by comparing numbers of deer killed with overall populations or trends in populations to assure the magnitude of take is maintained below the level that would cause significant adverse effects to the viability of populations.
- Euthanasia methods approved by the AVMA that cause minimal pain are used as often as practical.
- Whenever practicable, WS' personnel perform components of deer removal activities, such as shooting and euthanizing, away from public view.
- In addition, deer which are transported after being killed are concealed from public view when they must be transported in areas of human habitation, in an effort to reduce adverse effects on the aesthetic quality of the environment.

Effects on Non-target Wildlife, Including T&E Species

- WS' personnel are trained and experienced to select the most appropriate method for removing deer causing damages and excluding non-targets.
- WS uses methods that are highly selective (e.g., shooting) or methods that allow for the release of any non-target unharmed (e.g., live traps). WS has policy mandating traps be checked at designated intervals to reduce the possibility of non-target take.

Effects on Human Health and Human Safety

- WS' personnel are trained and supervised in the use of WDDM methods, including firearms, traps, and immobilization drugs to ensure that they are used properly and according to policy. WS' personnel using firearms will routinely receive firearms safety training according to WS' policy.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information for making informed decisions on the WDDM program outlined in Chapter 1, and the issues and affected environment discussed in Chapter 2. This Chapter consists of: 1) analysis of environmental consequences, 2) analysis of each alternative against the issues considered in detail, and 3) summary of WS's impacts. The environmental consequences of each alternative are analyzed in comparison with the no action alternative (Alternative 1) to determine if the real or potential effects would be greater, lesser, or the same (Table 2).

The No Action alternative is a procedural NEPA requirement (40 CFR 1502.14(d)) and is a viable and reasonable alternative that could be selected and serves as a baseline for comparison with the other alternatives. The No Action Alternative, as defined here, is consistent with the Council on Environmental Quality (CEQ) (1981).

The following resource values within the state are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, visual resources, air quality, prime and unique farmlands, timber, and range. These resources will not be analyzed further.

Cumulative Effects: Cumulative effects are discussed in relationship to each of the alternatives analyzed, with emphasis on potential cumulative effects from methods employed, and including summary analyses of potential cumulative impacts to target and non-target species, including T&E species.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

4.1 Alternative 1. Integrated Deer Damage Management Program (Proposed Action/No Action)

4.1.1 Effects on White-tailed Deer Populations

The current program removes only a very small number of deer from the statewide population in Illinois. While annual take will likely be much lower, Illinois WS expects that no more than 3,000 deer would be lethally removed annually under permits issued by the IDNR while conducting WS direct damage management activities. Therefore, a maximum take of 3,000 deer was used to analyze WS potential impacts to the statewide deer population in Illinois.

<u>White-tailed Deer Population Analysis</u>

According to IDNR, white-tailed deer are found in every county in Illinois. Their highest densities are associated with wooded areas near watersheds along major rivers, though urban and suburban areas may have very high densities as well. Deer breed from October through January, with gestation lasting approximately seven months. Mature does with good nutrition will often have twins or triplets, while quadruplets are rare but possible. This means that in general, deer populations can double in size every other year (IDNR 2014).

The IDNR is responsible for the management of resident, protected wildlife species in Illinois, and deer are classified as game mammals. IDNR collects and compiles information on white-tailed deer population trends and uses this information to manage deer populations. Over the past several years, the

annual hunter harvest has ranged from 149,569 to 203,105 deer with an average of 184,820 deer harvested per year.

The number of deer taken by WS, taken by non-WS personnel under permits issued by the IDNR, and harvested by hunters in Illinois is illustrated in Table 3 (Jones, M. IDNR, Pers Comm. 2014). The maximum number of deer removed by WS in any year was 1,279 deer. WS defines magnitude as a measure of the number of animals lethally removed in relation to their abundance. Using the harvest data and the potential annual lethal removal of up to 3,000 deer by WS, the magnitude is considered low for WS' proposed deer removal. Thus, cumulative take will have had a negligible impact on the statewide deer population as WS' take is not expected to exceed 3% of the other forms regulated harvest (Jones, M. IDNR, Pers. Comm. 2014).

Table 1. Deer Harvest Data for Hunters, Depredation Permits, and WS Take in Illinois from 2008-2013.

IDNR Season Harvest Entity	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
# Taken During State Regulated Harvest Season	199,611	188,901	189,634	182,270	181,451	180,811
# Taken Under IDNR Depredation Permits[3]	3,494	3,872	2,418	3,767	3,932	2,501
Total Harvest	203,105	192,773	192,052	186,037	185,383	183,312
WS Take in Illinois	1,210	1,240	1,090	1,230	1,279	1,181
WS Take as % of Total Harvest	0.60%	0.64%	0.57%	0.66%	0.69%	0.64%
WS Proposed Take (3,000) as % of Total Harvest	1.48%	1.56%	1.56%	1.61%	1.62%	1.64%

Although the deer management program is not expected to have a substantial impact on deer populations, there may be situations, such as deer removal from urbanized locations or airports that have deer contained within a formidable fence, where very small and localized populations are substantially reduced. Such actions would only be conducted in accordance with landowner management objectives and under authorization by the IDNR.

Deer removal efforts may also be conducted to manage herd health. The removal of diseased, free-ranging deer would ultimately make for a healthier population where deer would readily re-establish in locations where habitat exists. Successful suppression of deer diseases that are easily transmitted would benefit deer populations in the long term and would protect the interests of concerned groups (hunters, wildlife watchers, wildlife managers, and captive cervid owners) (WDNR 2003). Although hunters do not typically find government culling popular, recent research has demonstrated evidence that culling localized deer populations can maintain low disease prevalence and minimize impacts to recreational deer harvest (Manjerovic et al. 2014). Similarly, WS may be asked to assist with the depopulation of captive

[3] This number includes WS' take.

deer herds where CWD or other diseases are a concern to regulatory agencies. Such removals would be conducted at the request of IDNR and/or the appropriate management authority under appropriate authorizations and permits. Complete removal of a captive deer herd would not impact the statewide population of wild, free-ranging deer as captive herds are typically isolated.

Effects on Aesthetic Values

Those who routinely view or feed[4] individual animals would likely be disturbed by removal of those deer under the current program. WS is aware of such concerns and takes these concerns into consideration when developing site-specific management plans. WS may be able to mitigate such concerns by leaving certain animals that have been identified by interested individuals.

Some members of the public have expressed opposition to the killing of any deer. Under this Proposed Action Alternative, some lethal control of deer would occur and these persons would be opposed. However, many persons who voice opposition have no direct connection or opportunity to view or enjoy the particular deer that would be killed by WS' lethal control activities. Lethal control actions would generally be restricted to local sites and to small, unsubstantial percentages of overall populations. Therefore, the species subjected to limited lethal control actions would remain common and abundant and would, therefore, continue to remain available for viewing by persons with that interest.

Damage to property would be expected to decrease under this alternative since all available damage management methods and strategies would be available for WS use and consideration.

Public reaction would be variable and mixed because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to reduce conflicts/problems between humans and wildlife. The IWDM approach, which includes non-lethal and lethal methods as appropriate, provides relief from damage or threats to human health or safety to those people who would have no relief from such damage or threats if non-lethal methods were ineffective or impractical. Many people directly affected by problems and threats to human health or safety caused by deer insist upon their removal from the property or public location when the wildlife acceptance capacity is reached or exceeded. Some people will have the opinion that deer should be captured and relocated to a rural area to alleviate damage or threats to human health or safety. Some people would strongly oppose removal of the deer regardless of the amount of damage. Individuals not directly affected by the threats or damage may be supportive, neutral, or totally opposed to any removal of deer from specific locations or sites. Some people that totally oppose lethal damage management feel that deer should never be killed and want WS to teach tolerance for deer damage and threats to public and pet health or safety.

Effects on Regulated White-tailed Deer Hunting

Lethal removal of deer by WS under the Proposed Action would only occur after a permit has been issued by the IDNR to remove deer that are causing damage. This activity would result in reduced deer densities on and adjacent to project areas and may reduce densities in some small portions of some 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 minimized due to:

[4] Illinois Administrative Code Title 17 Section 652.40 states that it is illegal to "make available food, salt, mineral blocks, or other products for ingestion by wild deer or other wildlife in areas where wild deer are present", though there are some exemptions.

- The number of deer expected to be lethally taken by WS is minimal (< 2.0%) when compared to the number taken by hunters across the state.
- The number of deer expected to be taken by WS would not cause a statewide deer population reduction.
- WDDM often takes place in areas where hunting is not allowed due to concerns related to human safety (e.g., urban parks/preserves).

In most cases where WS conducts deer removal projects, the landowners or land administrators have not permitted regulated deer hunting due to safety restrictions. This would have only a minimal impact on deer hunting, since the land was not accessible to hunters. In fact, it is possible that WS' activities could push non-harvested deer from restricted sites into locations accessible to hunters. WS may recommend regulated hunting to landowners, but it is ultimately the landowner's decision as to what methods of deer damage management they want to employ on their land. In cases where WS is conducting captive herd depopulation for disease reasons, removals would not affect hunter opportunities to harvest free-ranging deer, and may prevent the spread of disease to wild populations.

4.1.2 Effects on Non-target and Other Wildlife Species, Including Native Flora and Threatened and Endangered Species

WS personnel are trained and experienced to select the most appropriate tools and methods for taking target animals and excluding non-targets. Methods proposed for use by WS for deer management are highly selective, especially considering WS's use of advanced technology, such as Forward Looking Infrared (FLIR) and night vision. Use of live-capture devices would allow for release of non-target individuals unharmed. WS take of non-target species is expected to be minimal or nonexistent. Illinois WS has taken no non-target species while conducting WDDM during the review period (FY08-FY12). Other wildlife populations would not be negatively affected, except for the occasional scaring effect from the sound of gunshots. In these cases, birds and other mammals may temporarily leave the immediate vicinity of shooting, but would most likely return after conclusion of the action.

WS has reviewed the list of T&E species in Illinois (USFWS 2014) and has determined that the Proposed Action will have no effect on federal T&E species or their critical habitat in Illinois. The methods used and locations of WDDM do not directly interfere with the viability of any listed species in Illinois. 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. Engeman et al. (2014) documented the success that the WS deer management program had on the browse rates of sensitive species in forest preserves around Chicago. Browse rate of sensitive species were reduced as much as 54% subsequent to deer herd reduction (Engeman et al. 2014). Recovery plans for five federally listed species have deer browsing listed as a threat to these species (Rogner 2002). This alternative has the greatest potential of reducing the damaging effects that deer are having on native flora and fauna including the recovery of state and federally listed T&E species to acceptable levels since all available WDDM methods, tools, and methodology would be available for consideration and use.

4.1.3 Effects on Human Health and Human Safety

The only pesticides that might be used or recommended by WS would be non-lethal repellents such Hinder®, Deer Away®, and others that are registered with the Illinois Department of Agriculture (DOA). Such chemicals must undergo rigorous testing and research to prove safety, and low environmental risks before they would be registered by the EPA or FDA. Any operational use of chemical repellents would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations which are established to avoid adverse effects on the environment. Following labeling requirements and use

restrictions are a built-in SOP that would assure that use of registered chemical products would avoid significant adverse effects on human health. Since these methods could be used without WS' assistance, use by WS would not contribute to any adverse cumulative impacts.

Drugs used in capturing, sedating, handling, and euthanizing deer for wildlife management purposes may include ketamine hydrochloride, a mixture of tiletamine and zolazepam (Telazol), xylazine (Rompun), sodium pentabarbitol, potassium chloride, Yohimbine, antibiotics, and others. WS would adhere to all applicable requirements of the AMDUCA to prevent any significant adverse impacts on human health with regard to this issue. Standard operating procedures for the use of drugs would include:

- All drugs used in capturing and handling wildlife would be under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and WS. As determined on a state-level basis by these veterinary authorities (as allowed by AMDUCA), wildlife hazard management programs may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting season for the deer to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. In some instances, animals collected for control purposes would be euthanized when they are captured within a certain specified time period prior to the legal hunting season to avoid the chance that they would be consumed as food while still potentially having immobilizing drugs in their systems. Deer that have been drugged and released would be ear tagged or otherwise marked to alert hunters that they should contact state officials before consuming the animal.

- Activities involving the handling and administering drugs, drugs selected for use, animal marking systems, and the fate of any animals that must receive drugs at times during or close to scheduled hunting seasons would be coordinated with the IDNR.

By following these procedures, the proposed action would avoid any significant impacts on human health with regard to this issue. When requested, WS may work to reduce deer populations to reduce deer-vehicle collisions. This alternative would provide the most efficient means of providing relief for deer-vehicle collisions.

WS' lethal methods pose minimal or no threat to human or pet health or safety. Firearm safety precautions are followed by WS when conducting damage management and WS complies with all laws and regulations governing the lawful use of firearms. WS' personnel are trained and given refresher courses to maintain awareness of firearm safety and handling as prescribed by WS' policy. 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.

This alternative has the greatest potential of reducing threats to public health and safety since all available WDDM methods, tools, and methodology would be available for consideration and use.

4.2 Alternative 2. Non-lethal Deer Damage Management Only by WS

4.2.1 Effects on White-tailed Deer Populations

Only non-lethal methods would be used by WS to manage deer damage under this alternative. Although the methods employed by WS would not be intended to result in the death of the animal, some methods,

such as live-capture and anesthesia can result in injury or death of target animals despite the training and best efforts of management personnel. This type of take is likely to be limited to a few individuals and would not adversely impact deer populations.

Although WS lethal take of deer would not occur, it is likely that without WS conducting some level of lethal WDDM activities, private WDDM efforts would increase. Cumulative impacts on deer populations would be variable depending upon actions taken by affected landowners/resource managers and the level of training and experience of the individuals conducting the WDDM.

Resource owners may also obtain special permits from the IDNR to allow them to shoot deer outside of the regular hunting season and in those areas where regulated hunting is not allowed. Deer populations could continue to increase where hunting pressure is low or when an insufficient number of deer are removed under special permits issued by IDNR. Some local populations of deer would temporarily decline or stabilize where hunting pressure and permitted removal activities were adequate. Some resource owners may take illegal, unsafe, or environmentally harmful action against local populations of deer out of frustration or ignorance.

Effects on Aesthetic Values

The impacts of this alternative to stakeholders would be variable depending upon the effectiveness of non-lethal methods, the damage management efforts employed by resource owners, their values toward deer, and compassion for their neighbors. Some people who oppose lethal control of wildlife by the government, but are tolerant of government involvement in non-lethal wildlife damage management would favor this alternative. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct WDDM activities similar to those that would no longer be conducted by WS, which means the cumulative effects would be similar to the Proposed Action Alternative.

There is also the possibility that deer damage may not be reduced, regardless of the impacts on the deer population. The effectiveness of this alternative without IWMD is unknown, and could result in lower aesthetic quality where continuing deer damage is undesirable. If non-lethal damage control efforts are ineffective, some people would have a negative view of the absence of native plants, the fencing/netting around ornamental plants and gardens and possibly the higher number of deer carcasses along the roadways. Others would oppose this alternative because they believe resource owners would use illegal, inhumane, or environmentally unsafe methods to mitigate their damages on their own.

Effects on Regulated White-tailed Deer Hunting.

WS would have no direct impact on regulated deer hunting since WS would not lethally remove deer under this alternative. However, resource owners may remove deer under special permits issued by IDNR resulting in impacts similar to the proposed action. Cumulative impacts on regulated harvest would be variable depending upon actions taken by affected landowners/resource managers and the level of training and experience of the individuals removing deer via special permits.

4.2.2 Effects on Plants and Other Wildlife Species, Including T&E Species

WS will not have any direct impact on non-target species. WS take of non-target animals would be less than that of the proposed action because no lethal control actions would be taken by WS. Non-target species are usually not affected by WS's non-lethal management methods, except for the occasional

scaring from harassment devices. In these cases, affected non-target wildlife may temporarily leave the immediate vicinity of scaring, but would most likely return after conclusion of the action. Risks to T&E species from increased private efforts to address damage management problems will vary depending upon the training and level of experience of the individual conducting the work. As stated above, frustrated individuals may use unsafe or illegal methods which may increase risks to other listed species. Risks to T&E species may be lower with this alternative than with Alternative 3 because WS could still advise individuals as to the potential presence of state and federally-listed species in their area and could facilitate consultation with the appropriate agency.

Although technical support might lead to more selective use of control methods by private parties, private efforts to reduce or prevent depredations could still result in less experienced persons implementing control methods. This may result in greater risks to non-target wildlife than under the proposed action. It is hypothetically possible that frustration caused by difficulties in addressing wildlife damage problems could lead to use of illegal methods which could result in unknown risks to non-target species, the environment, or other humans. While WS could only provide non-lethal assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to the proposed action alternative but with potentially greater associated risks.

4.2.3 Effects on Human Health and Human Safety

The effects of WS use of non-lethal methods would be similar to those described under the proposed action. In those situations where non-lethal methods are effective at reducing threats to human health and human safety, impacts would be similar to the proposed action. In those situations where non-lethal methods were ineffective, impacts to human health and human safety could possibly remain the same or increase resulting in impacts similar to Alternative 3. Additionally, resource owners may attempt to lethally resolve deer damage problems through illegal use of methods, without WS expertise. In these situations there may be some risk to human or pet health or safety from improper or inexperienced use of these methods.

4.3 Alternative 3. No Deer Damage Management by WS

4.3.1 Effects on White-tailed Deer Populations

No WDDM activities would be conducted by WS under this alternative. The effects on deer populations could be reduced, stay the same, or increased depending on actions taken by others. Some resource owners may kill deer, or allow other hunters access to kill deer during the legal harvest season. Resource owners may also obtain special permits from the IDNR to allow the removal of deer outside of the regular season and in those areas where regulated hunting is not allowed. Deer populations could continue to increase where hunting pressure was low or when an insufficient number of deer are removed under special permits issued by IDNR. Some local populations of deer could temporarily decline or stabilize where hunting pressure and permitted removal activities were adequate. Some resource owners may take illegal, unsafe, or environmentally harmful action against local populations of deer out of frustration or ignorance. While WS would provide no assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to the proposed action alternative. With regard to captive deer herds infected with CWD, less experienced personnel may have difficulty removing all deer in a fenced facility as this typically requires specialized equipment and expertise.

<u>Effects on Aesthetic Values</u>

The impacts of this alternative to stakeholders would be variable depending on their values towards wildlife and compassion for their neighbors. Resource owners receiving damage from deer would likely

strongly oppose this alternative because they would bear the damage caused by deer. Some individuals would prefer this alternative because some groups believe it is morally wrong to kill or use animals for any reason and the damage to plants or landscaping is an acceptable cost for the benefit of potentially viewing more wildlife. Some people would support this alternative because they enjoy seeing deer, or having deer nearby. However, while WS would take no action under this alternative, other individuals or entities could, and likely would, conduct WDDM activities in the absence of WS.

Effects on Regulated White-tailed Deer Hunting

WS would have no direct impact on regulated deer hunting. However, resource owners may still remove deer under the same permits issued by IDNR, resulting in impacts similar to the proposed action. Cumulative impacts on regulated harvest would be variable depending upon actions taken by affected landowners/resource managers and the level of training and experience of the individuals removing deer via special permits.

4.3.2 Effects on plants and other wildlife species, including T&E Species

Alternative 3 would not allow any WS WDDM in Illinois; therefore non-target species would not be taken by WS under this alternative. Private efforts to reduce or prevent damage could increase which could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than under the proposed action. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of mechanical methods and chemical toxicants which could impact local non-target species populations, including some T&E species.

4.3.3 Effects on Human Health and/or Human Safety

Concerns about human health risks from WS's use of lethal methods would be alleviated because no such use would occur. Private efforts to reduce or prevent damage would be expected to increase. Risks to human health and/or human safety from lethal methods will be variable depending upon the training and experience of the individual conducting the WDDM. Hazards to humans and pets could be greater under this alternative if other individuals do not receive the same level of firearms and chemical immobilization training as WS personnel. It is hypothetically possible that frustration caused by the inability to alleviate deer damage could lead to illegal use of certain methods that pose hazards to pets and humans.

Table 2 summarizes the expected impacts of each of the alternatives on each of the issues.

Table 2. Comparison of Issues/Impacts and Alternatives

Issues/Impacts	***Alternative 1***	***Alternative 2***	***Alternative 3***
Effects on white-tailed deer populations, regulated hunting, and aesthetics	Local populations could be reduced and sustained at a lower level. No effect on statewide deer population, hunting opportunities, or long-term opportunities to view deer.	Populations would not be affected by WS. If resource owner conducts deer management, effect would be similar to Alternative 1.	Populations would not be affected by WS. If resource owner conducts deer management, effect would be similar to Alternative 1.
Effects on plants and other wildlife species, including 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 non-lethal methods are effective.	No impact by WS. Positive impact to those species being negatively impacted by deer if resource owner implements damage reduction program.

Effects on Human Health and Human Safety	No probable direct negative effect. Positive effect from reduced deer strikes and disease transmission.	No probable direct negative effect. Risks could be greater if inexperienced entities attempt lethal methods.	No impact by WS. Probable increase in risks associated from deer strikes and disease transmission. Risks could be greater if inexperienced entities attempt lethal methods.

4.4 CUMULATIVE IMPACTS

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

No significant cumulative environmental impacts are expected from any of the three alternatives. Under the Proposed Action, the lethal removal of deer would not have a significant impact on overall deer populations in Illinois, but some local reductions may occur. Although some persons will likely be opposed to WS' participation in WDDM activities, the analysis in this EA indicates that WS IWDM program will not result in significant cumulative adverse impacts on the quality of the human environment.

4.4.1 Cumulative Impacts on Target, Non-target, and T&E Wildlife Species

Evaluation of the WDDM program activities relative to target, non-target and T&E species indicated that program activities will likely have no cumulative adverse effects on wildlife populations in Illinois. WDDM program actions would be occurring simultaneously, over time, with other natural processes and human generated changes that are currently taking place. Those activities include, but are not limited to:

- Natural mortality of target, non-target, and T&E species
- Human-induced mortality of target and non-target species through hunting, deer damage management, disease, and other activities
- Human and naturally induced alterations of wildlife habitat
- Annual and perennial cycles in wildlife population densities

All these factors play a role in the dynamics of wildlife populations. In many circumstances, WDDM is necessary to reduce damage when some or all of those elements have contrived to elevate deer populations or place deer at a juncture to cause damage to resources. WS' actions taken to minimize or eliminate damage are constrained as to scope, duration and intensity, for the purpose of minimizing or avoiding impacts to the environment. WS evaluates damage occurring, including other affected elements and the dynamics of the damaging species; determines appropriate strategies to minimize effects on environmental elements; applies damage management actions; and subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992). This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target, non-target, and T&E species.

The presence of hemorrhagic disease (HD) in Illinois and its impact on the deer population is a concern to some hunters in Illinois. According to the Southeastern Cooperative Wildlife Disease Study, deer death losses to HD usually represent less than 25% of the local population, but may reach 50% or more in some

situations. However, there is no evidence that repeated HD outbreaks are a limiting factor for population growth. "Although die-offs of white-tailed deer due to hemorrhagic disease often cause alarm, past experiences have shown that mortality will not decimate local deer populations and that the outbreak will be curtailed by the onset of cold weather" (Southeastern Cooperative Wildlife Disease Study 2013). In 2013, 1,220 deer mortalities attributed to HD were reported in Illinois. This was down considerably from the 2,968 deer mortalities reported as probable HD mortalities in 2012. However, the high number of mortalities in 2012 (2,968) only represents 1.6% of the lowest hunter harvest in the state during the period of review of this document. Because WS only removes deer under permits issued by the IDNR, the effects of disease outbreak and damage management needs will likely be considered by the IDNR before permits are issued.

No cumulative adverse impacts on target and non-target wildlife are expected from WS' WDDM actions based on the following considerations:

1. Historical outcomes of WS' WDDM programs on wildlife

No cumulative adverse effects have been identified for target, non-target, and T&E species identified in this EA as a result of WDDM program activities implemented over time. WS continues to implement an integrated damage management program that adapts to the damage situation and the number of deer involved with causing the damage. WS only targets deer causing damage and only after a request for assistance is received. All program activities are coordinated with appropriate federal, state, and local entities to ensure WS' activities do not adversely impact the populations of any native wildlife species.

2. SOP strategies built into WS' WDDM program

SOPs are designed to reduce the potential negative effects of WS' WDDM actions on wildlife, and are tailored to respond to changes in wildlife populations which could result from unforeseen environmental changes. This would include those changes occurring from sources other than WS. Alterations in WDDM programs are defined through SOPs, and implementation is insured through monitoring, in accordance with the WS' Decision Model (Slate et al. 1992).

3. Current status of potentially affected wildlife species

Natural and human-induced mortality patterns for target, non-target, and T&E species are expected to remain essentially unchanged in Illinois. As a result, no cumulative adverse effects are expected from repetitive WDDM programs over time in the fairly static set of conditions currently affecting deer or other wildlife in Illinois.

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to lethally remove mammals. As described in Appendix B, the lethal removal of mammal species with firearms by WS to alleviate damage or threats would occur using a handgun, rifle, or shotgun. In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996). Hunt et al. (2009) also found that deer killed with rifles using lead bullets might pose a risk of lead exposure to scavengers from ingestion of lead fragments in the carcass.

To reduce risks to human safety and property damage from bullets passing through deer, the use of firearms is applied in such a way (e.g., caliber, bullet weight, distance) to ensure there is a safe backstop

behind the target animal, such as an embankment. When using firearms, the retrieval of carcasses for proper disposal is highly likely. With risks of lead exposure occurring primarily from ingestion of shot and bullet fragments, the retrieval and proper disposal of deer carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead.

However, deposition of lead into soil could occur if, during the use of firearms, the projectile(s) pass through, if misses occur, or if the carcass is not retrieved. In general, hunting tends to spread lead over wide areas and at low concentrations (Craig et al. 1999). Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, other concerns are that lead from bullets or shot deposited in soil from shooting activities could lead to contamination of water, either ground water or surface water, from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "transport" readily in surface water when soils were neutral or slightly alkaline in pH (i.e., not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "fall zones," the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot where it was believed the lead contamination was due to runoff from the parking lot, and not from the shooting range areas. The study also indicated that even when lead shot is highly accumulated in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water further downstream. Muscle samples from two species of fish collected in the water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil around the impact areas were far below the "action level" of 15 parts per billion as defined by the EPA (i.e., requiring action to treat the water to remove lead). The study found that the dissolution (i.e., capability of dissolving in water) of lead declines when lead oxides form on the surface areas of the spent bullets and fragments (Craig et al. 1999). Therefore, the transport of lead from bullets or shot distributed across the landscape is reduced once the bullets and shot form crusty lead oxide deposits on their surfaces, which serves to naturally further reduce the potential for ground or surface water contamination (Craig et al. 1999). Those studies suggest that, given the very low amount of lead being deposited and the concentrations that would occur from WS' activities using firearms, as well as most other forms of dry land small game hunting in general, lead contamination of water from such sources would be minimal to nonexistent.

WS' assistance with removing deer would not be additive to the environmental status quo since those deer removed by WS using firearms could be lethally removed by the landowners or other entities receiving a similar permit from the IDNR in the absence of WS' involvement. The amount of lead deposited into the environment may be lowered by WS' involvement in activities. The proficiency training received by WS' employees in firearm use and accuracy increases the likelihood that deer are lethally removed in a humane manner in situations that ensure accuracy and that misses occur infrequently which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement ensures carcasses would be retrieved and disposed of properly to limit the availability of lead in the environment and ensures carcasses are removed from the environment to prevent the ingestion of lead by scavengers. Based on current information, the risks associated with lead bullets or shot that are deposited into the environment from WS' activities due to

misses, the bullet or shot passing through the carcass, or from carcasses that may be irretrievable, would be below any level that would pose any risk from exposure or significant contamination of water.

4.4.2 Summary of Cumulative Impacts

No significant cumulative environmental impacts are expected from any of the three alternatives including the Proposed Action. WS' management activities will not adversely impact protected flora and fauna in Illinois, including T&E species. Under the Proposed Action, the lethal removal of deer by WS would not have a significant impact on overall deer populations in Illinois, but some local reductions may occur.

No risk to human health or human safety is expected when services are provided and accepted by requesting individuals in Alternative 1 since only trained and experienced wildlife biologists and wildlife specialists would conduct and recommend WDDM methods. There is a potential slight increased risk to human safety when persons who reject WS' assistance and recommendations in Alternatives 1 and Alternative 2 and conduct their own WDDM activities, and when no WS' assistance is provided in Alternative 3. In all three alternatives, however, it would not be to the point that the impacts would be significant.

Under Alternative 3, management actions taken by non-federal entities would be considered the environmental status quo. In those situations where a non-federal cooperator has already made the decision to remove or otherwise manage mammals to stop damage with or without WS' assistance in Alternative 1, WS' participation in carrying out the action will not affect the environmental status quo. In some situations, dependent upon the skills and abilities of the non-federal entity, 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.

Although some persons will likely be opposed to WS' participation in management activities to reduce mammal damage, the analysis in this EA indicates that WS' WDDM program will not result in significant cumulative adverse impacts on the quality of the human environment.

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APPENDIX A: LITERATURE CITED

AVMA 2001. 2000 report of the panel on euthanasia. Journal of the American Veterinary Medical Association. 218:669-696.

AVMA 2007. AVMA Guidelines on Euthanasia. 2007 report of the panel on euthanasia. AVMA, Schaumburg, IL.

AVMA 2013. AVMA Guidelines for the Euthanasia of Animals: 2013 Edition. AVMA, Schaumburg, IL. 102 pp.

Bishop, R. C. 1987. Economic values defined. Pages 24 -33 *in* D. J. Decker and G. R. Goff, eds. Valuing wildlife: economic and social perspectives. Westview Press, Boulder, CO. 424 p.

Blackley, Brian (editor). 2001. Jet Crashes, Burns at Airport. The Messenger. Troy, Alabama.

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.

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. 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., 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.

Craig, J.R., J.D. Rimstidt, C.A. Bonnaffon, T.K. Collins, and P.F. ScanIon. 1999. Surface water transport of lead at a shooting range. Bulletin of Environmental Contamination and Toxicology 63:312-319.

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.

Decker, D. J., K. M. Loconti-Lee, And N. A. Connelly. 1990. Incidence and costs of deer-related vehicular accidents in Tomkins County, New York. Human Dimensions Research Unit Publication 89-7. Cornell University Department of Natural Resources, Ithaca, New York, USA.

Decker, D. J., and K. G. Purdy. 1988. Toward a concept of wildlife acceptance capacity in wildlife management. Wildl. Soc. Bull. 16:53-57.

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

Decker, D.J., and L.C. Chase. 1997. Human dimensions of living with wildlife – a management challenge for the 21st century. Wildlife Society Bulletin 25:788-795.

Devault, T. A., J. L. Belant, B. F. Blackwell, and T. W. Seamans. 2011. Interspecific Variation in Wildlife Hazards to Aircraft: Implications for Airport Wildlife Management. Wildlife Society Bulletin 35(4): 394–402.

DiTommaso A, Morris SH, Parker JD, Cone CL, Agrawal AA (2014) Deer Browsing Delays Succession by Altering Aboveground Vegetation and Belowground Seed Banks. PLoS ONE 9(3): e91155. doi:10.1371/journal.pone.0091155

Dolbeer, R.A., S.E. Wright, J. Weller, and M.J. Beiger. 2013. Wildlife Strikes to Civil Aircraft in the United States, 1990–2012. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Serial Report No. 19, Washington, D.C..

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 Agri., APHIS, ADC, Denver Wildl. Res. Cent. Sandusky, OH. Interim Report DTFA01-91-A-02004. 38pp.

Engeman, R., T. Guerrant, G. Dunn, S. Beckerman, C. Anchor. 2014. Benefits to rare plants and highway safety from annual population reductions of a “native invader”, white-tailed deer, in a Chicago-area woodland. Environ Sci Pollut Res (2014) 21:1592-1597.

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. 19th Vertebr. Pest Conf. (T.P. Salmon & A.C. Crabb, eds.)

FAA (Federal Aviation Administration). 1997. Hazardous Wildlife attractants on or Near Airports. Advisory Circular No. 150/5200-33. 14 pp.

FAA. 2001. Deer Aircraft Hazard. Certalert No. 01-01. 1p.

FAA. 2013. National Wildlife Strike Database. Accessed online February 11, 2013: http://wildlife-mitigation.tc.faa.gov/wildlife/database.aspx.

Horsley, S., S. Stout, and S. DeCalesta. 2003. White-tailed deer Impact on the Vegetation Dynamics of A Northern Hardwood Forest. Ecological Application, 13 (1), 2003, pp. 98-118.

Hunt, W.H., W. Burnham, C.N. Parish, K.K. Burnham, B. Mutch, and J.L. Oaks. 2009. Bullet fragments in deer remains: Implications for lead exposure in avian scavengers. Wildlife Society Bulletin 34:167-170.

IDNR. 2014. Revising Illinois Deer Management Objectives. Online. http://www.dnr.illinois.gov/conservation/wildlife/Documents/Revising%20Illinois%20Deer%20Management%20Objectives.pdf.

_____. 2014. Living with White-tailed Deer in Illinois. Natural History. http://web.extension.illinois.edu/deer/naturalhistory.cfm. Accessed April 29, 2014.

_____. 2013a. EHD Hits Illinois Again This Year; Not As Bad As Last Year. Online. http://www.dnr.illinois.gov/news/Pages/EHDHitsIllinoisAgainThisYear;NotAsBadAsLastYear.aspx

_____. 2013b. Illinois Deer Management Program Review. Posters. Online. http://www.dnr.illinois.gov/conservation/wildlife/documents/posters.pdf

_____. 2013c. Illinois Chronic Wasting Disease 2012-2013 Surveillance and Management Annual Summary. Online. http://www.dnr.illinois.gov/programs/CWD/Documents/CWDAnnualReport20122013.pdf

_____. 2012. 2011-2012. Chronic Wasting Disease Surveillane and Management Annual Summary. Online. http://www.dnr.illinois.gov/programs/CWD/Documents/CWDBrochure.pdf.

IDOT. 2008. Illinois Crash Facts and Statistics. Online. http://www.dot.state.il.us/trafficsafety/crashreports.html

_____. 2009. Illinois Crash Facts and Statistics. Online. http://www.dot.state.il.us/trafficsafety/crashreports.html

_____. 2010. Illinois Crash Facts and Statistics. Online. http://www.dot.state.il.us/trafficsafety/crashreports.html

_____. 2011. Illinois Crash Facts and Statistics. Online. http://www.dot.state.il.us/trafficsafety/crashreports.html

_____. 2012. Illinois Crash Facts and Statistics. Online. http://www.dot.state.il.us/trafficsafety/crashreports.html

Jones, J. M. 2002. Memorandum to USDA-APHIS-WS regarding comments to the Predecisional Environmental Assessment: An Integrated Wildlife Damage Management Approach for the Management of White-tailed Deer Damage In the State of Illinois.

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. Symposium 55th Midwest fish and Wildlife Conference, 12-14 December 1993, St. Louis, Mo. North Cent. Sect., The Wildl. Soc.

Kendall, R.J., T.E. Lacher, Jr., C. Bunck, B. Daniel, C. Driver, C.E. Grue, F. Leighton, W. Stansley, P.G. Watanabe, and M. Whitworth. 1996. An ecological risk assessment of lead shot exposure in non-waterfowl avian species: Upland game birds and raptors. Environmental Toxicology and Chemistry 15:4-20.

Kroll, J.C., P.J. Behrman, and W.D. Goodrum. 1986. Twenty-seven years of overbrowsing: implications in white-tailed deer management. Pages 6-7 *in* The Ninth Annual Meeting of the Southeast Deer Study Group. Gatlinburg, Tennessee.

Laidlaw, M.A., H.W. Mielke, G.M. Filippelli, D.L. Johnson, and C.R. Gonzales. 2005. Seasonality and children's blood lead levels: Developing a predictive model using climatic variables and blood lead data from Indianapolis, Indiana, Syracuse, New York, and New Orleans, Louisiana (USA). Environmental Health Perspectives 113:793-800.

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. Journal of Wildlife Disease 20: 21 – 26.

Manjerovic, M. A., M. L. Green, N. Mateus-Pinilla, J. Novakofski. 2014. The importance of localized culling in stabilizing chronic wasting disease prevalence in white-tailed deer populations. Preventative Veterinary Medicine 113 (2014) 139-145.

McGinness, Stephen. 1998. Bovine Tuberculosis. The United Kingdom Parliament, House of Commons Library. Research Paper 98/63. 30pp.

Miller, M., E. Williams, N. Hobbs, L. Wolfe. 2004. Environmental sources of prion transmission in mule deer. Emerg Infect Dis [serial on the Internet]. Available from: http://wwwnc.cdc.gov/eid/article/10/6/04-0010.htm

Montgomery County Health Department (Pennsylvania). 2000. Lyme disease surveillance and prevention education. Pages 149 -155 in 2000 Montgomery County Health Department program plans, communicable disease control and prevention. Internet site: http:www.montcopa.org/health/.

Nuttle, T., E. H. Yerger, S. H. Stoleson, and T. E. Ristau. 2011. Legacy of top-down herbivore pressure ricochets back up multiple trophic levels in forest canopies over 30 years. Ecosphere 2(1):art4. doi:10.1890/ES10-00108.1

Rawinski, T. 2008. Impacts of White-tailed deer overabundance in Forest Ecosystems: An Overview. Northeast Area State and Private Forestry. Forest Service, USDA. Newtown Square, PA. www.na.fs.fed.us.

Rooney, T. and D. Waller. 2002. Direct and indirect effects of white-tailed deer in forest ecosystems. Forest Ecology and Management 181 (2003) 165—176.

Rogner, J. D. 2002. Memorandum to USDA-APHIS-WS regarding comments to the Predecisional Environmental Assessment: An Integrated Wildlife Damage Management Approach for the Management of White-tailed Deer Damage In the State of Illinois. FWS/AES-CIFO/T1480.

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.

Schmidt, R.H. 1989. Animal welfare and wildlife management. Trans. N.A. Wildl. and Nat. Res. Conf. 54:468-475.

Shelton, P. and P. McDonald. 2013. Illinois Chronic Wasting Disease: 2012-2013 Surveillance and Management Report. Forest Wildlife Program, IDNR. http://www.dnr.illinois.gov/programs/cwd/documents/cwdannualreport20122013.pdf

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.

Southeastern Cooperative Wildlife Disease Study. 2013. Hemorrhagic Disease of White-tailed Deer. Pamphlet. College of Veterinary Medicine, University of Georgia. Athens, GA.

State Farm Mutual Automobile Insurance Company. 2011. Deer-vehicle Collisions Fall 7 Percent. Online. https://www.multivu.com/mnr/49911-state-farm-u-s-deer-vehicle-collisions-fall-7-percent

Stansley, W., L. Widjeskog, and D. E. Roscoe. 1992. Lead contamination and mobility in surface water at trap and skeet Ranges. Bulletin of Environmental Contamination and Toxicology 49:640-647.

Stewart, C. M., and N. B. Veverka. 2011. The extent of lead fragmentation observed in deer culled by sharpshooting. Journal of Wildlife Management 75:1462-1466.

Swihart, R. K., P. M. Picone, A. J. DeNicola, G. S. Kania, and L. Cornicelli. 1995. Pages 35-44 *in* J. B. McAninch, ed. Urban deer: a manageable resource? Proc. Symposium 55th Midwest fish and Wildlife Conference, 12-14 December 1993, St. Louis, Mo. North Cent. Sect., The Wildl. Soc.

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

USDA (U.S. Department of Agriculture). 1995. - Bovine Tuberculosis. Veterinary Services Fact Sheet Animal and Plant Health Inspection Service, Riverdale, MD.

USDA. 2001. Chronic Wasting Disease. Veterinary Services Fact Sheet, Animal and Plant Health Inspection Service, Riverdale, MD.

USDA Veterinary Services. 2013. Status of Current Eradication Programs. Online. http://www.aphis.usda.gov/animal_health/animal_dis_spec/downloads/eradication_status.pdf.

USDA. 2014. Chronic Wasting Disease. Online. Updated May 12, 2014. http://www.aphis.usda.gov/wps/portal/footer/topicsofinterest/applyingforpermit?1dmy&urile=wcm%3apath%3a%2Faphis_content_library%2Fsa_our_focus%2Fsa_animal_health%2Fsa_animal_disease_information%2Fsa_alternate_livestock%2Fsa_cervid_health%2Fsa_cwd%2Fct_cwd_index

USFWS. 2014. Environmental Conservation Online System: Listings and Occurrences for Illinois. Accessed 10 March 2014. http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=IL&s8fid=112761032792&s8fid=112762573902

Vercauteren, K. C., C. W. Anderson, T. R. Van Deelen, D. Drake, W. D. Walter, S. M. Vantassel, S> E. Hygnstrom. 2011. Regulated Commercial Harvest to Manage Overabundant White=tailed Deer: An Idea to Consider? Wildlife Society Bulletin 35 (3):185-194.

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.

WDNR (Wisconsin Department of Natural Resources). 2002a. Chronic Wasting Disease and Wisconsin Deer. Wisconsin Department of Natural Resources. Paper obtained at web site: http://www.dnr.state.wi.us/org/land/wildlife/whealth/issues/cwd/

WDNR. 2002b. WDNR FAQ Sheet - Chronic Wasting Disease. Wisconsin Department of Natural Resources. Paper obtained at web site: http://www.dnr.state.wi.us/org/land/wildlife/whealth/issues/cwd/CWDfacts.pdf

WDNR. 2003. Wisconsin Department of Natural Resources Environmental Impact Statement – Permanent rules to eradicate chronic wasting disease in wisconsin's free-ranging white-tailed deer herd. Available from WDNR, 101 S. Webster St., PO Box 7921, Madison, WI 53707-7921.

Williams, S., A. DeNicola, T. Almendinger, and J. Maddock. 2012. Evaluation of Organized Hunting as a Management Technique for Overabundant White-tailed Deer in Suburban Landscapes. Wildlife Society Bulletin, DOI: 10.1002/wsb.236

Yeates, J. 2010. Death is a welfare issue. J Agric Environ Ethics 2010; 23:229-241.

APPENDIX B: WHITE-TAILED DEER DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE OR RECOMMENDATION BY THE ILLINOIS WILDLIFE SERVICES PROGRAM

NONLETHAL METHODS:

Nonlethal preventative methods, such as habitat modification, physical exclusion, and animal behavior modification, are basic components of IWDM. Resource owners/managers may be encouraged to use these methods based on the level of risk, need, and professional judgment on their effectiveness and practicality. These methods include, but are not limited to:

Environmental/Habitat Modification: Environmental/Habitat Modification can be an integral part of IWDM. Wildlife production and/or presence are directly related to the type, quality and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain wildlife species. The property owner/manager is responsible for implementing habitat modifications. WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Habitat management is most often a primary component of IWDM strategies at or near airports to reduce problems by eliminating loafing, bedding and feeding sites. Generally, many problems on airport properties can be minimized through management of vegetation and water on areas adjacent to aircraft runways.

Physical Exclusion (Wildlife Fence): A fence around the area where deer are not desirable, like an airfield, can limit the entry of deer into the area. There are several types of fences that inhibit the movement of deer into protected areas if properly installed, including electric fencing, woven wire, and chain link fencing. The height of a fence required to exclude deer is a debated topic. One study reported that a 2.1-meter fence (7 feet) reduced deer/vehicle collisions by 44.3 to 83.9 percent along a New York Thruway (Smith, Coggin 1984). Although this is a clear reduction, this would not satisfy the objectives stated in 1.3.2. A WS Biologist at O'Hare International Airport witnessed a deer jump from a parallel embankment over the airport's 10-foot fence topped with two feet of serpentine wire (Pers Comm. Mark Jensen, WS State Director, Nevada). This is clearly an isolated incident. Dolbeer and Clearly recommend in a joint USDA/FAA airport manual, Wildlife Hazards Management at Airports, that a 10-foot chain link fence with barbed-wire outriggers should be installed to prevent mammal entry to an airport (Cleary, E. C. and Dolbeer, R. A. 1999). For the purpose of this EA, WS recommends a fence height of 12-feet, with an additional three feet buried below the ground, to exclude deer from the areas to be protected.

Animal Behavior Modification: This refers to tactics that alter the behavior of wildlife to reduce damage. Animal behavior modification may involve use of pyrotechnics, propane cannons, sirens, flashing lights, dogs, and visual techniques to help deter or repel animals that cause loss or damage.

Auditory scaring devices: The proper use of frightening devices and harassment techniques including sirens, flashing lights, electronic distress sounds, pyrotechnics, propane exploders, dogs, and rubber projectiles fired from a shotgun could help reduce conflicts (Craven and Hygnstrom 1994). Used in the proper context, these devices can help keep deer away from conflict areas. Some disadvantages are that these methods can be labor intensive and expensive. Also, frightening methods must be continued indefinitely unless the deer population is reduced or excluded from the resource.

Pyrotechnics: Pyrotechnics are specialized fireworks that are shot out of a 12-gauge shotgun or starter's pistol to deter deer and other wildlife. To be successful, pyrotechnics should be carried by wildlife control personnel at all times and used whenever the situation warrants. Continued use of pyrotechnics alone may lessen their effectiveness.

Propane Cannons: Propane cannons are mechanical devices that use propane gas and an igniter to produce a loud explosive sound. Propane cannons are often suggested as effective frightening agents for deer (Craven and Hygnstrom, 1994), and have been used frequently in attempts to reduce crop damage and encroachment on airports. Research has shown that propane cannons detonated systematically at 8-10 minute intervals are effective in frightening deer away from protected areas for two days (VerCauteren et al. 2011). Motion-activated cannons however, detonate only when deer approach the area to be protected and have been shown to be effective up to 6 weeks (Belant et al 1996).

Repellents: There are several products and items that act as deer repellents but they fall into two basic types; contact and area (Craven and Hygnstrom, 1994). Contact repellents are those that are applied directly to plants that deer are feeding on. Deer are not "repelled" until they have eaten a portion of a treated plant. Contact repellents tend to be more effective, and expensive, than area repellents.

Area repellents repel by odor. They are applied, or hung, near areas where deer tend to feed. Besides several commercial products, objects like bags of human hair and bar soap can be used as area repellents. Area repellents tend to be less effective, but cheaper than contact repellents.

LETHAL METHODS:

When non-lethal preventive methods have proven ineffective or not practical, removals using lethal methods may become necessary. Depending upon the views of the owners/managers of the resources to be protected, and state and local laws, any, or all, of the following lethal methods can be used to minimize damage caused by white-tailed deer.

Sharpshooting: Studies have suggested that localized (deer) management (deer removal) is an effective tool where deer are causing undesired effects (McNutly, S. A. et al 1997). This study supported the hypothesis that the removal of a small, localized group of white-tailed deer would create an area of persistent, low density in the population. The goal of sharpshooting, conducted by WS, would be to reduce the deer density(ies) to the established WAC(s) for the site(s).

WS would conduct sharpshooting, with center-fire rifles or shotguns, during daylight or at night using spotlights or night-vision equipment, as necessary. Rifles would be equipped with noise suppressors to avoid disturbance to local residents, airport operations or other nearby functions 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 vehicles. 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 that, otherwise, would present 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, in accordance with state regulations, to attract deer to safe sites for shooting and to enhance success and efficiency.

The venison from deer killed by WS could be processed and donated for consumption to one or more charitable organizations as directed by the IDNR. WS, or their cooperators, will be responsible for properly preparing deer and delivery to a DOA approved meat processor.

Only WS personnel who have completed firearms safety training, have demonstrated skill and proficiency with the firearms used for deer removal, and have been approved for sharpshooting by the State Director of Illinois WS and certified by the IDNR will participate in sharpshooting of 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 prior to the use of firearms in the conduct of official duties and continuing education as prescribed by WS Directive 2.615. WS employees who carry 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. WS employees who are stationed in Illinois are also subject to Illinois' Firearms Owner's Identification requirements.

Forward Looking Infra-Red (FLIR) and Night Vision equipment are used in combination with shooting to remove deer at night or are used to conduct wildlife surveys. FLIR and night vision equipment allow personnel to view deer at night when deer are active and when human activities are minimal. This approach is often more selective when compared to other activities since WS' personnel are present on-site during application and target animals are identified prior to application. FLIR and night vision equipment could be used under the alternatives where appropriate.

LIVE CAPTURE FOLLOWED BY EUTHANASIA: White-tailed deer can be captured a number of different ways (Craven and Hygnstrom, 1994). Deer can be drugged with a dart gun fired by a trained person on the ground, in a vehicle, or from an elevated platform. Once recovered, darted deer can be euthanized at the recovery point or at another site. Deer captured using tranquilizing drugs and/or chemically euthanized would be unsuitable for human consumption thus precluding them from being harvested under a Deer Population Control Permit in Illinois (Jones 2002).

Deer can be trapped using a baited cage trap or by using a clover or corral trap that deer can either walk into by themselves or by be driven into by people on foot or in vehicles. Trapped deer can be euthanized at the trap location or another site, if necessary. Deer can also be captured using nets. Drop nets and rocket/cannon nets can be used by baiting deer into a specific area and firing the rockets/cannons or dropping the net over the deer. This method can be used to catch multiple deer at one time. Nets can also be fired at individual animals using a net gun. The net gun can be fired from a person on the ground, in a vehicle, or from an elevated position. Netted deer can be euthanized at the capture site or another location, if necessary.

SPORT HUNTING: White-tailed deer hunting is a robust industry in Illinois. The statewide archery season opens in early October and runs into mid-January, with temporary closures for the firearm season in all counties with the exception of Cook, DuPage, Kane (east of Hwy47), and Lake. There is a shotgun (slug) deer hunting season in mid-November, a combined shotgun/muzzle-loading rifle combined season in early December, a muzzle-loading rifle only season in mid-December, antlerless-only firearms seasons in some counties in January, and CWD management deer hunting zone/seasons. Cook, DuPage, Kane (east of Hwy 47), and Lake Counties all have a continuous archery season from October to mid-January. Bag limits are set at one deer per permit but hunters may be able to purchase

multiple permits. No hunter can take more than two antlered bucks total during the year, except that those hunters with valid, unfilled either-sex permits from the previous firearm, muzzleloader, or youth deer season may take additional antlered deer during the special CWD Deer Season without regard to the limit, provided those permits were issued for an open CWD Season county. See http://www.dnr.illinois.gov/hunting/deer/Pages/default.aspx for more information on deer hunting opportunities in Illinois.

Literature Cited

Craven, S. R. and S. E. Hygnstrom. 1994. Deer. *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, Nebraska, Pp D25-40.

McNulty, S.A., W.F. Porter, N.E. Mathews, and J.A. Hill. 1997. Localized management for reducing white-tailed deer populations. Wildlife Society Bulletin 25:265-271.

Smith, R. L. and J. L. Coggin. 1984. Basis and role of management. Pages 571-600 *in* White-tailed deer: ecology and management. L. K. Halls, editor. Stackpole Books. Harrisburg, Maryland.

APPENDIX C: LIST OF FEDERALLY AND STATE LISTED THREATENED AND ENDANGERED SPECIES IN ILLINOIS

CHECKLIST OF ENDANGERED AND THREATENED ANIMALS AND PLANTS OF ILLINOIS

Illinois Endangered Species Protection Board

Effective February 22, 2011

The Board revises the list of protected species at least once every five years and completed its most recent revisions in 2009. The following list reflects those 2009 and subsequent 2010 revisions: This booklet contains a list of all species which have been designated as endangered or threatened by the Illinois Endangered Species Protection Board. Species are listed alphabetically by scientific name. Species listed at the Federal level are indicated by asterisks -

** = Federally Endangered

* = Federally Threatened

CRITERIA FOR STATE LISTING A species shall be included on the official list of endangered and threatened species when one or more of the following criteria exists: 1) Species included in the Federal list of Endangered or Threatened Species, 2) Species proposed for Federal Endangered or Threatened Species which occur in Illinois, 3) Species which formerly were widespread in Illinois but have been nearly extirpated from the State due to habitat destruction, collecting, or other pressures resulting from the development of Illinois, 4) Species which exhibit very restricted geographic ranges of which Illinois is a part, 5) Species which exhibit restricted habitats or low populations in Illinois, or 6) Species which are significant disjuncts in Illinois i.e., the Illinois population is far removed from the rest of the species' range.

DEFINITIONS:

FEDERALLY ENDANGERED SPECIES - Any species which is in danger of extinction throughout all or a significant portion of its range.

FEDERALLY THREATENED SPECIES - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

STATE ENDANGERED SPECIES - Any species which is in danger of extinction as a breeding species in Illinois.

STATE THREATENED SPECIES - Any breeding species which is likely to become a state endangered species within the foreseeable future in Illinois.

TAKE - In reference to animals and animal products, to harm, hunt, shoot, pursue, lure, wound, kill, destroy, harass, gig, spear, ensnare, trap, capture, collect, or to attempt to engage in such conduct. In reference to plants and plant products, to collect, pick, cut, dig up, kill, destroy, bury, crush, or harm in any manner.

The Illinois Endangered Species Protection Act prohibits the possession, taking, transportation, sale, offer for sale, or disposal of any listed animal or products of listed animals without a permit issued by the Department of Natural Resources. Also prohibited are the taking of listed plants without the expressed written permission of the landowner and the sale or offer to sell plants or plant products of endangered species.

Citation: Illinois Endangered Species Protection Board. 2011. Checklist of Endangered and Threatened Animals and Plants of Illinois. Illinois Endangered Species Protection Board, Springfield, Illinois. 18 pp.

ES
langered, 12 Threatened
gered
ser fulvescens Lake Sturgeon
crypta clarum Western Sand Darter
toma camurum Bluebreast Darter
toma histrio Harlequin Darter
nathus hayi Cypress Minnow
sis amblops Bigeye Chub
sis amnis Pallid Shiner
omyzon fossor Northern Brook Lamprey
is miniatus Redspotted Sunfish
ybopsis gelida Sturgeon Chub
toma valenciennesi Greater Redhorse
is micropogon River Chub
is anogenus Pugnose Shiner
is boops Bigeye Shiner
is heterolepis Blacknose Shiner
is maculatus Taillight Shiner
is texanus Weed Shiner
s stigmosus Northern Madtom
*rhynchus albus*** Pallid Sturgeon
tened
crypta pellucidum Eastern Sand Darter
omus catostomus Longnose Sucker
onus artedi Cisco
stax x-punctatus Gravel Chub
Etheostoma exile Iowa Darter
Fundulus diaphanus Banded Killifish
Fundulus dispar Starhead Topminnow
Lampetra aepyptera Least Brook Lamprey
Lepomis symmetricus Bantam Sunfish
Moxostoma carinatum River Redhorse
Notropis chalybaeus Ironcolor Shiner
Notropis heterodon Blackchin Shiner

AMPHIBIANS
3 Endangered, 6 Threatened
Endangered
Salamanders
Ambystoma platineum Silvery Salamander
Cryptobranchus alleganiensis Eastern Hellbender
Desmognathus conanti Spotted Dusky Salamander
Threatened
Salamanders
Ambystoma jeffersonianum Jefferson Salamander
Hemidactylium scutatum Four-toed Salamander
Necturus maculosus Mupuppy
Frogs and Toads
Gastrophryne carolinensis Eastern Narrowmouth Toad
Hyla avivoca Bird-voiced Treefrog
Pseudacris illinoensis Illinois Chorus Frog

ES
ngered, 8 Threatened
red

nutica Smooth Softshell
guttata Spotted Turtle
ea blandingii Blanding's Turtle
on flavescens Yellow Mud Turtle
elys temminckii Alligator Snapping Turtle
ys concinna River Cooter

his flagellum Coachwhip
asciata Broad-banded Watersnake
phis emoryi Great Plains Rat Snake
catenatus Eastern Massasauga
ed

e ornata Ornate Box Turtle

s kirtlandi Kirtland's Snake
horridus Timber Rattlesnake
n nasicus Plains Hog-Nosed Snake
cyclopion Mississippi Green Watersnake
racilis Flathead Snake
his sauritus Eastern Ribbonsnake
lonion lineatum Lined Snake

ngered, 5 Threatened
red
meus Short-eared Owl

Bartramia longicauda Upland Sandpiper
Botaurus lentiginosus American Bittern
Buteo swainsoni Swainson's Hawk
*Charadrius melodus*** Piping Plover
Chlidonias niger Black Tern
Circus cyaneus Northern Harrier
Egretta caerulea Little Blue Heron
Egretta thula Snowy Egret
Gallinula chloropus Common Moorhen
Lanius ludovicianus Loggerhead Shrike
Laterallus jamaicensis Black Rail
Limnothlypis swainsonii Swainson's Warbler
Nyctanassa violacea Yellow-crowned Night-Heron
Nycticorax nycticorax Black-crowned Night-Heron
Pandion haliaetus Osprey
Phalaropus tricolor Wilson's Phalarope
Rallus elegans King Rail
Sterna forsteri Forster's Tern
Sterna hirundo Common Tern
*Sternula antillarum*** Least Tern
Thryomanes bewickii Bewick's Wren
Tympanuchus cupido Greater Prairie-Chicken
Tyto alba Barn Owl
Xanthocephalus xanthocephalus Yellow-headed Blackbird
Threatened
Coccyzus erythropthalmus Black-billed Cuckoo
Dendroica cerulea Cerulean Warbler
Falco peregrinus Peregrine Falcon
Ictinia mississippiensis Mississippi Kite
Ixobrychus exilis Least Bittern

MALS
angered, 4 Threatened
gered
orhinus rafinesquii Rafinesque's Big-eared Bat
austroriparius Southeastern Myotis
*grisescens*** Gray Bat
*sodalis*** Indiana Bat
na floridana Eastern Wood Rat
tened
*lupus*** Gray/Timber Wolf
tomys nuttalli Golden Mouse
mys palustris Rice Rat
ophilus franklinii Franklin's Ground Squirrel

RTEBRATES
dangered, 12 Threatened
gered

*macclintocki*** Iowa Pleistocene Snail
ens antroecetes Hydrobiid Cave Snail
a obovata Shawnee Rocksnail
ls
rlandia monodonta Spectaclecase
*genia stegaria*** Fanshell
*asma rangiana*** Northern Riffleshell
asma triquetra Snuffbox
*ilis abrupta*** Pink Mucket
Lampsilis fasciola Wavy-rayed Lampmussel
*Lampsilis higginsii*** Higgins Eye
*Plethobasus cooperianus*** Orangefoot Pimpleback
Plethobasus cyphyus Sheepnose
*Pleurobema clava*** Clubshell
Pleurobema cordatum Ohio Pigtoe
*Potamilus capax*** Fat Pocketbook
Ptychobranchus fasciolaris Kidneyshell
Quadrula cylindrica Rabbitsfoot
Simpsonaias ambigua Salamander Mussel
Toxolasma lividus Purple Lilliput
Villosa iris Rainbow
Crustaceans
Caecidotea lesliei Isopod
Caecidotea spatulata Isopod
Crangonyx anomalus Anomalous Spring Amphipod
Crangonyx packardi Packard's Cave Amphipod
*Gammarus acherondytes*** Illinois Cave Amphipod
Orconectes indianensis Indiana Crayfish
Orconectes kentuckiensis Kentucky Crayfish
Orconectes lancifer Shrimp Crayfish
Orconectes placidus Bigclaw Crayfish
Stygobromus iowae Iowa Amphipod
Scorpions
Centruroides vittatus Common Striped Scorpion

EBRATES
red (continued)
ies
*lora hineana*** Hine's Emerald Dragonfly
ils
nopalites madonnensis Madonna Cave Springtail
s
a robusta Robust Springfly
completa Central Forestfly
pers
la incongrua Leafhopper
psius lupalus Leafhopper
es and Moths
arogos Arogos Skipper
s mutica Swamp Metalmark
ottoe Ottoe Skipper
polios Hoary Elfin
*s melissa samuelis*** Karner Blue Butterfly
na eryngii Eryngium Stem Borer

Threatened
Mussels
Alasmidonta viridis Slippershell
Cyclonaias tuberculata Purple Wartyback
Ellipsaria lineolata Butterfly
Elliptio crassidens Elephant-ear
Elliptio dilatata Spike
Fusconaia ebena Ebonyshell
Ligumia recta Black Sandshell
Villosa lienosa Little Spectaclecase
Dragonflies
Nannothemis bella Elfin Skimmer
Leafhoppers
Aflexia rubranura Redveined Prairie Leafhopper

Butterflies
Hesperia metea Cobweb Skipper
Speyeria idalia Regal Fritillary

TS
ndangered, 81 Threatened
gered
moschatellina Moschatel
ncana subsp. *rugosa* Speckled Alder
nchier sanguinea Shadbush
phila breviligulata Marram Grass
ha nitens Smooth False Indigo
taphylos uva-ursi Bearberry
sia dracunculus Dragon Wormwood
ias lanuginosa Wooly Milkweed
*ias meadii** Mead's Milkweed
ias ovalifolia Oval Milkweed
ias stenophylla Narrow-leaved Green Milkweed
ium bradleyi Bradley's Spleenwort
ium resiliens Black Spleenwort
alus crassicarpus var. *trichocalyx* Large Ground Plum
alus distortus Bent Milk Vetch
alus tennesseensis Tennessee Milk Vetch
ia tinctoria Yellow Wild Indigo
ia paniculata Screwstem
annia syzigachne American Slough Grass
is canadensis Allegheny Barberry
alleghaniensis Yellow Birch
hium campestre Prairie Moonwort
hium matricariifolium Daisyleaf Grape Fern
hium multifidum Northern Grape Fern
hium simplex Dwarf Grape Fern
oua gracilis Blue Grama
ia lanuginosa Wooly Buckthorn
agrostis insperata Bluejoint Grass
palustris Water Arum
ogon oklahomensis Oklahoma Grass Pink Orchid
ogon tuberosus Grass Pink Orchid
sia angusta Wild Hyacinth
mine pratensis var. *palustris* Cuckoo Flower
alata Winged Sedge
arkansana Arkansas Sedge
brunnescens Brownish Sedge
canescens var. *disjuncta* Silvery Sedge
chordorrhiza Cordroot Sedge
crawfordii Crawford's Sedge
cryptolepis Yellow Sedge

PLANTS
Endangered (continued)
Carex cumulata Sedge
Carex decomposita Cypress-knee Sedge
Carex diandra Sedge
Carex disperma Shortleaf Sedge
Carex echinata Sedge
Carex formosa Sedge
Carex garberi Elk Sedge
Carex gigantea Large Sedge
Carex inops subsp. *heliophila* Plains Sedge
Carex nigromarginata Black-edged Sedge
Carex oligosperma Few-seeded Sedge
Carex physorhyncha Bellow's Beak Sedge
Carex plantaginea Plaintain-leaved Sedge
Carex reniformis Reniform Sedge
Carex trisperma Three-seeded Sedge
Carex tuckermanii Tuckerman's Sedge
Carya pallida Pale Hickory
Castilleja sessiliflora Downy Yellow Painted Cup
Ceanothus herbaceus Redroot
Chamaelirium luteum Fairy Wand
Chamaesyce polygonifolia Seaside Spurge
Chimaphila maculata Spotted Wintergreen
Chimaphila umbellata Pipsissewa
Cimicifuga americana American Bugbane
Cimicifuga racemosa False Bugbane
Circaea alpina Small Enchanter's Nightshade
Cladrastis lutea Yellowwood
Clematis crispa Blue Jasmine
Clematis occidentalis Mountain Clematis
Clematis viorna Leatherflower
Collinsia violacea Violet Collinsia
Comptonia peregrina Sweetfern
Conioselinum chinense Hemlock Parsley
Cornus canadensis Bunchberry
Corydalis aurea Golden Corydalis
Corydalis halei Hale's Corydalis
Corydalis sempervirens Pink Corydalis
Corylus cornuta Beaked Hazelnut
Cynosciadium digitatum Cynosciadium
Cypripedium acaule Moccasin Flower
Cypripedium parviflorum var. *makasin* Small Yellow Lady's Slipper

ed (continued)

um reginae Showy Lady's Slipper
s laurentiana Laurentian Fragile Fern
*osa*** Leafy Prairie Clover
ltia punctilobula Hay-scented Fern
sia flexuosa Hairgrass
lium boreale Northern Panic Grass
lium joori Panic Grass
lium portoricense Hemlock Panic Grass
lium ravenelii Ravenel's Panic Grass
lium yadkinense Panic Grass
eifolia Whitlow Grass
otundifolia Round-leaved Sundew
s celsa Log Fern
us tenellus Small Burhead
s olivacea Capitate Spikerush
s pauciflora Few-flowered Spikerush
scirpoides Dwarf Scouring Rush
sylvaticum Woodland Horsetail
m virginicum Rusty Cotton Grass
prostratum Eryngo
americanus American Strawberry Bush
m hyssopifolium Hyssop-leaved Thoroughwort
spathulata Spurge
a rubra Queen-of-the-Prairie
is vahlii Vahl's Fimbristylis
nohlenbrockii Boykin's Dioclea
nceolatum Wild Licorice
rgatum Dwarf Bedstraw
bicknellii Northern Cranesbill
rkansana Arkansas Mannagrass
uartermaniae Hedge Hyssop
rpium dryopteris Oak Fern
rpium robertianum Scented Oak Fern
deflexa var. *americana* Stickseed
rolina Silverbell Tree
s giganteus Tall Sunflower
um tenellum Slender Heliotrope
era reniformis Mud Plantain
s spicata Crested Coralroot Orchid
tomentosa False Heather
uniflora One-flowered Hydrolea

PLANTS

Endangered (continued)

Hypericum adpressum Shore St. John's Wort
Hypericum kalmianum Kalm's St. John's Wort
Iliamna remota Kankakee Mallow
Iresine rhizomatosa Bloodleaf
Isoetes butleri Butler's Quillwort
Isotria verticillata Whorled Pogonia
Juncus vaseyi Vasey's Rush
Juniperus horizontalis Trailing Juniper
Justicia ovata Water Willow
*Lespedeza leptostachya** Prairie Bush Clover
Lesquerella ludoviciana Silvery Bladderpod
Lonicera dioica var. *glaucescens* Red Honeysuckle
Lonicera flava Yellow Honeysuckle
Luzula acuminata Hairy Woodrush
Lycopodiella inundata Bog Clubmoss
Lycopodium clavatum Running Pine
Lycopodium dendroideum Ground Pine
Lysimachia radicans Creeping Loosestrife
Malus angustifolia Narrow-leaved Crabapple
Malvastrum hispidum False Mallow
Matelea decipiens Climbing Milkweed
Medeola virginiana Indian Cucumber Root
Megalodonta beckii Water Marigold
Melanthera nivea White Melanthera
Melica mutica Two-Flowered Melic Grass
Mimulus glabratus Yellow Monkey Flower
Mirabilis hirsuta Hairy Umbrella-wort
Nemophila triloba Baby Blue-eyes
Nothocalais cuspidata Prairie Dandelion
Opuntia fragilis Fragile Prickly Pear
Orobanche fasciculata Clustered Broomrape
Oxalis illinoensis Illinois Wood Sorrel
Paspalum dissectum Bead Grass
Penstemon brevisepalus Short-sepaled Beard Tongue
Penstemon grandiflorus Large-flowered Beard Tongue
Penstemon tubaeflorus Tube Beard Tongue
Phacelia gilioides Ozark Phacelia
Phegopteris connectilis Long Beech Fern
Phlox pilosa subsp. *sangamonensis* Sangamon Phlox
Pinus banksiana Jack Pine
Pinus echinata Shortleaf Pine

PLANTS
Endangered (continued
Pinus resinosa Red Pine
Plantago cordata Heart-leaved Plantain
Platanthera ciliaris Orange Fringed Orchid
Platanthera clavellata Wood Orchid
Platanthera flava var. *flava* Tubercled Orchid
*Platanthera leucophaea** Eastern Prairie Fringed Orchid
Platanthera psycodes Purple Fringed Orchid
Poa alsodes Grove Bluegrass
Poa languida Weak Bluegrass
Poa wolfii Wolf's Bluegrass
Pogonia ophioglossoides Snake-mouth
Polanisia jamesii James' Clammyweed
Polygala incarnata Pink Milkwort
Polygonatum pubescens Downy Solomon's Seal
Polygonum arifolium Halberd-leaved Tearthumb
Polygonum careyi Carey's Heartsease
Populus balsamifera Balsam Poplar
Potamogeton praelongus White-stemmed Pondweed
Potamogeton pulcher Spotted Pondweed
Potamogeton robbinsii Fern Pondweed
Potamogeton strictifolius Stiff Pondweed
Primula mistassinica Bird's-eye Primrose
Ptilimnium nuttallii Mock Bishop's Weed
Quercus texana Nuttall's Oak
Rhamnus alnifolia Alder Buckthorn
Rhexia mariana Dull Meadow Beauty
Rhynchospora glomerata Clustered Beak Rush
Ribes hirtellum Northern Gooseberry
Rosa acicularis Bristly Rose
Rubus odoratus Purple-flowering Raspberry
Sabatia campestris Prairie Rose Gentian
Sagittaria australis Arrowhead
Salix serissima Autumn Willow
Salix syrticola Dune Willow
Sambucus racemosa subsp. *pubens* Red-berried Elder
Sanguisorba canadensis American Burnet
Sanicula smallii Southern Sanicula
Sarracenia purpurea Pitcher Plant
Saxifraga virginiensis Early Saxifrage
Schizachne purpurascens False Melic Grass
Schoenoplectus purshianus Weak Bulrush

PLANTS
Endangered (continued)
Schoenoplectus smithii Smith's Bulrush
Scirpus hattorianus Bulrush
Scirpus microcarpus Bulrush
Scleria muhlenbergii Muhlenberg's Nut Rush
Scleria pauciflora Carolina Whipgrass
Shepherdia canadensis Buffaloberry
Silene ovata Ovate Catchfly
Silene regia Royal Catchfly
Sisyrinchium montanum Mountain Blue-eyed Grass
Sorbus americana American Mountain Ash
Sparganium americanum American Burreed
Sparganium emersum Green-fruited Burreed
Spiranthes lucida Yellow-lipped Ladies' Tresses
Spiranthes vernalis Spring Ladies' Tresses
Stellaria pubera Great Chickweed
Stenanthium gramineum Grass-leaved Lily
Stylisma pickeringii Patterson's Bindweed
Styrax grandifolius Bigleaf Snowbell Bush
Symphoricarpos albus var. *albus* Snowberry
Synandra hispidula Hairy Synandra
Talinum calycinum Fameflower
*Tetraneuris herbacea** Lakeside Daisy
Thelypteris noveboracensis New York Fern
Tilia heterophylla White Basswood
Torreyochloa pallida Pole Manna-Grass
Trichomanes boschianum Filmy fern
Trichophorum cespitosum Tufted Bulrush
Trientalis borealis Star-flower
Trillium cernuum Nodding Trillium
Trillium erectum Ill-scented Trillium
Trillium viride Green Trillium
Ulmus thomasii Rock Elm
Utricularia cornuta Horned Bladderwort
Utricularia minor Small Bladderwort
Vaccinium corymbosum Highbush Blueberry
Vaccinium macrocarpon Large Cranberry
Vaccinium oxycoccos Small Cranberry
Vaccinium stamineum Deerberry
Valeriana uliginosa Marsh Valerian
Valerianella chenopodifolia Corn Salad
Valerianella umbilicata Corn Salad

PLANTS
Endangered (continued)
Veronica americana American Brooklime
Viola blanda Hairy White Violet
Viola canadensis Canada Violet
Viola primulifolia Primrose Violet
Woodsia ilvensis Rusty Woodsia
Zigadenus elegans White Camass
Threatened
Agalinus skinneriana Pale False Foxglove
Amelanchier interior Shadbush
Aster furcatus Forked Aster
Berchemia scandens Supple-Jack
Besseya bullii Kitten Tails
*Boltonia decurrens** Decurrent False Aster
Botrychium biternatum Southern Grape Fern
Buchnera americana Bluehearts
Cakile edentula Sea Rocket
Carex atlantica Sedge
Carex aurea Golden Sedge
Carex bromoides Sedge
Carex communis Fibrous-rooted Sedge
Carex intumescens Swollen Sedge
Carex oxylepis Sharp-scaled Sedge
Carex prasina Drooping Sedge
Carex viridula Little Green Sedge
Carex willdenowii Willdenow's Sedge
Carex woodii Pretty Sedge
Carya aquatica Water Hickory
Chamaedaphne calyculata Leatherleaf
Cimicifuga rubifolia Black Cohosh
*Cirsium pitcheri** Pitcher's (Dune) Thistle
Corallorhiza maculata Spotted Coral-root Orchid
Cyperus grayioides Umbrella Sedge
Cyperus lancastriensis Galingale
Cypripedium candidum White Lady's Slipper
Delphinium carolinianum Wild Blue Larkspur
Dodecatheon frenchii French's Shootingstar
Drosera intermedia Narrow-leaved Sundew
Eleocharis rostellata Beaked Spike Rush
Elymus trachycaulus Bearded Wheat Grass

PLANTS
Threatened (continued)
Epilobium strictum Downy Willow Herb
Equisetum pratense Meadow Horsetail
Helianthus angustifolius Narrow-leaved Sunflower
Huperzia porophila Cliff Clubmoss
Hymenopappus scabiosaeus Old Plainsman
Juncus alpinus Richardson's Rush
Juniperus communis Ground Juniper
Larix laricina Tamarack
Lathyrus ochroleucus Pale Vetchling
Lechea intermedia Pinweed
Liatris scariosa var. *nieuwlandii* Blazing Star
Matelea obliqua Climbing Milkweed
Melanthium virginicum Bunchflower
Melothria pendula Squirting Cucumber
Menyanthes trifoliata Buckbean
Minuartia patula Slender Sandwort
Oenothera perennis Small Sundrops
Orobanche ludoviciana Broomrape
Phaeophyscia leana Lea's Bog Lichen
Planera aquatica Water Elm
Platanthera flava var. *herbiola* Tubercled Orchid
Potamogeton gramineus Grass-leaved Pondweed
Quercus montana Rock Chestnut Oak
Quercus phellos Willow Oak
Ranunculus rhomboideus Prairie Buttercup
Rhynchospora alba Beaked Rush
Rubus pubescens Dwarf Raspberry
Rubus schneideri Bristly Blackberry
Rudbeckia missouriensis Missouri Orange Coneflower
Salvia azurea subsp. *pitcheri* Blue Sage
Schoenoplectus hallii Hall's Bulrush
Scirpus polyphyllus Bulrush
Sedum telephioides American Orpine
Sisyrinchium atlanticum Eastern Blue-eyed Grass
Solidago sciaphila Cliff Goldenrod
Styrax americana Storax
Sullivantia sullivantii Sullivantia
Talinum parviflorum Small Flower-of-an-hour
Tofieldia glutinosa False Asphodel
Tomanthera auriculata Ear-leafed Foxglove
Tradescantia bracteata Prairie Spiderwort
Trifolium reflexum Buffalo Clover
Triglochin maritima Common Bog Arrowgrass
Triglochin palustris Slender Bog Arrowgrass
Urtica chamaedryoides Nettle
Utricularia intermedia Flat-leaved Bladderwort
Veronica scutellata Marsh Speedwell
Viburnum molle Arrowwood
Viola conspersa Dog Violet