ENVIRONMENTAL ASSESSMENT

Feral Swine Damage Management in South Carolina

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

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ACRONYMS

AGL	Above Ground Level
AMDUCA	Animal Medicinal 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
DEA	Drug Enforcement Administration
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FLIR	Forward Looking Infrared
FR	Federal Register
FSIS	Food Safety and Inspection Service
FY	Fiscal Year
IV	Intravenous
IC	Intracardiac
MOU	Memorandums of Understanding
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NWRC	National Wildlife Research Center
PL	Public Law
SCDA	South Carolina Department of Agriculture
SCDNR	South Carolina Department of Natural Resources
SOP	Standard Operating Procedures
T&E	Threatened and Endangered
USDA	United States Department of Agriculture
USC	United States Code
USFWS	United States Fish and Wildlife Service
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 PURPOSE

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS)[1] program in South Carolina continues to receive requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety, associated with feral swine (*Sus scrofa*). Individual projects conducted by the WS program to manage damage caused by feral swine 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).

The purpose of this Environmental Assessment (EA) is to evaluate cumulatively the individual damage management projects that WS could conduct to manage damage and threats to agricultural resources, property, natural resources, and threats to people caused by feral swine. This EA will assist in determining if the proposed cumulative management of feral swine damage could have a significant impact on the human environment based on previous activities conducted by WS and based on the anticipation of conducting additional efforts to manage damage caused by feral swine. Because the goal of WS would be to conduct a coordinated program to alleviate feral swine damage in accordance with plans, goals, and objectives developed to reduce damage, and because the program's goals and directives[2] would be to provide assistance 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 apply to actions that may occur in any locale and at any time within South Carolina as part of a coordinated program.

This EA analyzes the potential effects of alternative approaches to managing feral swine damage when requested, as coordinated between WS and the South Carolina Department of Natural Resources (SCDNR). In addition to feral swine, WS also receives requests to address damage and threats of damage associated with beaver (*Castor canadensis*) and other mammal species. Activities conducted by WS to alleviate damage or threats of damage associated with beaver and several other mammal species were evaluated in separate EAs (USDA 2002, USDA 2015*a*).

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 or cumulative effects from the alternative approaches developed to meet the need for action. The analyses contained in this EA are based on information derived from WS' Management Information System, published documents (see Appendix A), interagency consultations, and public involvement.

This EA evaluates the need for action to manage damage associated with feral swine in the State, the potential issues associated with managing damage, and the environmental consequences of conducting different alternatives to meet the need for action while addressing the identified issues. WS initially developed the issues and alternatives associated with managing damage caused by feral swine in consultation with the SCDNR. The SCDNR has regulatory authority to manage populations

[1]The WS program is authorized to protect agriculture and other resources from damage caused by wildlife through 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).
[2]At the time of preparation, WS' Directives occurred at the following web address: http://www.aphis.usda.gov/wildlife_damage/ws_directives.shtml.

of wildlife in the State. To assist with identifying additional issues and alternatives to managing damage associated with feral swine in South Carolina, WS will make this EA available to the public for review and comment prior to the issuance of a Decision[3].

WS previously developed an EA that addressed WS' activities to manage damage associated with feral swine in the State (USDA 2013*a*). Based on the analyses in that EA, WS signed a Decision and Finding of No Significant Impact selecting the proposed action alternative. The proposed action alternative implemented a damage management program using a variety of methods in an integrated methods approach. This new EA will assist in determining if the proposed management of damage associated with feral swine could have a significant impact on the environment for both people and other organisms and analyze several alternatives to address the need for action and the identified issues. In addition, this EA will coordinate efforts between WS, the SCDNR, and other entities, inform the public, and document the environmental consequences of the alternatives to comply with the NEPA. This new EA re-evaluates activities addressed in the previous EA to address the new need for action and the associated affected environment; therefore, this analysis and the outcome of the Decision issued for this EA will supersede the previous EA that addresses feral swine damage management in the State.

1.2 NEED FOR ACTION

The need for action to manage damage associated with feral swine in South Carolina arises from requests for assistance[4] received by WS to reduce and prevent damage associated with feral swine. Feral swine are medium-size hoofed mammals that look similar to domestic swine. Feral swine present in the State are not native to South Carolina or any part of North America. Introduction of domestic swine to North America likely occurred during the arrival of the first European explorers to the continent. The first introductions likely occurred along the coastal areas of North American by European explorers that used domesticated swine as a food source. Closed-range or fencing requirements for livestock were not common until the 1900s and allowing domestic swine to range freely was common (Ruth 2011). Some established feral swine populations originated from free-ranging domestic swine that became feral (*i.e*., living in a wild state), from the intentional release of domestic swine that became feral, or from domestic swine that escaped confinement and became feral. In addition, people have introduced the wild boar, which is native to Europe and Asia, into the United States. Although morphologically distinct, domestic swine, feral domestic swine, and the wild boar are all the same species (*Sus scrofa*). When free roaming in North America, domestic swine and the wild boar are included in the term "*feral swine*", as are hybrids of the two types. Therefore, the use of the term feral swine includes other common names, including "*wild pigs*", "*wild boars*", and "*feral hogs*".

Feral swine usually have coarser and denser coats than their domestic counterparts and exhibit modified canine teeth called "*tusks*", which are usually 7.5 to 12.5 cm (3 to 5 inches) long, but may up to 23 cm (9 inches) long. These tusks curl out and up along the sides of the mouth. Lower canines are also prominent but smaller. Young feral swine may have pale longitudinal stripes on the body until they are about six weeks of age. Adults of the species average 90 cm (3 feet) in height with a

[3]After the development of the EA by WS and after public involvement with identifying new issues and alternatives, WS will issue a Decision. Based on the analyses in the EA after public involvement, WS will make a decision to publish a Notice of Intent to prepare an Environmental Impact Statement or WS will issue a Finding of No Significant Impact notice to the public in accordance to the NEPA and the Council of Environmental Quality regulations.

[4]WS would only conduct feral swine damage management after receiving a request for assistance. Before initiating feral swine damage activities, a Memorandum of Understanding, work initiation document, or other comparable document would be signed between WS and the cooperating entity, which would list all the methods the property owner or manager would allow to be used on property they own and/or manage.

length of 1.32 to 1.82 m (4.5 feet to 6 feet). Males may attain a weight of 75 kg to 200 kg (165 lbs to 440 lbs), while females may weigh 35 kg to 150 kg (77 lbs to 330 lbs).

Feral swine breed any time of year but peak breeding times usually occur from August through October in South Carolina (J. Mayer, Savannah River National Laboratory pers. comm. 2013). Litters sizes usually range from one to 12 piglets (Mayer and Brisbin 2009). Feral swine are the most prolific wild mammal in North America. Given adequate nutrition, a feral swine population can reportedly double in just four months (Barrett and Birmingham 1994). Feral swine may begin to breed as young as four months of age and sows can produce two litters per year (Mayer and Brisbin 2009). Feral swine occur in variable habitat in most of the United States, with the highest densities occurring in the southern United States. Populations generally cluster around areas with ample food and water supplies. Evidence of the presence of feral swine may be rooted-up earth, tree rubs at ground level to 900 cm (36 inches) high, with clinging hair or mud, and muddy wallows.

Historically, the distribution of feral swine was limited to the floodplains of the major river systems within the State. Introductions of feral swine into the mountainous regions of South Carolina occurred in the 1960s and 1970s (Mayer and Brisbin 1991). The feral swine distribution in the State during the 1980s was limited to 26 counties, with their distribution continuing to resemble the historical range of swine along the major river systems throughout the State. In 2008, feral swine occurred in all 46 counties of the State (South Carolina Wild Hog Task Force 2012).

The release of feral swine by hunters is likely responsible for feral swine becoming established in areas where they were not found previously (Ruth 2011). Between 2003 and 2011, the estimated statewide population nearly doubled (South Carolina Wild Hog Task Force 2012). As the feral swine population increased and expanded in the State, the damage associated with feral swine also increased (South Carolina Wild Hog Task Force 2012). The South Carolina Wild Hog Task Force (2012) estimates the direct damage associated with feral swine in the State has reached $45 million each year, along with the potential for increased risks of disease transmission to the domestic livestock industry and damage to natural resources. One of the goals expressed by the South Carolina Wild Hog Task Force (2012) is to reduce the feral swine population in the State, along with the associated damages and risks.

Damage in areas supporting feral swine populations can sometimes be a serious natural resource management concern for land managers. Substantial damage has occurred to natural resources, including destruction of fragile plant communities, killing, and destruction of tree seedlings, and erosion of soils (Barrett and Birmingham 1994, West et al. 2009, Hamrick et al. 2011). Food sources for feral swine includes acorns, hickory nuts, pecans, beech nuts, and a wide variety of vegetation including roots, tubers, grasses, fruit, and berries, but feral swine also eat crayfish, frogs, snakes, salamanders, mice, eggs and young of ground nesting birds, young rabbits, and any other easy prey or carrion encountered. They may also kill considerable numbers of domestic livestock, especially young animals, in some areas (Barrett and Birmingham 1994). Lowe et al. (2000) ranked feral swine as one of the 100 worst invasive species in the world.

Wildlife damage management is the alleviation of damage or other problems caused by or related to the behavior of animals and can be an integral component of wildlife management (The Wildlife Society 2015). The threat of damage or loss of resources is often sufficient for people to initiate individual actions and the need for damage management can occur from specific threats to resources. Feral swine have no intent to do harm. They utilize habitats (*e.g.*, reproduce, travel, forage) where they can find a niche. If their activities result in lost economic value of resources or threaten human safety, people often characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or pose a threat to human safety, people often seek assistance with resolving

damage or reducing threats to human safety. The threshold triggering a request for assistance is often unique to the individual person requesting assistance and many factors can influence when people request assistance (*e.g.*, economic, social, aesthetics). Therefore, what constitutes damage is often unique to the individual person. What one individual person considers damage, another person may not consider as damage. However, the use of the term "*damage*" is consistently used to describe situations where the individual person has determined the losses associated with an animal or animals is actual damage requiring assistance (*i.e.*, has reached an individual threshold). Many people define the term "*damage*" as economic losses to resources or threats to human safety; however, "*damage*" could also occur from a loss in the aesthetic value of property and other situations where the behavior of an animal or animals was no longer tolerable to an individual person.

The need for action to manage damage and threats associated with feral swine in South Carolina arises from requests for assistance[5] received by WS. WS receives requests to reduce or prevent damage from occurring to four major categories: agricultural resources, natural resources, property, and threats to human safety.

Damage caused by feral swine occurs primarily from the consumption of resources and the destruction of habitat from their rooting and wallowing behavior. Feral swine can also pose threats to human safety and property when struck by airplanes and by vehicles. Estimates have placed the agricultural and environmental damage caused by feral swine from $800 million per year (Pimentel et al. 2005) to $1.5 billion per year (Pimentel 2007) in the United States. The following subsections of the EA provide additional information regarding feral swine damage to agricultural resources, natural resources, property, and threats to human safety.

Need to Manage Damage to Agricultural Resources Caused by Feral Swine

Agricultural damage and threats caused by feral swine in South Carolina can occur to a variety of crops, livestock, and other agricultural resources (Beach 1993, Seward et al. 2004, West et al. 2009, Hamrick et al. 2011). Damage occurs from direct consumption of agricultural resources and from trampling, rooting, and/or wallowing that are common activities of feral swine (Beach 1993). Rooting is a common activity of feral swine where they overturn sod and soil in search of food (West et al. 2009, Stevens 2010, Hamrick et al. 2011). Feral swine also wallow in water and mud to regulate body temperature and to ward off skin parasites.

Damage and threats to livestock associated with feral swine can occur from predation on livestock and the risks associated with disease transfer from feral swine to domestic livestock (West et al. 2009, Hamrick et al. 2011). Feral swine can also cause damage to other agricultural resources. For example, feral swine can cause damage to pastures and land used for hay by rooting and wallowing, can cause damage to ponds and water sources for livestock, and can cause damage from the consumption of livestock feed. Feral swine feeding activities in agricultural crops can also lead to increased erosion from the removal of vegetation that leaves the soil bare along with the overturning of soil caused by rooting.

Feral swine can cause damage to a variety of agricultural crops through direct consumption but also from trampling, rooting, and wallowing (Beach 1993, West et al. 2009, Stevens 2010, Hamrick et al. 2011). In South Carolina, numerous grain crops and vegetable crops are susceptible to feral swine damage, including corn, soybeans, peanuts, sorghum, sweet potatoes, wheat, cantaloupe, cucumbers,

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squash, tomatoes, and watermelons. Of the grain crops grown in South Carolina in 2013, soybeans and corn ranked the highest in acres planted. In 2013, there were 310,000 acres of soybeans harvested in the State valued at nearly $112 million while 345,000 acres of corn were harvested valued at nearly $205 million (USDA 2013*b*). Agricultural producers harvested approximately 7,100 acres of watermelon in the State during 2013 and approximately 1,600 acres of squash (USDA 2013*b*). Although crop damage is not well documented in South Carolina, the presence of feral swine in agricultural areas of the State are likely to lead to requests for assistance to manage and prevent damage to agricultural crops.

In addition, feral swine also damage pastures, land used for hay, and sod farms through rooting and wallowing activities (Beach 1993, West et al. 2009, Stevens 2010, Hamrick et al. 2011). Rooting activities can also lead to increased erosion and soil loss. Wallowing and rooting activities in watering areas for livestock can result in severely muddied water, algal blooms, oxygen depletion, bank erosion, and reduction in fish viability (Beach 1993). Since feral swine often travel in family groups, damage from rooting and wallowing can be extensive often encompassing several acres.

Additional risks associated with feral swine are the potential for disease transmission from feral swine to domestic livestock, especially to domestic swine. Feral swine are potential reservoirs for several diseases that they can transmit to domestic livestock (Wood and Barrett 1979, Corn et al. 1986, Beach 1993, Davidson 2006). Corn et al. (1986) found feral swine tested in Texas were positive for pseudorabies, brucellosis, and leptospirosis. A study in Oklahoma found samples from feral swine tested positive for antibodies of porcine parvovirus, swine influenza, and porcine reproductive and respiratory syndrome virus (Saliki et al. 1998). Porcine reproductive and respiratory syndrome is a highly infectious virus that causes reproductive failure and respiratory disease in swine (USDA 2009). The total cost of productivity losses due to porcine reproductive and respiratory syndrome in the domestic swine herd in the United States was estimated at $664 million annually during 2011 and represented an increase from the $560 million annual cost estimated in 2005 (Holtkamp et al. 2013).

Pseudorabies is a viral disease associated with an extremely contagious herpes virus that can have negative effects on reproduction in domestic swine. An economic analysis estimated that the annual cost of pseudorabies to pork producers in the United States at more than $30 million annually in lost production as well as testing and vaccination costs (USDA 2008). Brucellosis is a bacterial disease that can also have negative effects on reproduction of swine. Cholera, trichinosis, and African swine fever are additional diseases that feral swine could transmit to livestock. Disease transmission is likely to occur where domestic livestock and feral swine have a common interface, such as at water sources and livestock feeding areas.

Although several diseases carried by swine are also transmissible to other livestock, the primary concern is the potential transmission of diseases from feral swine to domestic swine. Many of the diseases associated with feral swine also negatively affect the health and marketability of domestic swine that can lead to economic losses to the livestock producer. A disease outbreak not only has negative economic implications to the individual livestock producer but an outbreak also could cause economic losses that can negatively affect the statewide or the national swine industry. The United States is one of the world's largest producers of pork and is the second largest exporter of pork. Pork production in the United States accounts for about 10% of the total world supply. The retail value of pork sold to consumers exceeds $30 billion annually. In addition, the pork industry supports more than 600,000 jobs (USDA 2008). In 2013, there were approximately 245,000 domestic swine in South Carolina (USDA 2013*b*). The WS program in South Carolina could conduct disease surveillance in the feral swine population as part of the National Wildlife Disease Surveillance Program.

From federal fiscal year (FY) 2007 through FY 2014, 174 out of 753 (23.1%) samples collected from feral swine in South Carolina were sero-positive for pseudorabies and 134 out of 722 (18.6%) were sero-positive for swine brucellosis. From FY 2010 through FY 2014, 21 out of 363 (5.8%) feral swine samples collected were swine influenza (serum) positive. From FY 2010 through FY 2014, 18 out of 283 (6%) feral swine samples were positive for trichionosis. In FY 2014 six out of 119 (5%) tested sero-positive for porcine reproductive and respiratory syndrome. In FY 2007 through FY 2009, 175 out of 301 (58.1%) were sero-positive for porcine circovirus in South Carolina (WS, unpublished data).

Although the source of livestock disease outbreaks can be difficult to identify, a risk of transmission and the spreading of diseases to domestic swine and other livestock exists wherever feral swine and domestic livestock interact (Witmer et al. 2003). In addition to large-scale commercial operations, small-scale "*backyard*" swine operations where domestic swine could interact with feral swine are also at risk (Saliki et al. 1998). With the large number of domestic swine in the State, the potential exists for severe economic losses to occur because of the transmission of infectious diseases between feral and domestic swine.

In addition to the potential for disease transmission, feral swine can also predate livestock. Feral swine can kill considerable numbers of domestic livestock, especially young animals, in some areas (Barrett and Birmingham 1994). Feral swine can kill calves, kids (goats), lambs, and poultry (West et al. 2009, Stevens 2010). Predation occurs primarily on young livestock but feral swine can also kill weakened or injured livestock. Predation of livestock likely does not occur with regular frequency. However, if feral swine populations continue to increase, WS could receive requests to address localized predation associated with feral swine.

Therefore, the need for action associated with feral swine damage to agricultural resources arises from an agricultural producers desire to lessen or prevent damage and the requests for assistance that WS receives to manage that damage. Since feral swine can cause damage and pose threats to agricultural resources, an increase in the statewide population of feral swine could lead to an increase in the number of requests for assistance received by WS to manage damage and threats.

Need to Manage Damage and Threats to Natural Resources caused by Feral Swine

Natural resources can be those assets belonging to the public that government agencies, as representatives of the people, often manage and hold in trust. Such resources may be plants or animals, including threatened or endangered species, or habitats in general. Examples of natural resources would include parks and recreational areas; natural areas, including unique habitats or topographic features; threatened or endangered plants or animals; and any plant or animal populations that the public has identified as a natural resource.

Damage in areas supporting feral swine populations can sometimes be a serious natural resource management concern for land managers. Substantial damage can occur to natural resources, including destruction of fragile plant communities, killing, and destruction of tree seedlings, and erosion of soils (Barrett and Birmingham 1994, West et al. 2009, Hamrick et al. 2011). Food sources for feral swine includes acorns, hickory nuts, pecans, beech nuts, and a wide variety of vegetation, including roots, tubers, grasses, fruit, and berries, but feral swine can also eat crayfish, frogs, snakes, salamanders, mice, eggs and young of ground nesting birds, young rabbits, and any other easy prey or carrion encountered (Ditchkoff and Mayer 2009). Feral swine can also kill and eat fawns of white-tailed deer (*Odocoileus virginianus*) (Hellgren 1993, Ditchkoff and Mayer 2009).

Feral swine can cause damage to natural flora and fauna on private lands along with designated natural areas, such as parks and wildlife management areas in South Carolina. Those sites can suffer erosion and local loss of critical ground plants and roots as well as destruction of seedlings because of their feeding and other activity (Barrett and Birmingham 1994). Experts in the fields of botany and herpetology have observed notable declines in some rare species of plants, reptiles, amphibians, and soil invertebrates in areas inhabited by feral swine (Singer et al. 1982). Many state and federal natural resource managers are now in the process of controlling swine numbers because of their known impact to endangered plants and animals (Thompson 1977). Feral swine can disturb large areas of vegetation and soils through rooting, and feral swine inhabiting coastal, upland, and wetland ecosystems can uproot, damage, and feed on rare native species of plants and animals. Feral swine can disrupt natural vegetative communities, eliminate rare plants and animals, alter species composition within a forest, including both canopy and low growing species (Lipscomb 1989, Frost 1993), increase water turbidity in streams and wetlands (reducing water quality and impacting native fish), and increase soil erosion and alter nutrient cycling (Singer et al. 1982, DeBenedetti 1986).

One of the more important seasonal food resources used by feral swine is wild fruit and nut crops, especially oak mast (Wood and Roark 1980). Mast crops, such as beechnut (*Fagus* spp.), acorns (*Quercus* spp.), and hickory nuts (*Carya* spp.), are an important food source for deer, wild turkey (*Meleagris gallopavo*), black bear (*Ursus americanus*), and squirrels (*Sciurus* spp.) (Knee 2011). Oak mast is an important food source for white-tailed deer and wild turkey. Each adult feral swine can consume up to 1,300 pounds of mast per year (Knee 2011). When feral swine actively compete for mast, resident deer and wild turkey may enter the winter with inadequate fat reserves; thus, threatening the viability of these native wildlife species (Beach 1993). They can also compete for acorns and hickory nuts with native wildlife during years of poor mast production (Campbell and Long 2009). In years of poor mast production, feral swine could have negative effects on white-tailed deer populations due to competition for acorns (Wood and Roark 1980). Due to their acute sense of smell, feral swine more rapidly and efficiently consume fallen mast crop (Beach 1993). Feral swine also have the ability to change to other food sources when acorns were depleted, which deer are often unable to do (Beach 1993). Consumption of hard mast by feral swine in forests also reduces the potential for forest regeneration, further affecting the food chain necessary to maintain species diversity and stable populations (Campbell and Long 2009).

Feral swine can compete with over 100 species of native wildlife for important and limited natural food supplies, and will consume animal material year round, including earthworms, arachnids, crustaceans, insects, gastropods, fish, amphibians, reptiles, birds, and mammals (Mayer and Brisbin 2009). The rooting behavior of feral swine has been identified as the cause of the near extirpation of northern short-tailed shrews (*Blarina brevicuada*) and southern red-backed voles (*Clethrionomys gapperi*) in areas with intensive rooting due to the removal of leaf litter, which is crucial for the survival of those two species (Singer et al. 1984). Feral swine will often search out and excavate food caches used by small mammals, potentially affecting their ability to survive (Campbell and Long 2009).

Feral swine can cause direct mortality through predation on native wildlife species. Feral swine are known to feed on many smaller animals (some threatened or endangered), and will consume voles, shrews, turtles, amphibians, and shrub- or ground-nesting birds (Campbell and Long 2009). Many species, including quail, turkey, endangered sea turtles, and shorebirds, are at risk of predation by nest destruction and the consuming of eggs (Campbell and Long 2009). A study conducted in northern Texas found that feral swine consumed 23.5% and 11.5 % of simulated Northern bobwhite (*Colinus virginianus*) nests in each of the study areas. Researchers concluded feral swine nest predation could be a contributing factor in Northern bobwhite population declines (Timmons et al. 2011).

Mayer and Brisbin (2009) found that of the 40 studies they reviewed, 86% listed vertebrates consumed by feral swine. In New Zealand, feral swine may have caused local extinctions of the endangered Hutton's Shearwater (*Puffinus huttoni*) (Campbell and Long 2009). Feral swine were a common nest predator of re-introduced Eastern wild turkeys (*M. g. silvestris*) at a 10,782-acre Texas wildlife management area. In 1998, researchers removed 68 swine during the first year of a study and estimated the turkey nesting success rate was 0% in the study area (Timmons et al. 2011). The following year, researchers removed 313 feral swine from the study area and the nesting success rate for turkeys increased to 25%. Timmons et al. (2011) concluded that feral swine were a contributing factor to turkey nest depredation in the wildlife management area. Feral swine can also prey on turkey poults (Wood and Lynn 1977).

Plant forage makes up approximately 88% of a feral swine's dietary composition and is consumed year-round (Mayer and Brisbin 2009). This high dependence on vegetation may be why feral swine can cause the greatest damage to environmentally sensitive areas (Campbell and Long 2009). Feral swine can reduce recruitment of saplings, increase the spread of invasive plants, prevent forest regeneration, reduce seedlings and seedling survival, and eliminate understory (Campbell and Long 2009). Bratton (1975) found that the rooting behavior of feral swine in beech forest understory could be so severe that recovery was unlikely to occur. Where feral swine reduced herbaceous and belowground vegetation, recovery time could take more than three years (Howe et al. 1981). Feral swine can reduce the amount of vegetative ground cover and leaf litter, reducing the critical microclimatic conditions necessary for seedling establishment and growth in forests (Chavarria et al. 2007).

In terrestrial plant communities, disturbance can threaten native communities by promoting the spread of invasive, exotic plant species (Tierney and Cushman 2006). Following disturbance through feeding activities by feral swine, percent cover of native perennial grasses recovered at a consistently slower rate than exotic grasses (Tierney and Cushman 2006). Tierney and Cushman (2006) also found that removing or reducing the size of feral swine populations is an effective technique for restoring native perennial grasses.

Habitat damage by feral swine can be severe in wet environments (Engeman et al. 2007). Wet soils may make it easier for feral swine to obtain the foods they favor, such as the roots, tubers, and bulbs that are characteristic of many wetland plants. Choquenot et al. (1996) found that there appeared to be a strong correlation between soil moisture and rooting damage. Aquatic macrophytes are a key component of habitat in wetlands, providing both an important food resource and structural complexity to the waterscape for associated biota (Thomaz et al. 2008). Macrophytes are an aquatic plant that grows in or near water and are emergent, submergent, or floating. The destruction of wetland vegetation by feral swine was also found to alter production and respiration regimes causing anoxic (depleted of dissolved oxygen) conditions (Doupe et al. 2010). Lower dissolved oxygen levels caused chronic sub-lethal effects for the associated biota.

Feral swine can affect lakes, ponds, streams, and wetlands, since their rooting and wallowing activities near water sources may increase water turbidity in streams and wetlands, and increase soil erosion and alter nutrient cycling (Singer et al. 1982, DeBenedetti 1986). Increases in water turbidity reduce water quality and can affect native fishes (DeBenedetti 1986). Doupe et al. (2010) found that feral swine foraging in wetland floodplains disrupted physical, chemical, and biological environments by increasing turbidity, destroying aquatic macrophytes, and by causing the proliferation of bare ground and open water.

Feral swine can spend considerable time foraging or wallowing in aquatic habitats (Mersinger and Silvy 2007). They can also forage both in and out of water to obtain wetland roots and bulbs (Doupe

et al. 2010). Due to their foraging behavior, feral swine are more likely to disturb the wetland substrate and water body.

Kaller and Kelso (2003) found that feral and free-ranging swine were associated with increased levels of fecal coliform and other potentially pathogenic bacteria in a watershed. Kaller et al. (2007) used DNA fingerprinting to determine that feral swine contribute detectable *E. coli* into aquatic ecosystems. Additionally, the fecal coliform from feral swine can negatively affect some species of freshwater mussels and aquatic insects within a watershed (Kaller and Kelso 2006).

Need to Manage Damage to Property associated with Feral Swine

Feral swine can damage landscaping, golf courses, roads, drainage ditches, and cause erosion by feeding in those areas. Feral swine dig or root in the ground with their nose in search of desired roots, grubs, earthworms, and other food sources. The rooting and digging activity of feral swine turns sod and grass over, which often leaves the area bare of vegetation and susceptible to erosion. Feral swine can also pose a threat to property when motor vehicles and aircraft strike swine. Mayer and Johns (2007) collected data on 179 feral swine-vehicle collisions involving 212 feral swine. Mayer and Johns (2007) suggested that vehicular accidents with feral swine are costly due to their mass; and that potentially, the total annual cost of feral swine-vehicle collisions in the United States can be as high as $36 million, roughly $1,173 per vehicle (Mayer and Johns 2007). Collisions with feral swine are most common in areas of preferred feral swine habitat. An evaluation of 311 feral swine-vehicle collisions in South Carolina determined that collisions were more likely in areas closer to streams and with less pine forest than would occur if collisions were randomly distributed (Beasley et al. 2013).

Need to Reduce Threats to Human Safety associated with Feral Swine

Feral swine can pose a threat to human safety from disease transmission, from aggressive behavior, and from vehicles and aircraft striking feral swine. Feral swine are potential reservoirs for approximately 30 viral and bacterial diseases (Samuel et al. 2001, Williams and Barker 2001, Davidson 2006) and 37 parasites (Forrester 1991) that are transmissible to people. Brucellosis, salmonellosis, toxoplasmosis, trichinosis, tuberculosis, and tularemia are some of the zoonotic diseases (*i.e.*, diseases that could be transmitted to people) that can be carried by feral swine (Hubalek et al. 2002, Seward et al. 2004, Stevens 2010); however, actual transmission of diseases to people is thought to be rare (Amass 1998).

Over 200 people in the United States became ill and three deaths occurred after people ate spinach leaves contaminated with *E. coli* that originated from feral swine feces deposited in California spinach fields (FDA 2007, Rouhe and Sytsma 2007). Vehicle collisions are also a human health and safety threat due to the potential for injury or death when striking feral swine, which can weigh up to 400 pounds or more (Mayer and Johns 2007).

Swine can serve as major reservoirs of H1N1 and H3N2 influenza viruses, which are endemic in swine populations worldwide and are responsible for one of the most prevalent respiratory diseases in swine (Brown 2004). Swine husbandry practices can facilitate the maintenance of these viruses in swine and the frequent exchange of viruses between swine and other species. Following interspecies transmission to swine, some influenza viruses may be extremely unstable genetically, giving rise to many virus variants (Brown 2004). It is a concern of public health officials that swine will be the organism in which a re-assortment of the H5N1 virus changes into one that is easily transmissible to people (Hutton et al. 2006).

From FY 2007 through FY 2014, 134 out of 722 (18.6%) feral swine samples collected in South

Carolina were sero-positive for swine brucellosis. In some areas, swine brucellosis infections can be high within the State. For example, in Richland County, South Carolina, the number of feral swine samples that were sero-positive for brucellosis was as high as 43.9% (WS, unpublished data).

In many circumstances, people request WS' assistance with a wildlife conflict because of a perceived risk to human health or safety associated with wild animals living near people or acting abnormally in human-inhabited areas. Under the proposed action, WS could assist in resolving those types of problems. In the majority of cases in which human health concerns were a major reason for requesting assistance with feral swine damage, there may have been no actual cases of transmission of disease to people to prompt the request. Thus, the primary reason people request assistance from WS would be the potential for disease transmission. In addition to threats from disease transmission, is the threat that feral swine can pose from aggressive behavior. Feral swine can be very aggressive toward people, especially when threatened (Mayer 2013).

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

This EA documents the need to manage damage caused by feral swine, the issues associated with meeting that need, and alternative approaches to address those issues and to meet the need for action. The mission of WS would be to provide federal leadership with managing damage and threats of damage associated with animals (see WS Directive 1.201). WS would only provide assistance when the appropriate property manager or property owner requested WS' assistance. WS could receive a request for assistance from a property owner or manager to conduct activities on property they own or manage, which could include federal, state, tribal, municipal, and private land within the State of South Carolina. WS Directive 2.320 provides guidelines for WS' actions in the management of invasive species in fulfillment of Executive Order 13112.

Appendix B[6] of this EA discusses the methods available for use or recommendation under each of the alternative approaches evaluated. The alternatives and Appendix B also discuss how WS and other entities could recommend or employ methods to manage damage and threats associated with feral swine in the State. Therefore, the actions evaluated in this EA are the use or recommendation of those methods available under the alternatives and the employment or recommendation of those methods by WS to manage or prevent damage and threats associated with feral swine from occurring when requested by the appropriate resource owner or manager. WS' activities that could involve the lethal removal of feral swine under the alternatives would only occur when agreed upon by the requester and when authorized by the SCDNR, when required, and only at levels authorized.

Federal, State, County, City, and Private Lands

WS could continue to provide assistance with alleviating feral swine damage or threats of damage on federal, state, county, municipal, and private land in South Carolina when receiving a request for such assistance from the appropriate resource owner or manager. In those cases where a federal agency requests WS' assistance with managing damage caused by feral swine on property they own or manage, the requesting agency would be responsible for analyzing those activities in accordance with the NEPA. However, this EA could cover such actions if the requesting federal agency determined the analyses and scope of this EA were appropriate for those actions and the requesting federal

[6]A complete list of methods available for use by WS under the identified alternatives, except the alternative with no damage management by WS (Alternative 1), occurs in Appendix B. However, listing methods neither implies that all methods would be used by WS to resolve requests for assistance nor does the listing of methods imply that all methods would be used to resolve every request for assistance.

agency adopted this EA through their own Decision based on the analyses in this EA. Therefore, the scope of this EA analyzes actions that could occur on federal, state, county, municipal, and private lands, when requested.

Native American Lands and Tribes

The WS program in South Carolina would only conduct damage management activities on Native American lands when requested by a Native American Tribe. WS would only conduct activities after WS and the Tribe requesting assistance signed a Memorandum of Understanding (MOU), a work initiation document, or another comparable document. Therefore, the Tribe would determine what activities would be allowed and when WS' assistance was required. Because Tribal officials would be responsible for requesting assistance from WS and determining what methods would be available to alleviate damage, no conflict with traditional cultural properties or beliefs would likely occur. Those methods available to alleviate damage associated with feral swine on federal, state, county, municipal, and private properties under the alternatives analyzed in this EA would be available for use to alleviate damage on Tribal properties when the Tribe requesting WS' assistance approved the use of those methods. Therefore, the activities and methods addressed under the alternatives would include those activities that WS could employ on Native American lands, when requested and when agreed upon by the Tribe and WS.

Period for which this EA is Valid

If the preparation of an Environmental Impact Statement (EIS) is not warranted, based on the analyses associated with this EA, WS would review activities conducted under the selected alternative to ensure those activities occurred within the parameters evaluated in this EA. This EA would remain valid until WS, in consultation with the SCDNR, determined that new needs for action, changed conditions, new issues, or new alternatives having different environmental impacts must be analyzed. At that time, WS would supplement this analysis or conduct a separate evaluation pursuant to the NEPA. Under the alternative analyzing no involvement by WS, no review or additional analyses would occur based on the lack of involvement by WS. The monitoring of activities by WS would ensure the EA remained appropriate to the scope of damage management activities conducted by WS in South Carolina under the selected alternative.

Site Specificity

As mentioned previously, WS would only conduct damage management activities when requested by the appropriate resource owner or manager. This EA analyzes the potential impacts of managing damage caused by feral swine based on previous activities conducted on private and public lands in South Carolina where WS and the appropriate entities have signed a MOU, work initiation document, or another comparable document. This EA also addresses the potential effects of managing damage caused by feral swine in areas where WS and a cooperating entity could sign additional agreements in the future. Because the need for action would be to reduce damage and because the program's goals and directives would be to provide assistance 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 analyzes the potential effects of those efforts as part of the alternatives.

Feral swine occur statewide and throughout the year in the State; therefore, damage or threats of damage could occur wherever feral swine occur. Planning for the management of feral swine damage must be viewed as being conceptually similar to the actions of other entities whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and

locations where they would occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire departments, police departments, emergency clean-up organizations, and insurance companies. Although WS could predict some locations where feral swine damage would occur, WS could not predict every specific location or the specific time where such damage would occur in any given year. In addition, the threshold triggering an entity to request assistance from WS to manage damage associated with feral swine is often unique to the individual; therefore, predicting where and when WS would receive such a request for assistance would be difficult. This EA emphasizes major issues as those issues relate to specific areas whenever possible. However, many issues would apply wherever feral swine damage and the resulting management actions occur. Therefore, the analyses treat those issues as though they occur wherever feral swine damage and the resulting management actions occur.

Chapter 2 of this EA identifies and discusses issues relating to managing damage caused by feral swine in South Carolina. The standard WS Decision Model (Slate et al. 1992; see WS Directive 2.201) would be the site-specific procedure for individual actions that WS could conduct in the State (see Chapter 3 for a description of the Decision Model and its application). Decisions made using the model would be in accordance with WS' directives and Standard Operating Procedures (SOPs) described in this EA, as well as relevant laws and regulations in accordance with WS Directive 2.210.

The analyses in this EA would apply to any action that may occur by WS in any locale and at any time within South Carolina. In this way, WS believes the program 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 the mission of the program.

Summary of Public Involvement

WS initially developed the issues associated with managing damage caused by feral swine in consultation with the SCDNR. WS defined the issues and identified the preliminary alternatives through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS implementing regulations for the NEPA, WS will make this document available to the public for review and comment. WS will make the document available to the public through legal notices published in local print media, through direct notification of parties that have requested notification, or that WS has identified as having a potential interest in the reduction of threats and damage associated with feral swine in the State. In addition, WS will post this EA on the APHIS website for review and comment.

WS will provide for a minimum of a 30-day comment period for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS will clearly communicate to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. WS would fully consider new issues, concerns, or alternatives the public identifies during the public involvement period to determine whether WS should revisit the EA and, if appropriate, revise the EA prior to issuance of a Decision.

1.4 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

WS' Environmental Assessment – Beaver Damage Management in South Carolina

WS has developed an EA that analyzed the need for action to manage damage associated with beaver in the State (USDA 2002). Although this EA does not specifically address beaver, some of the methods available to alleviate beaver damage could also be available to alleviate damage associated with feral swine, such as cable restraints. In addition, the unintentional removal of non-target species

could be similar across program activities. Therefore, this EA will evaluate the cumulative use of methods related to beaver damage management and the methods available under the alternatives in this EA.

WS' Environmental Assessment – Mammal Damage Management in South Carolina

WS has also prepared a separate EA to evaluate the need to reduce damage associated with other mammal species in the State (USDA 2015*a*). WS could use some of the methods available to reduce feral swine damage and threats of damage to alleviate damage caused by other mammal species, such as cage traps, cable restraints, and shooting. In addition, the unintentional removal of non-target species could be similar across program activities. Therefore, this EA will evaluate the potential cumulative effects associated with the alternative approaches evaluated in the EA evaluating the need to manage damage associated with other mammal species in the State.

WS' Environmental Assessment - Feral Swine Damage and Disease Management in South Carolina

As was stated previously, WS previously developed an EA that addressed WS' activities to manage damage associated with feral swine in the State (USDA 2013*a*). This EA will address more recently identified changes in activities and will assess the potential environmental impacts of program alternatives based on those changes, primarily a need to evaluate increasing requests for assistance and the development of an EIS by WS that evaluates a national approach to managing feral swine damage. This new EA will re-evaluate activities discussed under the previous EA to address the new need for action and the associated affected environment. Therefore, the outcome of the Decision issued based on the analyses in this EA will supersede the previous EA.

Final Environmental Impact Statement - Feral Swine Damage Management

The APHIS and cooperating agencies prepared a programmatic EIS to address feral swine damage management in the United States, American Samoa, Mariana Islands, United States Virgin Islands, Guam, and Puerto Rico (USDA 2015*b*). The Record of Decision selected the preferred alternative in the EIS to implement a nationally coordinated program that integrates methods to address feral swine damage. In accordance with the Record of Decision, WS developed this EA to be consistent with the EIS and the Record of Decision.

South Carolina Comprehensive Wildlife Conservation Plan

The SCDNR has developed an extensive wildlife conservation plan that evaluates species of plants and animals within the State (SCDNR 2005) and has prepared a draft state wildlife action plan (SCDNR 2015). The conservation plan states, "*In order to sustain South Carolina's diverse wildlife resources in the future, the following actions are critical: (1) increase baseline biological inventories with emphasis on natural history, distribution and status of native species; (2) increase commitment by natural resource agencies, conservation organizations and academia toward establishing effective conservation strategies; (3) increase financial support and technological resources for planning and implementation of these strategies; and (4) create public-private partnerships and educational outreach programs for broad-scale conservation efforts*" (SCDNR 2005). The plan further states, "*feral hogs….are examples of animals that can cause serious impacts to natural communities and native species*" (SCDNR 2005). The draft state wildlife action plan further states, "*Feral hogs can destroy habitat for many species, particularly those found in wetland habitats*" (SCDNR 2015). WS consulted the Comprehensive Wildlife Conservation Strategy and the wildlife action plan as part of this analysis and the alternatives would be consistent with both plans.

1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES

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

WS' Legislative Authority

The primary statutory authority for the WS program is 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 animals. WS' directives define program objectives and guide WS' activities when managing animal damage.

United States Environmental Protection Agency (EPA)

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

South Carolina Department of Natural Resources

The authority of the SCDNR in wildlife management is given under Title 50, Chapters 1, 3, 9, 11, 15, 16, and 123 of the Official Code of South Carolina Unannotated.

South Carolina Department of Agriculture (SCDA)

The State Crop Pest Commission of the SCDA enforces state laws pertaining to the use and application of pesticides. Under the South Carolina Pesticide Control Act this section monitors the use of pesticides in a variety of pest management situations. It also licenses private and commercial pesticide applicators and pesticide contractors. Under the South Carolina Pesticide Control Act the division licenses restricted use pesticide dealers and registers all pesticides for sale and distribution in the State of South Carolina.

1.6 COMPLIANCE WITH LAWS AND STATUTES

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

National Environmental Policy Act

All federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS follows the CEQ regulations implementing the NEPA (40 CFR 1500 et seq.) along with the USDA (7 CFR 1b) and the APHIS implementing guidelines (7 CFR 372) as part of the decision-making process. Those laws, regulations, and guidelines generally outline five broad types of activities that federal agencies must accomplish as part of any project: public involvement, analysis, documentation, implementation, and monitoring. The NEPA also sets forth the requirement that all major federal actions be evaluated in terms of their potential to significantly affect the quality of the human environment for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. In part, the CEQ, through regulations in 40 CFR, Parts 1500-1508, regulate federal activities

that could affect the physical and biological environment. In accordance with regulations of the CEQ and the USDA, the APHIS has published guidelines concerning the implementation of the NEPA (see 44 CFR 50381-50384).

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

Endangered Species Act

Under the Endangered Species Act (ESA), all federal agencies will seek to conserve threatened and endangered (T&E) species and will utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts consultations with the United States Fish and Wildlife Service (USFWS) pursuant to Section 7 of the ESA to ensure that "*...any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species...Each agency will use the best scientific and commercial data available*" (Sec.7 (a)(2)). Evaluation of the alternatives in regards to the ESA will occur in Chapter 4 of this EA.

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

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

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

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; PL 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. Congress authorized funds for cost-sharing grants to states to develop their programs. Subsequent to federal approval of their plans, awarding of funding grants occurred for implementation purposes. In order to be eligible for federal approval, each state's plan was required to define boundaries of the coastal zone, identify uses of the area to be regulated by the state, determine the mechanism (criteria, standards or regulations) for controlling such uses, and develop 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 agencies conduct their actions 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. As appropriate, WS would conduct a consistency determination to assure management actions would be consistent with South Carolina's Coastal Zone Management Program.

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

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

WS would use only legal, effective, and environmentally safe methods, tools, and approaches under the appropriate alternatives. Other entities would regulate all chemicals that would be available to WS, including the EPA through the FIFRA, the SCDA, the FDA, and the DEA. In addition, MOUs with land managing agencies and WS' Directives would further constrain WS' use of chemical methods when those methods were available for use under the alternatives. WS would properly dispose of any excess solid or hazardous waste. WS' does not anticipate the alternatives would result in any adverse or disproportionate environmental effects to minority and low-income persons or populations. In contrast, the alternatives may benefit minority or low-income populations by reducing threats to public health and safety and property damage.

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

Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. WS has considered the potential impacts that the alternatives might have on children. The proposed activities would occur by using only legally available and approved methods where it would be highly unlikely that activities conducted pursuant to the alternative would adversely affect children. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing the alternatives. Additionally, the need for action identified a need to reduce threats to human safety, including risks to children; therefore, cooperators could request WS' assistance with reducing threats to the health and safety of children posed by feral swine.

Invasive Species (Executive Order 13112)

Executive Order 13112 establishes guidance to federal agencies to prevent the introduction of invasive species, provide for the control of invasive species, and to minimize the economic, ecological, and human health impacts that invasive species cause. The Order states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, reduce invasion of exotic species and the associated damages, and monitor invasive species populations and provide for restoration of native species and habitats. In addition, federal agencies should conduct research on invasive species and develop technologies to prevent introduction, and provide for environmentally sound control and promote public education of invasive species. The National Invasive Species Council specifically lists feral swine as an invasive species pursuant to Executive Order 13112. WS Directive 2.320 provides guidelines for WS' actions in the management of invasive species in fulfillment of Executive Order 13112.

The Native American Graves and Repatriation Act of 1990

The Native American Graves Protection and Repatriation Act (Public Law 101-106, 25 USC 3001) requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal agencies are to discontinue work until the agency has made a reasonable effort to protect the items and notify the proper authority.

Occupational Safety and Health Act of 1970

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

Federal Insecticide, Fungicide, and Rodenticide Act

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

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

This law places administration of pharmaceutical drugs, including those immobilizing drugs used for wildlife capture and handling, under the Food and Drug Administration (FDA).

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

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

Animal Medicinal Drug Use Clarification Act of 1994

The Animal Medicinal Drug Use Clarification Act (AMDUCA) and its implementing regulations (21 CFR 530) establish several requirements for the use of animal drugs, including those animal drugs used to capture and handle wildlife in damage management programs. Those requirements are: (1) a valid "*veterinarian-client-patient*" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under any alternative where WS could use those immobilizing drugs and euthanasia chemicals. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (*i.e.*, a period after a drug was administered that must lapse before an animal may be used for food) for specific drugs. Animals that people might consume within the withdrawal period must be identifiable (*e.g.*, use of ear tags) and labeled with appropriate warnings.

Airborne Hunting Act

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

South Carolina General Assembly Laws

In 2010, the South Carolina General Assembly passed a new law that prohibits the removal or transport of feral swine from the wild without a permit. This was part of continuing efforts by the SCDNR to reduce and curtail the expansion of the feral swine population in the State.

In South Carolina, it is unlawful to release or transport for the purpose of release, feral swine for hunting purposes or in an attempt to establish or supplement a free roaming population (South Carolina Code of Laws § 50-16-25). A person must now obtain an annual swine transport and release permit from SCDNR before transporting and/or releasing a swine from a free roaming population. All swine must also be tagged as prescribed on the permit with tags provided by the SCDNR. A permitted swine must be released on the same tract on which it was captured or into a permitted swine enclosure utilized for hunting purposes. Under no circumstances may a live swine removed from the wild be transported through or into another county or be released in a county other than the county in which it was captured.

Night hunting for most game species in South Carolina is unlawful. In 2010 and again in 2012, exceptions were made for feral swine. Feral swine may now be hunted at night throughout the year with a bow and arrow, other than a crossbow, or a pistol having iron sights, a barrel not exceeding nine inches, and which is not equipped with a butt-stock, scope, or laser sight. Additionally, feral swine may be hunted at night with or without the aid of bait, electronic calls, artificial light, or night vision devices from the last day of February to the first day of July with any legal firearm, bow and arrow, or crossbow when the landowner provides notice to the department at least 48 hours prior to hunting. The landowner must provide the names and hunting license number of all participants in the hunt. When hunting at night with a center fire rifle, a hunter must be at an elevated position at least ten feet from the ground. Finally, the department can issue a depredation permit during any time of year for the removal of swine causing damage to crops or property.

In South Carolina, it is unlawful to release or transport for the purpose of release, feral swine for hunting purposes or in an attempt to establish or supplement a free roaming population (South Carolina Code of Laws § 50-16-25).

1.7 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. The SCDNR is responsible for managing wildlife in the State, including feral swine. As the authority for the management of feral swine populations in the State, the SCDNR was involved in the development of the EA and provided input throughout the EA preparation process to ensure an interdisciplinary approach according to the NEPA and agency mandates, policies, and regulations. The SCDNR also establishes and enforces regulated hunting and trapping seasons in the State. Activities that WS could conduct under the alternatives to reduce and/or prevent feral swine damage in the State would be coordinated with the SCDNR, which would ensure the SCDNR has the opportunity to incorporate any activities WS' conducts into population objectives established for feral swine populations in the State.

Based on the scope of this EA, the decisions to be made are: 1) should WS conduct feral swine damage management, 2) should WS conduct disease surveillance and monitoring in feral swine populations when requested, 3) should WS implement an integrated methods approach to meet the need for action, 4) if not, should WS attempt to implement one of the alternatives to an integrated methods approach, and 5) would the proposed action or the other alternatives result in effects to the environment requiring the preparation of an EIS.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impact analysis in Chapter 4 (Environmental Consequences), issues that have driven the development of SOPs, and issues that WS did not consider in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues. Additional descriptions of the affected environment occur during the discussion of the environmental effects in Chapter 4.

2.1 AFFECTED ENVIRONMENT

In general, feral swine prefer moist bottomlands or riparian areas along streams and rivers, along with other areas associated with aquatic habitats (West et al. 2009, Stevens 2010, Hamrick et al. 2011). However, feral swine are capable of utilizing a variety of habitats in the State. Feral swine occur throughout the year across the State where suitable habitat exists for foraging and shelter. Since feral swine occur throughout most of the State, requests for assistance to manage damage or threats of damage could occur in areas occupied by feral swine. However, WS would only conduct activities to alleviate or prevent damage when requested by a landowner or manager and only on properties where a MOU, work initiation document, or another comparable document were signed between WS and a cooperating entity.

Upon receiving a request for assistance, WS could conduct activities to reduce feral swine damage or threats on federal, state, tribal, municipal, and private properties in South Carolina. Areas where damage or threats of damage could occur include, but would not be limited to agricultural fields, orchards, farmyards, ranches, livestock operations, aquaculture facilities, industrial sites, natural areas, government properties and facilities, private properties, corporate properties, schools, parks, woodlots, recreation areas, communally-owned homeowner/property owner association properties,

wildlife refuges, levees, dikes, and wildlife management areas. The area would also include airports and military airbases where feral swine were a threat to human safety and to property; areas where feral swine were negatively affecting wildlife, including T&E species; and public property where feral swine were negatively affecting historic structures, cultural landscapes, and natural resources. Chapter 4 also contains additional information on the affected environment.

Environmental Status Quo

As defined by the NEPA implementing regulations, the "*human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment*" (40 CFR 1508.14). Therefore, when a federal action agency analyzes their potential impacts on the "*human environment*", it is reasonable for that agency to compare not only the effects of the proposed federal action, but also the potential impacts that occur or could 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 animal species.

Neither federal nor state law protects some wildlife species, such as most non-native invasive species. State authority or law manages most wildlife species without any federal oversight or protection. In some situations, with the possible exception of restrictions on methods (*e.g.*, firearms restrictions, pesticide regulations), unprotected animal species and certain resident wildlife species are managed with little or no restrictions, which allows anyone to lethally remove or capture those species at any time when they are committing damage. In South Carolina, the SCDNR has the authority to manage and authorize the taking of wildlife for damage management purposes. A private landowner, or persons with the landowner's permission, may lethally remove feral swine throughout the year during daylight hours using legally available methods. In addition, property owners may request a permit from the SCDNR to shoot feral swine at night with some restrictions. People can also harvest feral swine on public lands during designated hunting seasons.

When a non-federal entity (*e.g.*, agricultural producers, municipalities, counties, private companies, individuals, or any other non-federal entity) takes an action to alleviate feral swine damage or threat, the action is not subject to compliance with the NEPA due to the lack of federal involvement in the action. In addition, methods available for resolving damage associated with feral swine would also be available for use by other entities. Under such circumstances, the environmental baseline or status quo would be an environment that includes those resources as other non-federal entities manage or affect those resources in the absence of the federal action. Therefore, in those situations in which a non-federal entity has decided that a management action directed towards feral swine should occur and even the particular methods that would be used, WS' involvement in the action would not affect the environmental status quo since the entity could take the action in the absence of WS' involvement. WS' involvement would not change the environmental status quo if the requester had conducted the action in the absence of WS' involvement in the action.

A non-federal entity could lethally remove feral swine on private property to alleviate damage when permitted by the SCDNR and in some cases, without the need for a permit (see Section 1.6). In addition, most methods available for resolving damage associated with feral swine would also be available for use by other entities. Therefore, WS' decision-making ability would be restricted to one of three alternatives. WS could take the action using the specific methods as decided upon by the non-federal entity, provide technical assistance only, or take no action. If WS' takes no action or provides just technical assistance, another entity could take the action anyway using those same methods without the need for authorization, during the hunting season, or through authorization by the SCDNR. Under those circumstances, WS would have virtually no ability to affect the

environmental status quo since the action would likely occur in the absence of WS' direct involvement.

Therefore, based on the discussion above, it is clear that in those situations where a non-federal entity has obtained the appropriate authorization, and has already made the decision to remove or otherwise manage feral swine to stop damage with or without WS' assistance, WS' participation in carrying out the action would not affect the environmental status quo.

2.2 ISSUES ASSOCIATED WITH FERAL SWINE DAMAGE MANAGEMENT ACTIVITIES

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

Chapter 4 discusses the issues, as those issues relate to the possible implementation of the alternatives, including the proposed action. WS evaluated, in detail, the following issues.

Issue 1 - Effects on Feral Swine Populations in South Carolina

A common issue when addressing damage caused by animals is the potential impacts of management actions on the populations of target species. Lethal and non-lethal methods would be available to resolve damage or threats to human safety (see Appendix B), which have the potential to disperse, exclude, capture, and remove feral swine from areas where damage or threats are occurring.

Non-lethal methods could disperse or otherwise make an area unattractive to feral swine causing damage, which could reduce the presence of those swine at the site and potentially the immediate area around the site where an entity employed those methods. Employing lethal methods could remove a single feral swine or those feral swine responsible for causing damage or posing threats to human safety. Therefore, the use of lethal methods could result in local population reductions in the area where damage or threats were occurring. The number of feral swine removed from the population using lethal methods or dispersed from an area using non-lethal methods under the alternatives would be dependent on the number of requests for assistance received, the number of individual feral swine involved with the associated damage or threat, and the efficacy of methods employed.

The analysis will measure the number of individuals lethally removed in relation to the abundance of feral swine to determine the magnitude of impact to the feral swine population from the use of lethal methods. Magnitude may be determined either quantitatively or qualitatively. Determinations based on population estimates, allowable harvest levels, and actual harvest data are quantitative. Determinations based on population trends and harvest trend data, when available, are qualitative.

Another concern is that activities conducted by WS would affect the ability of persons to harvest feral swine either by reducing local populations through the lethal removal of feral swine or by reducing the number of feral swine present in an area through dispersal techniques. Other entities can harvest feral swine in the State at any time and other entities could lethally remove feral swine using available methods when those swine cause damage or pose threats of damage. Therefore, any damage management activities conducted by WS under the alternatives addressed would be occurring along with other natural process and human-induced events, such as natural mortality, human-induced mortality from private damage management activities, mortality from harvest, and human-induced alterations of wildlife habitat.

Under certain alternatives, WS could employ methods available to resolve damage and reduce threats to human safety that target an individual feral swine or a group of individuals after applying the WS' Decision Model (Slate et al. 1992) to identify possible techniques. Chapter 4 analyzes the possible effects on the feral swine population in the State from implementation of the alternatives addressed in detail, including the proposed action.

Issue 2 - Effects on Non-target Species, including Threatened and Endangered Species

The issue of non-target species effects, including effects on T&E species, arises from the use of those methods available under each of the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently disperse, capture, or kill non-target animals.

The ESA states that all federal agencies *"...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* [Sec. 7(a)(1)]. WS conducts consultations with the USFWS pursuant to Section 7 of the ESA to ensure compliance. The WS program also conducts consultations 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)]. As part of the scoping process for this EA, WS consulted with the USFWS pursuant to Section 7 of the ESA to facilitate interagency cooperation between WS and the USFWS. Chapter 4 discusses the potential effects of the alternatives on this issue.

Issue 3 - Effects of Management Methods on Human Health and Safety

An additional issue often raised is the potential risks to the safety of people associated with employing methods to manage damage caused by feral swine. Both chemical and non-chemical methods have the potential to have adverse effects on human safety. WS' employees could use and would recommend only those methods that were legally available under each of the alternatives. Still, some concerns exist regarding the safety of methods available despite their legality and selectivity. As a result, this EA will analyze the potential for proposed methods to pose a risk to members of the public. In addition to the potential risks to the public associated with the methods available under each of the alternatives, risks to WS' employees would also be a concern. Injuries to WS' employees could occur during the use of methods. Selection of methods, under the alternatives, would include consideration for public and employee safety.

Safety of Chemical Methods Employed

The issue of using chemical methods as part of managing damage associated with feral swine relates to the potential for human exposure through direct contact with the chemical or through exposure to the chemical from feral swine that have been exposed. Under the alternatives identified, the use or recommendation of chemical methods could include immobilizing drugs and euthanasia chemicals. A list and description of immobilizing drugs and euthanasia chemicals available for use under the identified alternatives can be found in Appendix B.

The potential for drugs used in animal capture and handling to cause adverse health effects in people that hunt and consume feral swine has also been identified. There is no closed season for feral swine on private property. Therefore, people can harvest feral swine in the State throughout the year and people may consume meat from feral swine that they harvest. Chemicals available for use under the relevant alternatives are regulated by State laws, by the DEA, by the FDA, and by WS' Directives.

Safety of Non-Chemical Methods Employed

Most methods available to alleviate damage and threats associated with feral swine would be non-chemical methods. Non-chemical methods may include cultural methods, limited habitat modification, animal behavior modification, and other mechanical methods. Changes in cultural methods could include improved animal husbandry practices, altering feeding schedules, changes in crop rotations, or conducting structural repairs. Limited habitat modification would be practices that alter specific characteristics of a localized area, such as removing bushes to eliminate shelter locations or planting vegetation that was less palatable to feral swine. Animal behavior modification methods would include those methods designed to disperse feral swine from an area through harassment or exclusion. Behavior modification methods could include pyrotechnics, propane cannons, barriers, electronic guards, effigies, and lasers. Other mechanical methods could include live-traps, snares, shooting (including shooting from aircraft), drop nets, use of tracking dogs, or the recommendation that a local population of feral swine be reduced during hunting seasons.

The primary safety risk of most non-chemical methods occurs directly to the applicator or those persons assisting the applicator. However, risks to others do exist when employing non-chemical methods, such as when using firearms and pyrotechnics. Most of the non-chemical methods available to address feral swine damage would be available for use under any of the alternatives and any entity could employ those methods, when authorized. Chapter 4 further evaluates the risks to human safety from the use of non-chemical methods. Appendix B provides a complete list of non-chemical methods available to alleviate damage associated with feral swine.

Effects of not Employing Methods to Reduce Damage and Threats

Another concern is the threat to human safety from not employing methods or not employing the most effective methods to reduce the threats that feral swine could pose. The need for action in Chapter 1 addresses the risks to human safety from diseases associated with feral swine. The low risk of disease transmission from feral swine does not lessen the concerns of cooperators requesting assistance to reduce threats from zoonotic diseases. Increased public awareness of zoonotic events has only heightened the concern of direct or indirect exposure to zoonoses. Feral swine can also pose threats to human safety when struck by vehicles or aircraft. Not adequately addressing the threats associated with potential zoonoses could lead to an increase in incidences of injury, illness, or loss of human life. Chapter 4 evaluates this issue in relationship to the alternatives.

Issue 4 - Humaneness of Methods Available for Damage Management

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate 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."*

According to the American Veterinary Medical Association (AVMA), suffering is described as a *"…highly unpleasant emotional response usually associated with pain and distress"* (AVMA 1987). However, suffering *"…can occur without pain…,"* and *"…pain can occur without suffering…"*. Because suffering carries with it the implication of a time frame, a case could be made for *"…little or no suffering where death comes immediately…"* (California Department of Fish and Game 1991). Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain and identifying the causes that elicit pain responses in humans would "*...probably be causes for pain in other animals…"* (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (California Department of Fish and Game 1991).

The AVMA states "*...euthanasia is the act of inducing humane death in an animal*" and "*... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness*" (Beaver et al. 2001). Some people would prefer AVMA accepted methods of euthanasia to be used when killing all animals, including wild and invasive animals. The AVMA states that "*For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible*" (Beaver et al. 2001).

Pain and suffering, as it relates to methods available for use to manage feral swine has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since *"…neither medical nor veterinary curricula explicitly address suffering or its relief"* (California Department of Fish and Game 1991). Research suggests that some methods can cause "*stress*" (Kreeger et al. 1990). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress (Bateson 1991) for use in evaluating humaneness.

The decision-making process involves tradeoffs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering. The issue of humanness will be further discussed in Chapter 4. SOPs to alleviate pain and suffering are discussed in Chapter 3.

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

Additional issues were also identified by WS and the SCDNR during the scoping process of this EA. Those additional issues were considered but detailed analyses will not occur for the reasons provided. The following issues were considered but were not analyzed in detail:

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

A concern was raised that an EA for an area as large as the State of South Carolina would not 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 describe accurately 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 could occur, the program cannot predict the specific locations or times at which affected resource owners would determine a damage problem has become intolerable to the point that they request assistance from WS. In addition, the WS program would not be able to prevent such damage in all areas where it might occur without resorting to destruction of wild animal populations over broad areas at a much more intensive level than would be desired by most people, including WS and other agencies. Such broad scale population management would also be impractical or impossible to achieve within WS' policies and professional philosophies.

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 was to determine if the alternatives 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 feral swine in the State to analyze individual and cumulative impacts and to provide a thorough analysis.

In terms of considering cumulative effects, one EA analyzing impacts for the entire State would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination were 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 South Carolina would continue to receive requests for assistance associated with a very small area of the State where damage or threats were occurring or likely to occur.

Threats to Biodiversity from Damage Management Activities Conducted by WS

The WS program does not attempt to eradicate any species of native wildlife in the State. WS operates in accordance with federal and state laws and regulations enacted to ensure species viability. Methods available would target individual swine or groups of feral swine identified as causing damage or posing a threat of damage. Any reduction of a local population or group would frequently be temporary because immigration from adjacent areas or reproduction replaces the animals removed. WS has operated on a small percentage of the land area of the State previously and only swine identified as causing damage or posing a threat would be targeted under the alternatives after a request for assistance was received. Therefore, damage management activities conducted pursuant to any of the alternatives would not adversely affect biodiversity in the State.

Feral swine in South Carolina are considered a non-native species that can cause damage to a variety of resources, including causing damage to native ecosystems. Adverse effects associated with feral swine to natural resources were discussed in Section 1.2. Any reduction in feral swine populations in South Carolina could reasonably viewed as benefiting native wildlife and native plants. Executive Order 13112 directs federal agencies whose actions may affect the status of invasive species to reduce invasion of those species and the associated damages to the extent practicable and permitted by law.

Cost Effectiveness of Management Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with the NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. However, the methods that were determined to be most effective at reducing damage and threats to human safety caused by feral swine and that proved to be the most cost effective would likely receive the greatest application under the alternatives. Under the alternatives where WS could provide assistance when requested, evaluation of the methods would continually occur, which would allow those methods that were most effective at resolving damage or threats to be employed under similar circumstance where feral swine were causing damage or posing a threat. Additionally, management operations could be constrained by cooperator funding and/or objectives and needs.

A Loss Threshold Should Be Established Before Allowing Lethal Methods

One issue identified through WS' implementation of the NEPA processes is a concern that a threshold of loss should be established before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. Some damage and economic loss would likely be tolerated by cooperators until the damage reached a threshold where the damage became an economic burden. The appropriate level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and damage situations. In addition, establishing a threshold would be difficult or inappropriate to apply to human health and safety situations. For example, aircraft striking feral swine could cause damage to the aircraft, which could threaten passenger safety if a catastrophic failure of the aircraft occurred because of the strike. Therefore, addressing the threats of a strike prior to an actual strike occurring would be appropriate.

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

Feral swine Damage Management Should Not Occur at Taxpayer Expense

An issue identified is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based. Funding for damage management activities would be derived from federal appropriations and through cooperative funding. Activities conducted in the State for the management of damage and threats to human safety from feral swine would be funded through cooperative service agreements with individual property owners or managers. A minimal federal appropriation is allotted for the maintenance of a WS program in South Carolina. The remainder of the WS program would mostly be fee-based. Technical assistance would be provided to requesters as part of the federally funded activities, but the majority of direct assistance in which WS' employees would perform damage management activities would be funded through cooperative service agreements between the requester and WS.

Potential for Feral Swine to Disperse to Other Areas Due to Management Activities

Methods involving the exclusion, pursuit, shooting, and/or harassment of feral swine could lead to the abandonment of areas traditionally used by swine in South Carolina. If feral swine were dispersed by WS under the alternatives, damages and threats could arise in other areas.

Under the alternatives where WS would be involved with managing damage, WS would evaluate the damage or threat situation to determine the appropriate methods. Activities conducted under the alternatives would be coordinated between WS, SCDNR, and local entities to monitor feral swine populations in areas where dispersal may occur. The potential for methods to disperse feral swine would be considered as part of the evaluation of the damage situation and would be incorporated into the decision-making process associated with the alternatives to determine which methods to employ and recommend. The use of methods that would likely result in the exclusion, harassment, or dispersal of feral swine (*e.g.*, shooting, propane cannons, pyrotechnics), would be used in those situations where damage, threats of damage, and/or threats to human safety would require immediate resolution.

In those situations where feral swine could disperse to areas where damage could occur, individual feral swine could also be radio collared to locate and monitor movements of feral swine. Radio collaring could be used to track movements and locations of feral swine. The tracking of feral swine in relationship to damage management activities would also provide the ability to monitor movements and potential dispersal to other areas. Feral swine often form large groups that allow one individual of the group to be captured, collared, released, and allowed to return to the group. By collaring one individual, the movement and location of an entire group could be monitored. Radio telemetry would be available to monitor the movements of feral swine and to respond as necessary to swine potentially dispersing.

Coordination between agencies and local entities would ensure any dispersing feral swine were identified and addressed when they cause damage or threaten human safety. The limited use of methods that disperse feral swine should further ensure they would not be displaced to other areas within South Carolina. In addition, the passiveness of the primary methods proposed for use should limit dispersal of feral swine.

Effects on Feral Swine Hunting

Another issue identified is the concern that damage management activities conducted by WS would affect the ability of persons to harvest feral swine during the hunting season either by reducing local populations through the lethal removal of feral swine or by reducing the number of feral swine present in an area through dispersal techniques. Excluding, dispersing, or removing feral swine from areas where damage was occurring or could occur may limit the ability of those interested to harvest feral swine during the harvest season. Managing wildlife within the State is the responsibility of the SCDNR.

In South Carolina, there is currently no closed season for feral swine and no weapons restrictions on private property during the daylight hours; therefore, people can harvest feral swine throughout the year on private property (SCDNR 2014*a*). People can also hunt feral swine at night throughout the year on private property in the State using certain weapons[7]. People could use other weapons at night if they seek and receive authorization from the SCDNR. However, the SCDNR does not currently allow hunting of feral swine at night on Wildlife Management Areas (SCDNR 2014*a*). In addition, feral swine could be hunted at night from the last day of February through July 1 with no weapons restrictions when the SCDNR has been properly notified (SCDNR 2014*a*). On Wildlife Management Areas within South Carolina, people can harvest feral swine only during open harvest seasons for other harvestable wildlife and only during daylight, unless otherwise restricted (SCDNR 2014*a*).

As stated previously, WS would only conduct activities or make recommendations when requested by the appropriate property owner or manager. When receiving a request for assistance, WS' employees would give preference to the use and recommendation of non-lethal methods, when those methods were determined to be practical and effective using the WS Decision Model. In addition, if direct operational assistance was requested under the proposed action alternative and lethal methods were requested by the appropriate property owner or manager, WS would only target those feral swine responsible for causing damage. WS could also recommend the use of hunting to property owners as part of managing damage caused by feral swine. Therefore, activities that could be conducted by WS under the alternatives would not adversely affect the ability to harvest feral swine in the State.

[7] At the time this EA was developed, people could hunt feral swine "…*at night with or without the aid of bait, electronic calls, artificial lights, or night vision devices using a bow and arrow other than a crossbow, or a pistol of any caliber having iron sights, a barrel length not exceeding nine inches, and which is not equipped with a butt-stock, scope, or laser sight (50-11-710)*" (SCDNR 2014*a*).

The South Carolina Wild Hog Task Force (2012) estimated that 50 to 75% of the statewide population would have to be removed annually to stabilize or reduce the population. As stated previously, one of the goals expressed by the South Carolina Wild Hog Task Force (2012) is to reduce the feral swine population in the State. Activities that could be conducted by WS under the alternatives would occur within the goals and strategies outlined for the statewide feral swine population by the South Carolina Wild Hog Task Force.

Feral Swine Damage Should Be Managed By Private Companies or local entities

Private companies or local entities could be contacted to reduce feral swine damage for property owners or property managers when deemed appropriate by the resource owner. Some property owners would prefer to use a private company or local entity because those entities would be located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business or entity rather than a government agency. However, some property owners would prefer to enter into an agreement with a government agency. In particular, those persons seeking assistance may prefer to use WS because of security and safety issues. WS further clarifies interfacing with private business and establishing cooperative projects in WS Directive 3.101.

Effects from the Use of Lead Ammunition in Firearms

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to lethally remove feral swine. As described in Appendix B, the lethal removal of feral swine 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 lethal removal of feral swine by WS using firearms in the State would occur primarily from the use of rifles. However, the use of shotguns or handguns could be employed. To reduce risks to human safety and property damage from bullets passing through feral swine, the use of rifles would be applied in such a way (*e.g.*, caliber, bullet weight, distance) to ensure the bullet does not pass through feral swine. Feral swine that were removed using firearms would occur within areas where retrieval of all carcasses for proper disposal is highly likely. With risks of lead exposure occurring primarily from ingestion of bullet fragments, the retrieval and proper disposal of carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead that may be contained within the carcass.

However, deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through a feral swine, if misses occur, or if the feral swine carcass was not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns occur that lead from bullets deposited in soil from shooting activities could contaminate ground water or surface water from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "*transport*" readily in surface water when soils were neutral or slightly alkaline in pH (*i.e.*, not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "*fall zones*" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot. Stansley et al. (1992) believed the lead contamination near the parking lot was due to runoff from the

parking lot, and not from the shooting range areas. The study also indicated that even when lead shot was highly accumulated in areas with permanent water bodies present, the lead did not necessarily cause elevated lead levels in water further downstream. Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil around 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 was reduced once the bullets and shot formed crusty lead oxide deposits on their surfaces, which served to reduce naturally the potential for ground or surface water contamination (Craig et al. 1999). Those studies suggest that, given the very low amount of lead that could be deposited and the concentrations that would occur from WS' activities to reduce feral swine damage using firearms, as well as most other forms of dry land small game hunting in general, lead contamination of water from such sources would be minimal to nonexistent.

WS' assistance with removing feral swine would not be additive to the environmental status quo since those feral swine removed by WS using firearms could be lethally removed by the entities experiencing damage using the same method in the absence of WS' involvement. The amount of lead deposited into the environment could be lowered by WS' involvement in damage management activities due to efforts by WS to ensure projectiles do no pass through but are contained within the feral swine carcass, which limits the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by WS' employees in firearm use and accuracy would increase the likelihood that feral swine were lethally removed humanely in situations that ensure accuracy and that misses occur infrequently, which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS would dispose of feral swine carcasses in accordance with WS Directive 2.515. The retrieval and proper disposal of carcasses would limit the availability of lead in the environment and would ensure feral swine carcasses were removed from the environment to prevent the ingestion of lead by scavengers that may feed on the carcass. Based on current information, the risks associated with lead bullets that could be deposited into the environment from WS' activities due to misses, the bullet 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.

Site Specific Analysis Should Occur Wherever Damage Management is Requested

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

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

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

Donation of Feral Swine Removed Through Management Activities for Human Consumption

Under the Federal Meat Inspection Act, all swine must be inspected prior to entering into any establishment in which they are to be slaughtered. Inspections are carried out under the Food Safety and Inspection Services (FSIS) under the USDA. The FSIS has ruled that all swine are amenable to the Federal Meat Inspection Act and even if donated are considered to be in commerce; therefore, all animals must be processed under inspection at an official establishment. This would entail examining the animal alive, at rest and in motion from both sides before passing the animal for slaughter.

In most instances, it would be difficult to trace the origins of feral swine or determine fitness for human consumption due to the potential for feral swine to carry disease (Wyckoff et al. 2009). Transporting live feral swine to slaughter facilities also increases the potential for spreading disease to domestic swine at facilities where swine are being held prior to slaughter. Therefore, feral swine will not be donated to food banks.

Effects of Damage Management Activities on the Socio-cultural Elements of the Human Environment

One issue is the concern that the proposed action or the other alternatives would result in the loss of aesthetic benefits of feral swine 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 is truly subjective in nature, dependent on what an observer regards as beautiful.

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The public share a similar bond with animals and/or wildlife in general. In modern societies, a large percentage of households have indoor or outdoor pets. However, some people may consider individual wild animals as "*pets*" or exhibit affection toward those animals, especially people who enjoy viewing wildlife. Therefore, the public reaction can be 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 between humans and wildlife.

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). Those include direct benefits related to consumptive and non-consumptive uses, indirect benefits derived from vicarious wildlife related experiences, and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (Bishop 1987). Direct benefits are derived from a personal relationship with animals and may take the form of direct consumptive use (*i.e.*, using parts of or the entire animal) or non-consumptive use (*e.g.*, viewing the animal in nature or in a zoo, photographing) (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 benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms, either bequest or 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).

Public attitudes toward wildlife vary considerably. Some people believe that all wildlife should be captured and translocated to another area to alleviate damage or threats to protected resources. Some people directly affected by the problems caused by wildlife strongly support removal. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Some people totally opposed to wildlife damage management want WS to teach tolerance for damage and threats caused by wildlife, and that wildlife should never be killed. Some of the people who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. Those human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

Some individuals are offended by the presence of non-native species, such as feral swine. To such people those species represent pests that are nuisances, which upset the natural order in ecosystems, and are carriers of diseases transmissible to humans or other wildlife. Their overall enjoyment of other animals can be diminished by what they view as a destructive presence of such species. They are offended because they feel that those species proliferate in such numbers and appear to remain unbalanced.

However, Executive Order 13112 directs federal agencies whose actions may affect the status of invasive species to reduce invasion of those species and the associated damages to the extent practicable and permitted by law. Some loss of aesthetic value would be gained by the removal of an invasive species and the return of a more natural environment, including the return of native wildlife and plant species that may be suppressed or displaced by the presence of invasive feral swine.

CHAPTER 3: ALTERNATIVES

Chapter 3 contains a discussion of the alternatives that were developed to meet the need for action discussed in Chapter 1 and to address the identified issues discussed in Chapter 2. Alternatives were developed for consideration based on the need for action and issues using the WS Decision model (Slate et al. 1992). The alternatives will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences). Chapter 3 also discusses alternatives considered but not analyzed in detail, with rationale. SOPs that would be incorporated into activities conducted under the alternatives by WS in South Carolina are also discussed in Chapter 3.

3.1 DESCRIPTION OF THE ALTERNATIVES

The following alternatives were developed to meet the need for action and address the identified issues associated with managing damage caused by feral swine in South Carolina:

Alternative 1 - No Involvement by WS in Swine Damage Management

This alternative would preclude all activities by WS to reduce threats to human health and safety, and to alleviate damage to agricultural resources, property, and natural resources. WS would not be involved with any aspect of managing damage or threats associated with feral swine in the State. All requests for assistance received by WS to resolve damage caused by feral swine would be referred to the SCDNR, the SCDA, and/or other private entities.

Despite no involvement by WS in resolving damage and threats associated with feral swine, those persons experiencing damage caused by feral swine could continue to resolve damage by employing those methods legally available since the lethal removal of feral swine to alleviate damage or threats could occur despite the lack of involvement by WS. The lethal removal of feral swine could occur at any time and by any method that is legal. All methods described in Appendix B would be available for use by those persons experiencing damage or threats except for the use of immobilizing drugs, euthanasia chemicals, and shooting from an aircraft. Immobilizing drugs and euthanasia chemicals can only be used by WS, the SCDNR, or appropriately licensed veterinarians. Shooting from aircraft would currently not be available for use by any other entity under this alternative. All other methods described in Appendix B of the EA would be available to those persons experiencing damage.

Therefore, under this alternative, those persons experiencing damage or threats of damage could contact WS but WS would immediately refer the requester to the SCDNR, SCDA, and/or other entities, the requester could contact other entities for information and assistance with managing damage, could take actions to alleviate damage without contacting any entity, or could take no action.

Alternative 2 – Addressing Requests for Assistance through Technical Assistance Only

Under this alternative, WS would provide those cooperators requesting assistance with technical assistance only. Technical assistance could provide those cooperators experiencing damage or threats associated with feral swine with information, demonstrations, and recommendations on available and appropriate methods available. The implementation of methods and techniques to resolve or prevent damage would be the responsibility of the requester with no direct involvement by WS. In some cases, WS may provide supplies or materials that were of limited availability for use by private entities (*e.g.*, loaning of propane cannons). Technical assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies would be described to the requester for short and long-term solutions to managing damage. Those strategies would be based on the level of risk, need, and the practicality of their application. WS would use the Decision Model to recommend those methods and techniques available to the requester to manage damage and threats of damage. Those persons receiving technical assistance from WS could implement those methods recommended by WS, could employ other methods not recommended by WS, could seek assistance from other entities, or take no further action.

Under a technical assistance only alternative, WS would recommend an integrated approach similar to the proposed action alternative (see Alternative 3); however, WS would not provide direct operational assistance under this alternative. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Recommendation of methods and techniques by WS to resolve damage would be based on information provided by the individual seeking assistance or based on site visits using the WS Decision Model. In some instances, wildlife-related information provided to the requester by WS would result in tolerance/acceptance of the situation. In other instances, damage management options would be discussed and recommended. Only those methods legally available for use by the appropriate individual would be recommended or loaned by WS. Similar to Alternative 1, those methods described in Appendix B would be available to those persons experiencing damage or threats associated with feral swine in the State except for immobilizing drugs, euthanasia chemicals, and shooting from aircraft. Immobilizing drugs and euthanasia chemicals would only be available to WS, the SCDNR, or appropriately licensed veterinarians. Shooting from aircraft would currently not be available for use by any other entity under this alternative. All other methods described in Appendix B of the EA would be available to those persons experiencing damage.

The WS program regularly provides technical assistance to individuals, organizations, and other federal, state, and local government agencies for managing feral swine damage. Technical assistance includes collecting information about the species involved, the extent of the damage, and previous methods that the cooperator has attempted to resolve the problem. WS would then provide information on appropriate methods that the cooperator may consider to resolve the damage themselves. Technical assistance projects conducted by WS may include a visit to the affected property, written communication, telephone conversations, or presentations to groups such as homeowner associations or civic leagues. Between FY 2009 and FY 2014, WS conducted 16 technical assistance projects (primarily presentation and/or workshops) with 218 people that involved feral swine damage to agricultural resources, property, natural resources, and threats to human safety.

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

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, when requested, as deemed appropriate using the WS Decision Model, to reduce damage and threats caused by feral swine. A major goal of the program would be to resolve and prevent damage caused by feral swine and to reduce threats to human safety. To meet this goal of reducing damage and threats, WS would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding was available, operational damage management. Funding could occur through federal appropriations or from cooperative funding. The adaptive approach to managing damage associated with feral swine would integrate the use of the most practical and effective methods to resolve a request for damage management as determined by site-specific evaluation to reduce damage or threats to human safety for each request. City/town managers, agricultural producers, property owners, and others requesting assistance would be provided information regarding the use of appropriate non-lethal and lethal techniques.

WS would work with those persons experiencing damage in addressing those feral swine responsible for causing damage as expeditiously as possible. Under this alternative, WS could respond to requests for assistance by: 1) taking no action, if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by feral swine, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage.

Property owners or managers requesting assistance from WS would be provided with information regarding the use of effective and practical non-lethal and lethal techniques. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Property owners or managers may choose to implement WS' recommendations on their own (*i.e.*, technical assistance), use contractual services of private businesses, use volunteer services of private organizations/individuals, use the services of WS (*i.e.*, direct operational assistance), take the management action themselves without consulting another private entity or governmental agency, or take no further action.

WS would work with those persons experiencing damage caused by feral swine to address those feral swine responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should begin as soon as feral swine begin to cause damage. Feral swine damage that has been ongoing can be difficult to resolve using available methods since feral swine are conditioned to an area and are familiar with a particular location. Subsequently, making that area unattractive using available methods can be difficult to achieve once damage has been ongoing. WS would work closely with those entities requesting assistance to identify situations where damage could occur and begin to implement damage management activities under this alternative as early as possible to increase the likelihood of those methods achieving the level of damage reduction requested by the cooperating entity.

WS' Decision Model would be the implementing mechanism for a damage management program under the proposed action alternative that would be adapted to an individual damage situation, which would allow for the broadest range of methods to be used to address damage or the threat of damage. When WS received a request for direct operational assistance, WS would conduct a site visit to assess the damage or threat and identify the cause of the damage. Based on the information gathered during the site visit, WS would apply the WS' Decision Model described by Slate et al. (1992) and WS Directive 2.201 to determine the appropriate methods. The use of the Decision model by WS' employees under the proposed action is further discussed below.

Non-lethal methods available for use by WS under this alternative would include, but would not be limited to minor habitat modification, behavior modification, visual deterrents, live traps, lure crops, exclusionary devices, frightening devices, use of tracking dogs, foot snares[8], and immobilizing drugs (see Appendix B for a complete list and description of potential methods). Lethal methods that would be available to WS under this alternative would include shooting, including the use of firearms from aircraft, neck snares, and the recommendation of harvesting feral swine during hunting seasons. In addition, feral swine live-captured using non-lethal methods could be euthanized[9]. The lethal control of target feral swine would comply with WS Directive 2.505.

However, listing methods neither implies that all methods would be used or recommended by WS to resolve requests for assistance nor does listing of methods imply that all methods would be used to resolve every request for assistance. 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. For example, if an entity requesting assistance had already attempted to alleviate damage using non-lethal methods, WS would not necessarily employ those same non-lethal methods since those methods had been proven ineffective at reducing damage or threats to an acceptable level to the requester.

A complete list of chemical and non-chemical methods available for use under the identified alternatives, except the alternative with no damage management (Alternative 1), can be found in Appendix B. As part of an integrated approach, WS may provide technical assistance and direct operational assistance to those persons experiencing damage associated with feral swine.

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[8]Foot snares are similar to neck snares except that people can use them to capture the target animal by the hoof instead of around the neck. Like neck snares, the foot snare consists of a flexible wire hoop made from aircraft cable. Foot snares are placed along the ground; loop pointed up, on active trails and/or bait sites. The smaller loop size prevents larger animals from accidentally becoming caught. Non-target capture can be reduced through manipulation of the site (*e.g.*, brushing in the top of the trail, placing jump sticks), and by regularly checking snares.

[9]Live-captured feral swine would be euthanized using euthanasia chemicals or firearms. Euthanasia chemicals are an acceptable form of euthanasia for free-ranging wildlife (AVMA 2013). Feral swine live-captured would primarily be euthanized by gunshot, which is a method of euthanasia considered a conditionally acceptable[9] method of euthanasia by the AVMA for free-ranging wildlife (AVMA 2013).

Technical Assistance Recommendations

Under the proposed action, WS would provide technical assistance to those persons requesting assistance with managing damage as part of an integrated approach. Technical assistance would occur as described in Alternative 2 of this EA. From FY 2009 through FY 2014, WS conducted 16 technical assistance projects that involved feral swine damage to agricultural resources, property, natural resources, and threats to human safety.

Direct Operational Assistance

Operational damage management assistance would include damage management activities that were directly conducted by or supervised by personnel of WS. Operational damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and there was a written MOU, work initiation document, or other comparable document signed between WS and the entity requesting assistance. The initial investigation by WS' personnel would define the nature, history, and extent of the problem; species responsible for the damage; and methods available to resolve the problem.

Educational Efforts

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

Research and Development

The National Wildlife Research Center (NWRC) functions as the research unit of WS by providing scientific information and the development of methods that are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate methods and techniques. For example, research biologists from the NWRC are evaluating the reproductive inhibitor known under the trade name of Gonacon™. Research biologists with the NWRC have authored hundreds of scientific publications and reports based on research conducted involving wildlife and methods.

WS' Decision Making Procedures

The WS Decision Model (see WS Directive 2.201) described by Slate et al. (1992) depicts how WS' personnel would use a thought process for evaluating and responding to damage complaints. WS' personnel would assess the problem and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, WS' employees would incorporate methods deemed practical for the situation into a damage management strategy. After WS' employees implemented this strategy, employees would continue to monitor and evaluate the strategy to assess effectiveness. If the strategy

were effective, the need for further management would end. In terms of the WS Decision Model, most efforts to resolve animal damage consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions, including WS.

The general thought process and procedures of the WS Decision Model would include the following steps.

1. **Receive Request for Assistance:** WS would only provide assistance after receiving a request for such assistance. WS would not respond to public bid notices.
2. **Assess Problem:** First, WS would make a determination as to whether the assistance request was within the authority of WS. If an assistance request were within the authority of WS, WS' employees would gather and analyze damage information to determine applicable factors, such as what species was responsible for the damage, the type of damage, the extent of damage, and the magnitude of damage. Other factors that WS' employees could gather and analyze would include the current economic loss or current threat (*e.g.*, threat to human safety), the potential for future losses or damage, the local history of damage, and what management methods, if any, were used to reduce past damage and the results of those actions.
3. **Evaluate Management Methods:** Once a problem assessment was completed, a WS' employee would conduct an evaluation of available management methods. The employee would evaluate available methods in the context of their legal and administrative availability and their acceptability based on biological, environmental, social, and cultural factors.
4. **Formulate Management Strategy:** A WS' employee would formulate a management strategy using those methods that the employee determines to be practical for use. The WS employee would also consider factors essential to formulating each management strategy, such as available expertise, legal constraints on available methods, costs, and effectiveness.
5. **Provide Assistance:** After formulating a management strategy, a WS employee could provide technical assistance and/or direct operational assistance to the requester (see WS Directive 2.101).
6. **Monitor and Evaluate Results of Management Actions:** When providing direct operational assistance, it is necessary to monitor the results of the management strategy. Monitoring would be important for determining whether further assistance was required or whether the management strategy resolved the request for assistance. Through monitoring, a WS' employee would continually evaluate the management strategy to determine whether additional techniques or modification of the strategy was necessary.
7. **End of Project:** When providing technical assistance, a project would normally end after WS' employees provided recommendations or advice to the requester. A direct operational assistance project would normally end when WS' personnel stop or reduce the damage or threat to an acceptable level to the requester or to the extent possible. Some damage situations may require continuing or intermittent assistance from WS' personnel and may have no well-defined termination point.

Community-based Decision Making

WS could receive requests for assistance from community leaders and/or representatives. In those situations, the WS program in South Carolina, under this alternative, would follow the "*co-managerial approach*" to solve requests for assistance as described by Decker and Chase (1997). Within this management model, WS could provide technical assistance regarding the biology and ecology of feral swine and effective, practical, and reasonable methods available to the local decision-

maker(s) to reduce damage or threats. This could include non-lethal and lethal methods. WS and other state and federal wildlife management agencies may facilitate discussions at local community meetings when resources were available. Under this approach, resource owners within a community and other community members directly or indirectly affected by feral swine damage or the management of damage would have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request direct operational assistance from WS, other wildlife management agencies, local animal control agencies, private businesses, or seek no further assistance.

The community representative(s) and/or decision-maker(s) for the local community would be elected officials or representatives of the communities. The community representative(s) and/or decision-maker(s) who oversee the interests and business of the local community would generally be residents of the local community or appointees that other members of the community popularly elected. This person or persons 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.

WS could provide technical assistance and make recommendations for damage reduction to the local community or local business community decision-maker(s). Under a community based decision-making process, WS could provide information, demonstration, and discussion on available methods to the appropriate representative(s) of the community and/or community decision-maker(s) that requested assistance, which would help ensure that decisions made by representatives of the community and/or the decision-makers were based on community-based input. WS would only provide direct operational assistance if the local community representative(s) and/or decision-maker(s) requested such assistance and only if the assistance requested was compatible with WS' recommendations.

By involving community representatives and/or community decision-makers in the process, WS could present information that would allow decisions on damage management to involve those individuals that the representatives and/or decision-maker(s) represent. As addressed in this EA, WS could provide technical assistance to the appropriate representative(s) and/or decision-maker(s), including demonstrations and presentation by WS at public meetings to allow for involvement of the community. Requests for assistance to manage damage caused by feral swine often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives of the community, the community representative(s) and/or decision-maker(s) would be able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentation by WS on damage management activities. This process would allow WS, the community representative(s), and/or decision-maker(s) to make decisions on damage management activities based on local input. The community leaders could 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.

Private Property Decision-Makers

In the case of private property owners, the decision-maker is the individual that owns or manages the affected property. The decision-maker has the discretion to involve others as to what occurs or does not occur on property they own or manage. Therefore, in the case of an individual property owner or manager, the involvement of others and to what degree others were involved in the decision-making process would be a decision made by that individual. WS could provide direct operational assistance

when requested; however, WS would only provide assistance if the requested management actions were in accordance with WS' recommendations.

Public Property Decision-Makers

The decision-maker for municipal, county, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals, and legal mandates for the property. WS could provide technical assistance to this person and make recommendations to reduce damage. WS could provide direct operational assistance when requested; however, WS would only provide assistance if the requested management actions were in accordance with WS' recommendations.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

In addition to those alternatives analyzed in detail, several additional alternatives were identified by WS. However, those alternatives will not receive detailed analyses for the reasons provided. Those alternatives considered but not analyzed in detail include:

Non-lethal Methods Implemented Before Lethal Methods

This alternative would require that non-lethal methods or techniques described in Appendix B be applied to all requests for assistance to reduce damage and threats to safety from feral swine in the State. If the use of non-lethal methods failed to resolve the damage situation or reduce threats to human safety at each damage situation, lethal methods would be employed to resolve the request. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of the damage or threat until deemed inadequate to resolve the request. This alternative would not prevent the use of lethal methods by other entities or by those persons experiencing feral swine damage but would only prevent the use of those methods by WS until non-lethal methods had been employed.

Those persons experiencing damage often employ non-lethal methods to reduce damage or threats prior to contacting WS. Verification of the methods used would be the responsibility of WS. No standard currently exists to determine requester diligence in applying those methods, nor are there any standards to determine how many non-lethal applications would be necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods could be evaluated. The proposed action alternative (Alternative 3) and the technical assistance only alternative (Alternative 2) are similar to a non-lethal before lethal alternative because WS would give preference to the use or recommendation of non-lethal methods (see WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in the EA.

Use of Non-lethal Methods Only by WS

Under this alternative, WS would be required to implement non-lethal methods only to resolve damage caused by feral swine in the State. Only those methods discussed in Appendix B that were considered non-lethal would be employed by WS. No lethal removal of feral swine would occur by WS. The use of lethal methods could continue to be used under this alternative by other entities or by those persons experiencing damage by feral swine. The non-lethal methods used or recommended by WS under this alternative would be identical to those non-lethal methods identified as available under any of the alternatives.

In situations where non-lethal methods were impractical or ineffective to alleviate damages, WS could refer requests for information regarding lethal methods to the SCDNR, SCDA, local animal control agencies, or private businesses or entities. Property owners or managers could conduct management using any legal method. Property owners or managers might choose to implement WS' non-lethal recommendations, implement lethal methods on their own, or request assistance from a private or public entity other than WS. Property owners/managers frustrated by the lack of WS' assistance with the full range of feral swine damage management techniques may try methods not recommended by WS or use illegal methods (*e.g.*, poisons). In some cases, property owners or managers may misuse some methods or use some methods in excess of what is necessary, which could then become hazardous and pose threats to the safety of humans and non-target species.

The proposed action, using an integrated damage management approach, would incorporate the use of non-lethal methods when addressing requests for assistance. In those instances where non-lethal methods would effectively resolve damage those methods would be used or recommended under the proposed action. Since non-lethal methods would be available for use under the alternatives analyzed in detail, this alternative would not add to the analyses. Those feral swine that could be lethally removed by WS under any of the alternatives could be removed by those persons experiencing damage or threats even if WS was not involved.

Use of Lethal Methods Only by WS

This alternative would require the use of lethal methods only to reduce threats and damage associated with feral swine. However, non-lethal methods can be effective in preventing damage in certain situations. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. Non-lethal methods have been effective in alleviating feral swine damage. For example, electric fencing can prevent access of feral swine to gardens. In those situations where damage could be alleviated using non-lethal methods deemed effective, those methods would be employed or recommended as determined by the WS Decision Model. Therefore, this alternative was not considered in detail.

Trap and Translocate Feral Swine Only

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Feral swine would be live-captured using immobilizing drugs, live-traps, snares, or capture nets under this alternative. All feral swine live-captured through direct operational assistance by WS would be translocated. Translocation sites would be identified and have to be approved by the SCDNR and/or the property owner where the translocated feral swine would be placed prior to live-capture and translocation.

The translocation of feral swine that have caused damage to other areas following live-capture generally would not be effective at alleviating damage or cost-effective. Translocation is generally ineffective because problem animals are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and translocation would most likely result in feral swine damage problems at the new location. In addition, hundreds of feral swine would need to be captured and translocated to solve some damage problems; therefore, translocation would be unrealistic. Translocation of wildlife is also discouraged by WS policy (see WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988). There is also a concern of spreading wildlife diseases by moving wildlife from one location to another. In South Carolina, it is unlawful to release or transport for the purpose of release, feral swine for hunting

purposes or in an attempt to establish or supplement a free roaming population (South Carolina Code of Laws § 50-16-25). Consequently, WS would not translocate any feral swine live-captured.

Reducing Damage by Managing Feral Swine Populations through the Use of Reproductive Inhibitors

Under this alternative, the only method that would be available to resolve requests for assistance by WS would be the recommendation and the use of reproductive inhibitors to reduce or prevent reproduction in feral swine responsible for causing damage. Reproductive inhibitors are often considered for use where wildlife populations are overabundant and where traditional hunting or lethal control programs are not publicly acceptable (Muller et al. 1997). Use and effectiveness of reproductive control as a population management tool is often limited by population dynamic characteristics (*e.g.*, longevity, age at onset of reproduction, population size, and biological/cultural carrying capacity), habitat and environmental factors (*e.g.*, isolation of target population, cover types, and access to target individuals), socioeconomic, and other factors.

Reproductive control for wildlife could be accomplished through either sterilization (permanent) or contraception (reversible). Sterilization could be accomplished through: 1) surgical sterilization (vasectomy, castration, and tubal ligation), 2) chemosterilization, and 3) through gene therapy. Contraception could be accomplished through: 1) hormone implantation (synthetic steroids such as progestins), 2) immunocontraception (contraceptive vaccines), and 3) oral contraception (progestin administered daily).

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

Currently, reproductive inhibitors are not available for use to manage feral swine populations. Given the costs associated with live-capturing and performing sterilization procedures on feral swine and the lack of availability of chemical reproductive inhibitors, this alternative was not evaluated in detail. If a reproductive inhibitor became available and the product was proven effective in reducing localized populations, the use of the inhibitor could be evaluated under the proposed action as a method available that could be used in an integrated approach to managing damage. This EA would be reviewed and supplemented to the degree necessary to evaluate the use of the reproductive inhibitor as part of an integrated approach described under the proposed action. Currently, the only mammalian reproductive inhibitor that is registered with the EPA is GonaCon™, which is registered for use on white-tailed deer. However, GonaCon™ is not currently registered for use by the EPA for feral swine.

Compensation for Feral Swine Damage

The compensation alternative would require WS to establish a system to reimburse persons impacted by feral swine damage and to seek funding for the program. Under such an alternative, WS would continue to provide technical assistance to those persons seeking assistance with managing damage. In addition, WS would conduct site visits to verify damage. Evaluation of this alternative indicates that a compensation only alternative has many drawbacks. Compensation would: 1) require large expenditures of money and labor to investigate and validate all damage claims, and to determine and administer appropriate compensation, 2) compensation most likely would be below full market value,

3) give little incentive to resource owners to limit damage through improved cultural or other practices and management strategies, and 4) not be practical for reducing threats to human health and safety.

Bounties

Payment of funds (bounties) for killing some feral swine causing economic losses have not been supported by State agencies, such as the SCDNR, as well as most wildlife professionals for many years (Latham 1960). WS concurs with those agencies and wildlife professionals because of several inherent drawbacks and inadequacies in the payment of bounties. Bounties are often ineffective at controlling damage over a wide area, such as across the entire State. The circumstances surrounding the take of animals are typically arbitrary and completely unregulated because it is difficult or impossible to assure animals claimed for bounty were not taken from outside the area where damage was occurring or were not domestic swine. In addition, WS does not have the authority to establish a bounty program.

3.3 STANDARD OPERATING PROCEDURES FOR DAMAGE MANAGEMENT

SOPs improve the safety, selectivity, and efficacy of activities intended to resolve feral swine damage. The WS program in South Carolina uses many such SOPs. Those SOPs would be incorporated into activities conducted by WS under the appropriate alternatives when addressing feral swine damage and threats in the State.

Some key SOPs pertinent to resolving damage include the following:

- WS' employees would consistently use and apply the WS Decision when addressing feral swine damage to identify effective strategies to managing damage and their potential impacts.
- The use of non-lethal methods would be considered prior to the use of lethal methods when managing damage or making recommendations.
- Immobilizing drugs and euthanasia chemicals would be used according to the DEA, the FDA, and WS' directives and procedures.
- All controlled substances would be registered with the DEA or the FDA.
- WS' employees would follow approved procedures outlined in the WS' Field Manual for the Operational Use of Immobilizing and Euthanizing Drugs (Johnson et al. 2001).
- WS' employees that use controlled substances would be trained to use each material and would be certified to use controlled substances.
- WS' employees who use controlled substances would participate in approved continuing education to keep current of developments and maintain their certifications.
- Controlled substance use, storage, and disposal would conform to label instructions and other applicable laws and regulations, including Executive Order 12898.
- All personnel who use firearms would be trained according to WS' Directives.

- Whenever possible, damage management would be conducted away from areas of high human activity. If this were not possible, then activities would be conducted during periods when human activity was low (*e.g.*, early morning), if possible. Where such activities were conducted on private lands or other lands of restricted public access, the risk of hazards to the public would be even further reduced.

- Non-target animals captured in traps would be released unless it was determined that the animal would not survive and/or that the animal could not be released safely.

- WS' employees participating in any aspect of aerial wildlife operations would be trained and/or certified in their role and responsibilities during the operations. All WS' personnel would follow the policies and directives set forth in WS' Directive 2.620; WS' Aviation Operations Manual; WS' Aviation Safety Manual and its amendments; Title 14 CFR; and Federal Aviation Regulations, Part 43, 61, 91, 119, 133, 135, and 137.

- Trap monitoring devices would be employed, when applicable, that indicate when a trap has been activated. Trap monitoring device would allow personnel to prioritize trap checks and decrease the amount of time required to check traps, which decreases the amount of time captured swine were restrained. By reducing the amount of time feral swine were restrained, pain and stress can be minimized, which would reduce the distress of captured swine.

- WS would use non-lead ammunition within the constraints of availability, performance, and safety.

- The use of all traps, cable devices, and other capture devices by WS' personnel would adhere to WS Directive 2.450.

- WS' personnel would dispose of carcasses retrieved after damage management activities in accordance with WS Directive 2.515. If WS' personnel were directly involved with carcass burial (*i.e.*, WS' personnel physically or mechanically digging a hole in the ground to bury carcasses), siting decisions would occur after WS consulted with the South Carolina State Historic Preservation Office or the affected tribal authorities to avoid adverse effects on cultural/historic resources. If WS' personnel discovered cultural resources or artifacts during the burial of carcasses, WS would cease operations and contact the South Carolina State Historic Preservation Office or appropriate tribal authorities. However, WS' personnel rarely, if ever, are directly involved with the burial of carcasses in South Carolina.

3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

Several additional SOPs are applicable to the alternatives and the issues identified in Chapter 2 including the following:

Issue 1 - Effects on Feral Swine Populations in South Carolina

- The WS' Decision Model, designed to identify the most appropriate damage management strategies and their impacts, would be used to determine strategies for resolving damage.

- WS would monitor activities to ensure those activities remained within the scope of the analysis.

- WS would only target those individuals or groups of feral swine identified as causing damage or posing a threat to human safety.

Issue 2 - Effects on Non-target Species, including Threatened and Endangered Species

- When conducting removal operations via shooting, identification of the target would occur prior to application.

- As appropriate, suppressed firearms would be used to minimize the noise associated with the discharge of a firearm.

- Personnel would use lures, trap placements, and capture devices that would be strategically placed at locations likely to capture a target animal and minimize the potential of non-target animal captures.

- Trigger tension devices for foot snares would be used to reduce the capture of non-target animals that weigh less than feral swine.

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

- Live-traps would be checked in accordance with State laws and regulations to ensure non-target species were released in a timely manner to ensure survival.

- Carcasses of feral swine retrieved after damage management activities have been conducted would be disposed of in accordance with WS Directive 2.515.

- WS has consulted with the USFWS and the SCDNR to evaluate activities to resolve feral swine damage and threats to ensure the protection of T&E species.

- WS would monitor activities conducted under the selected alternative, if activities are determined to have no significant impact on the environment and an EIS is not required, to ensure those activities do not negatively affect non-target species.

- WS' personnel would review all projects proposed for implementation for potential to take[10] bald eagles in accordance with the provisions of the Bald and Golden Eagle Protection Act. If WS' personnel identify potential risks of take, WS would work with the USFWS on measures to reduce risks and the need for a non-purposeful take permit.

Issue 3 - Effects of Management Methods on Human Health and Safety

- Damage management activities would be conducted professionally and in the safest manner possible. Whenever possible, damage management would be conducted away from areas of high human activity. If this were not possible, then activities would be conducted during periods when human activity was low (*e.g.*, early morning), if possible.

[10]The Bald and Golden Eagle Protection Act defines "*take*" as "*pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb*." Disturb is defined as any activity that can result in injury to an eagle, or cause nest abandonment or decrease in productivity by impacting breeding, feeding, or sheltering behavior.

- Shooting would be conducted professionally and in the safest manner possible. Shooting would be conducted during times when public activity and access to the control areas was restricted. Personnel involved in shooting operations would be fully trained in the proper and safe application of this method.

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

- All chemical methods used by WS or recommended by WS would be registered with the EPA, DEA, FDA, and/or the SCDA, as appropriate.

- WS would adhere to all established withdrawal times for feral swine when using immobilizing drugs for the capture of feral swine that are agreed upon by WS, the SCDNR, and veterinarian authorities. Although unlikely, in the event that WS was requested to immobilize feral swine, WS would euthanize the animal or mark the animal with ear tags labeled with a "*do not eat*" warning and appropriate contact information.

- Carcasses of feral swine retrieved after damage management activities would be disposed of in accordance with WS Directive 2.515.

- As allowed by law, WS' personnel would provide information about food safety and the safe handling of carcasses to reduce risks to landowners that prefer to retain feral swine carcasses killed on their property for personal use (see WS Directive 2.510). Therefore, providing information about food safety and the safe handling of carcasses would minimize risks to human safety by emphasizing precautions for safe handling and preparation/consumption. In addition, WS' personnel would advise landowners to avoid feeding uncooked meat or other carcass products to pets or other animals.

Issue 4 - Humaneness of Methods Available for Damage Management

- Personnel would be well trained in the latest and most humane devices/methods for removing feral swine causing damage.

- WS' personnel would check methods in accordance with state laws and regulations to ensure feral swine captured would be addressed in a timely manner to minimize the stress of being restrained.

- When deemed appropriate using the WS' Decision Model, WS' use of lethal methods would comply with WS' directives (*e.g.*, WS Directive 2.101, WS Directive 2.505, WS Directive 2.430).

- The NWRC would continue to conduct research to improve the selectivity and humaneness of wildlife damage management devices used by personnel in the field.

- The use of non-lethal methods would be considered prior to the use of lethal methods when managing feral swine damage.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative to address the need for action described in Chapter 1 and the issues described in Chapter 2. This chapter analyzes the environmental consequences of each alternative as that alternative relates to the issues identified. The following resource values in the State are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, critical habitats (areas listed in T&E species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. Those resources will not be analyzed further.

The activities proposed in 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 because of any of the proposed alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each alternative in comparison to determine the extent of actual or potential impacts on the issues. Therefore, the proposed action/no action alternative (Alternative 3) serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of WS and the SCDNR.

Issue 1 - Effects on Feral Swine Populations in South Carolina

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

Methods available to address feral swine damage or threats of damage in the State that would be available for use or recommendation under Alternative 3 (proposed action/no action alternative) and Alternative 2 (technical assistance only alternative) would either be lethal methods or non-lethal methods. Many of the methods would also be available to other entities under Alternative 1 (no involvement by WS alternative). The only methods that would not be available for use by other entities under Alternative 1 and Alternative 2 would be immobilizing drugs, euthanasia chemicals, and shooting from an aircraft. Under Alternative 2, WS could recommend lethal and non-lethal methods as part of an integrated approach to resolving requests for assistance. Alternative 3 would address requests for assistance received by WS through technical and/or operational assistance where an integrated approach to methods would be employed and/or recommended. Non-lethal methods that would be available under Alternative 3 would include habitat modification, frightening devices, lure crops, live traps, exclusionary devices, foot snares, dogs, capture nets, and immobilizing drugs (see Appendix B for a complete list and description of potential methods).

Non-lethal methods that would be available under all the alternatives can disperse or otherwise make an area unattractive to feral swine causing damage; thereby, reducing the presence of feral swine at the site and potentially the immediate area around the site where non-lethal methods were employed. Non-lethal methods would be given priority when addressing requests for assistance under Alternative 2 and Alternative 3 (see WS Directive 2.101). However, non-lethal methods would not necessarily be employed or recommended to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if a cooperator requesting assistance had already used non-lethal methods, WS would not likely recommend or continue to employ those particular methods since their use had already been proven ineffective in adequately resolving the damage or threat.

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

The continued use of non-lethal methods can often lead to the habituation of feral swine to those methods, which can decrease the effectiveness of those methods. For any management methods employed, the proper timing would be essential in effectively dispersing those feral swine causing damage. Employing methods soon after damage begins or soon after threats were identified, would increase the likelihood that those damage management activities would achieve success in addressing damage. Therefore, coordination and timing of methods would be necessary to be effective in achieving expedient resolution of feral swine damage.

In addition to non-lethal methods, lethal methods would also be available for use under all the alternatives by WS and/or by other entities. Lethal methods available to address feral swine damage include euthanasia chemicals (applied after live-capture), shooting (including shooting from aircraft), and the recommendation that feral swine be harvested during hunting seasons. Euthanasia chemicals would only be applied after feral swine were live-captured and appropriately immobilized. All of those methods would be available for use by WS or for recommendation by WS under Alternative 3, except for euthanasia chemicals and shooting from an aircraft. Lethal methods could be employed by WS under Alternative 3 to resolve damage only after receiving a request for the use of those methods. Those same methods would also be available for WS to recommend and for other entities to use under Alternative 2, except for euthanasia chemicals and shooting from an aircraft. Under Alternative 1, those same lethal methods would continue to be available for use by other entities despite the lack of involvement by WS in damage management activities.

When live-captured target animals were to be lethally removed under Alternative 3, removal would occur pursuant to WS Directive 2.505 and WS Directive 2.430. Under alternative 2, WS would recommend the use of methods to lethally remove live-captured or restrained target animals in accordance with WS Directive 2.505; however, the persons requesting assistance could euthanize live-captured feral swine as they deem appropriate. No assistance would be provided by WS under Alternative 1; however, many of those methods available to lethally remove live-captured or restrained feral swine would continue to be available for use by other entities under Alternative 1,

except the availability of euthanasia chemicals would not be available to the public. Under Alternative 1, the person who live-captured the feral swine would determine the methods to lethally remove feral swine from live-capture devices.

The use of lethal methods by any entity could result in local population reductions in the area where damage or threats were occurring since feral swine would be removed from the population. Lethal methods could be employed or recommended to remove feral swine that have been identified as causing damage or posing a threat to human safety. Therefore, using lethal methods could result in local reductions of feral swine in the area where damage or threats were occurring. The number of feral swine removed from the population by WS using lethal methods under Alternative 3 would be dependent on the number of requests for assistance received, the number of feral swine involved with the associated damage or threat, and the efficacy of methods employed. The number of feral swine removed by other entities under Alternative 1 and Alternative 2 would be unknown but would likely be similar to the lethal removal that could occur under Alternative 3.

The use of most lethal methods would be intended to reduce the number of feral swine present at a location since a reduction in the number of feral swine at a location could lead to a reduction in damage, which would be applicable whether using lethal or non-lethal methods. The intent of non-lethal methods would be to harass, exclude, or otherwise make an area unattractive to feral swine, which disperses those animals to other areas leading to a reduction in damage at the location where those feral swine were dispersed. The intent of using lethal methods would be similar to the objective trying to be achieved when using non-lethal methods, which would be to reduce the number of feral swine in the area where damage was occurring; thereby, reducing the damage occurring at that location.

Often of concern with the use of lethal methods is that feral swine that were lethally removed would only be replaced by other feral swine either during the application of those methods (*e.g.*, feral swine that relocate into the area) or by feral swine the following year (*e.g.*, increase in reproduction and survivability that could result from less competition). As stated previously, WS would not use lethal methods during direct operational assistance as population management tools over broad areas. Lethal methods would be employed under Alternative 3 to reduce the number of feral swine present at a location where damage was occurring by targeting those feral swine causing damage or posing threats. Since the intent of using lethal methods would be to manage those feral swine causing damage and not to manage entire populations, those methods would not be ineffective because feral swine could be replaced by other feral swine later.

Most lethal and non-lethal methods currently available provide only short-term benefits when addressing feral swine damage. Those methods would be employed to reduce damage occurring at the time those methods were employed but do not necessarily ensure feral swine would not return once those methods were discontinued. Long-term solutions to resolving feral swine damage can often be difficult to implement and can be costly. In some cases, long-term solutions involve exclusionary devices, such as fencing. When addressing feral swine damage, long-term solutions generally involve modifying existing habitat or making conditions to be less attractive to feral swine. To ensure complete success, alternative sites in areas where damage was not likely to occur would often times be required to achieve complete success in reducing damage and to avoid moving the problem from one area to another. Modifying a site to be less attractive to feral swine would likely result in the dispersal of those feral swine to other areas where damage could occur or could result in multiple occurrences of damage situations.

The alternatives discussed in Chapter 3 were developed in response to the issues identified in Chapter 2, along with meeting the need for action that was identified in Chapter 1. The issues associated with conducting the alternatives on the feral swine population are analyzed for each alternative below.

Alternative 1 - No Involvement by WS in Swine Damage Management

Under this alternative, WS would not conduct damage management activities in the State associated with feral swine. WS would have no direct involvement with any aspect of addressing damage caused by feral swine and would provide no technical assistance. No lethal removal of feral swine by WS would occur under this alternative. Feral swine could continue to be lethally removed to resolve damage and/or threats without a permit as allowed in by state laws and regulations. Management actions taken by non-federal entities would be considered the environmental status quo.

Local feral swine populations could decline, stay the same, or increase depending on actions taken by those persons experiencing feral swine damage. Some resource/property owners may take illegal, unsafe, or environmentally harmful action against local populations of feral swine 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.

Since feral swine would still be lethally removed under this alternative, the potential effects on the populations of those feral swine would be similar among all the alternatives for this issue. WS' involvement would not be additive to lethal removal that could occur since the cooperator requesting WS' assistance could conduct feral swine damage management activities without WS' direct involvement. Therefore, any actions to resolve damage or reduce threats associated with feral swine could occur by other entities despite WS' lack of involvement under this alternative.

Alternative 2 – Addressing Requests for Assistance through Technical Assistance Only

Feral swine populations would not be directly affected by WS from a program implementing technical assistance only. However, persons experiencing damage or threats from feral swine may implement methods based on WS' recommendations. Under a technical assistance only alternative, WS would recommend and demonstrate for use both non-lethal and lethal methods legally available to resolve feral swine damage. Methods and techniques recommended would be based on WS' Decision Model using information provided from the requester or from a site visit. Requestors may implement WS' recommendations, implement other actions, or take no action. However, those persons requesting assistance are likely those people that would implement damage abatement methods in the absence of WS' recommendations.

Under a technical assistance only alternative, those persons experiencing threats or damage could lethally removal feral swine despite WS' lack of direct involvement in the management action. Therefore, under this alternative, the number of feral swine lethally removed would likely be similar to the other alternatives since removal could occur without a permit as allowed by state laws and regulations. WS' participation in a management action would not be additive to an action that could occur in the absence of WS' participation.

Under this alternative, WS would not be directly involved with damage management actions and therefore, direct operational assistance could be provided by other entities, such as the SCDNR, SCDA, private entities, and/or other authorities. If direct operational assistance is not available from WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal removal, which could lead to real but unknown

effects on other wildlife populations. People have resorted to the illegal use of chemicals and methods to resolve wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003).

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

Feral swine damage may be addressed by WS in response to requests by federal agencies, state agencies, or the public at any location in the State. Agricultural producers may request assistance with managing damage to standing crops or disease threats to domestic livestock. Natural resource managers may request assistance to protect natural areas, parks or recreation areas, or T&E species. Public health agencies may request assistance in reducing feral swine densities where disease threats to humans may be present. WS may use any legal methods among those outlined by Barrett and Birmingham (1994), West et al. (2009), and Hamrick et al. (2011) as suitable for feral swine damage management, including the use of aircraft to shoot feral swine.

As stated previously, feral swine are present in all 46 counties of the State, with populations occurring primarily along major river drainages. Kurz and Marchinton (1972) in upstate South Carolina and Wood and Brenneman (1980) in coastal South Carolina found home range sizes for feral swine in bottomland hardwood forests and marshes to be between 123 and 799 ha and 181 and 226 ha, respectively. Friebel and Jodice (2009) estimated home range size ranged from 66 ha to 456 ha for feral swine in the Congaree National Park, South Carolina, and core areas ranged from 10 ha to 60 ha. The total feral swine population in South Carolina has been estimated at 150,000 swine, with populations continuing to increase and expand (SCDNR 2014*b*). It is anticipated that feral swine populations in South Carolina will continue to increase due to their prolific breeding behavior, adaptability, and additional swine being illegally released into the wild. Given the unregulated status of feral swine in the State, the number of feral swine lethally removed annually is currently unknown. During 2013, an estimated 35,281 feral swine were harvested by deer hunters in South Carolina, a 24 percent increase from 2012, when deer hunters harvested 26,674 swine (SCDNR 2013). The counties with the highest feral swine harvest per unit area during 2013 were Abbeville (6.5 hogs/mile^2), Allendale (5.1 hogs/mile^2), Anderson (4.7 hogs/mile^2), Hampton (4.6 hogs/mile^2), and Williamsburg (3.0 hogs/mile^2) (SCDNR 2013). The total number of feral swine harvested in the State to alleviate damage and during other hunting activities is not currently known. There is no closed hunting season for feral swine on private property within the State and no limit on the number of feral swine that can be harvested (SCDNR 2014*b*).

From FY 2009 through FY 2014, WS removed a total of 1,227 feral swine to reduce damage and for disease surveillance in South Carolina. The highest annual removal of swine by WS occurred during FY 2013 when WS removed 458 feral swine to alleviate damage or threats of damage. Removal of a small number of feral swine or a single individual will sometimes reduce damage considerably where natural resources, agriculture, or property is affected (Barrett and Birmingham 1994). However, damage may increase dramatically in areas where feral swine have ample resources and opportunity to expand. WS anticipates increased requests to address damage in such locations in the future. Based on the future need to address feral swine as populations increase and expand, WS anticipates that up to 2,000 feral swine could be killed annually in South Carolina to alleviate damage or threats of damage.

In addition, WS may be requested by the SCDNR and/or the SCDA to assist with sampling and managing the spread of diseases found in free-ranging and/or captive feral swine populations. In the case of a disease outbreak, WS could lethally remove up to 500 additional feral swine for sampling and/or to prevent further spread of diseases. Therefore, WS' total annual removal would not exceed 2,500 feral swine annually under the proposed action.

If requested, WS could also assist with sampling and removing swine from captive facilities where swine are confined inside a perimeter fence. The detection of a disease at a captive facility often raises concerns of the potential spread of diseases to free-ranging animals. The spread of diseases among swine inside these facilities is often increased due to their close contact with one another. Often, once a disease is detected in a confined population, the entire population is destroyed to ensure the containment of the disease. Any involvement with the depopulation of swine confined inside a perimeter fence by WS would be at the request of the SCDNR and/or the SCDA. As proposed in this alternative, in those cases where WS is requested to assist with the removal of a captive swine, the removal would not exceed 500 for purposes of disease monitoring or surveillance. Swine confined inside perimeter fences for the purposes of non-traditional farming, including confined for hunting, are not included in statewide feral swine population estimates. However, since lethal removal of feral swine by WS for disease surveillance or monitoring could occur in free-ranging or captive herds, the potential removal of up to 500 feral swine for disease surveillance and monitoring by WS will be considered as part of the impact analysis on the statewide population. Therefore, the analyses will evaluate the lethal removal of up to 2,500 swine annually by WS at the request of cooperators.

The removal of up to 2,500 feral swine would not be expected to affect overall statewide population of feral swine because of the high reproductive rates exhibited by these animals (Barrett and Birmingham 1994). For example, Timmons et al. (2012) was able to model population growth rates for the feral swine population in Texas using demographic parameters gathered from feral swine in the southeastern United States. Using those demographic parameters, Timmons et al. (2012) estimated an average annual growth rate of 21% for feral swine populations in Texas. If the average annual harvest of feral swine in Texas represented 28% of the population, Timmons et al. (2012) expected the statewide population to double every five years. If annual harvest rates reached 41% of the statewide population, Timmons et al. (2012) predicted the population would continue to increase at a rate of 12% per year. The model determined that an annual harvest of 66% of the population was needed to hold the population stable (Timmons et al. 2012).

The statewide population of feral swine was estimated at 150,000 swine in 2010 (SCDNR 2014*b*). If 2,500 feral swine were lethally removed by WS and the population remained at least stable in the State, the highest level of lethal removal by WS would represent 1.7% of a stable population. If the estimated 35,281 feral swine harvested in the State by deer hunters during 2013 were representative of the annual harvest of feral swine in the State, the highest level of lethal removal by WS would represent 7.1% of the harvest. When combined, the highest level of lethal removal by WS and the harvest of feral swine in 2013 would represent 25.2% of a population estimated at 150,000 swine. The South Carolina Wild Hog Task Force (2012) estimated that 50 to 75% of the statewide population would have to be removed annually to stabilize or reduce the population. Based on the findings of the South Carolina Wild Hog Task Force (2012) and Timmons et al. (2012), an annual harvest rate of 25.2% would likely not reach a magnitude that would cause a decline in the statewide feral swine population. Although the actual cumulative harvest of feral swine is unknown in the State, the combined harvest is not likely to reach a level where statewide population declines would occur based on the reproductive potential of swine. In addition, one of the goals expressed by the South Carolina Wild Hog Task Force (2012) is to reduce the feral swine population in the State. Activities conducted by WS under the proposed action alternative would occur within the goals and strategies outlined for the statewide feral swine population by the South Carolina Wild Hog Task Force.

Damage management activities associated with feral swine conducted by WS under this alternative would target single animals or local populations of the species at sites where their presence was causing unacceptable damage or posing threats to agriculture, human health and safety, natural

resources, or property. Feral swine are not native to North America, including South Carolina. Executive Order 13112 directs federal agencies to reduce the extent of invasion by exotic species and the associated damages. The National Invasive Species Council specifically lists feral swine as an invasive species pursuant to Executive Order 13112. The WS program in South Carolina has reviewed the feral swine damage management programmatic EIS developed by the APHIS (USDA 2015*b*) and activities associated with feral swine conducted under this alternative would be consistent with the EIS.

Based upon the above information, WS' limited lethal removal of feral swine would not likely result in a statewide reduction in the statewide population of feral swine. Any damage management activities involving lethal methods by WS would be restricted to isolated individual sites. Some local populations may be temporarily reduced because of damage management activities aimed at reducing damage at a local site. Since feral swine are a non-native species, in those cases where feral swine were causing damage or posing a threat of damage and complete removal of the local population could be achieved, this could be considered as providing some benefit to the natural environment since feral swine are not considered part of the native ecosystem.

Issue 2 - Effects on Non-target Species, including Threatened and Endangered Species

As discussed previously, a concern is often raised about the potential impacts to non-target species, including T&E species, from the use of methods to resolve damage caused by feral swine. The potential effects on the populations of non-target wildlife species, including T&E species, are analyzed below.

Alternative 1 - No Involvement by WS in Swine Damage Management

Under this alternative, WS would not be directly involved with damage management activities in the State. Therefore, no direct impacts to non-targets or T&E species would occur by WS under this alternative. Feral swine could continue to be lethally removed by other entities within the State. Risks to non-targets and T&E species would continue to occur from those persons who implement damage management activities on their own or through recommendations by other federal, state, and private entities. Although some risks occur from those persons that implement damage management in the absence of any involvement by WS, those risks would likely be low and would be similar to those risks under the other alternatives.

The ability to reduce negative effects caused by feral swine to other wildlife species and their habitats, including T&E species, would be variable and would be based upon the skills and abilities of the person implementing damage management actions under this alternative.

Alternative 2 – Addressing Requests for Assistance through Technical Assistance Only

Under a technical assistance alternative, WS would have no direct impact on non-target species, including T&E species. Methods recommended or provided through loaning of equipment could be employed by those persons requesting assistance. Recommendations would be based on WS' Decision Model using information provided by the person requesting assistance or through site visits. Recommendations would include methods or techniques to minimize non-target impacts associated with the methods being recommended or loaned. Methods recommended could include non-lethal and lethal methods as deemed appropriate by WS using the Decision Model and as permitted by laws and regulations.

The potential impacts to non-targets under this alternative would be variable and based on several factors. If methods were employed, as recommended by WS, the potential impacts to non-targets would likely be similar to the proposed action. If recommended methods and techniques were not followed or if other methods were employed that were not recommended, the potential impacts on non-target species, including T&E species would likely be higher compared to the proposed action.

The potential impacts of harassment and exclusion methods on non-target species would be similar to those described under the proposed action. Harassment and exclusion methods would be easily obtainable and simple to employ. Since identification of targets would occur when employing shooting as a method, the potential impacts to non-target species would likely be low under this alternative.

Those persons experiencing damage from feral swine could implement methods and techniques based on the recommendations of WS. The potential for impacts would be based on the knowledge and skill of those persons implementing recommended methods. If those persons experiencing damage do not implement methods or techniques correctly, the potential impacts from providing only technical assistance could be greater than those potential impacts described in the proposed action. The incorrect implementation of methods or techniques recommended by WS could lead to an increase in non-target removal when compared to the non-target removal that could occur by WS under the proposed action alternative.

If requesters were provided technical assistance but do not implement any of the recommended actions and take no further action, the potential to remove non-targets would be lower when compared to the proposed action. If those persons requesting assistance implement recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to the proposed action. If WS made recommendations on the use of methods to alleviate damage but those methods were not implemented as recommended by WS or if those methods recommended by WS were used inappropriately, the potential for lethal removal of non-targets would likely increase under a technical assistance only alternative. Therefore, the potential impacts to non-targets, including T&E species would be variable under a technical assistance only alternative.

If non-lethal methods recommended by WS under this alternative were deemed ineffective by those persons requesting assistance, lethal methods could be employed by those persons experiencing damage. Those persons requesting assistance are those people likely to use lethal methods since a damage threshold has been met for that individual requester that has triggered seeking assistance to reduce damage. The potential impacts on non-targets by those persons experiencing damage would be highly variable. People whose feral swine damage problems were not effectively resolved by non-lethal control methods would likely resort to other means of legal or illegal lethal control. This could result in less experienced persons implementing control methods and could lead to greater removal of non-target wildlife than the proposed action. When those persons experiencing damage caused by wildlife reach a level where assistance does not adequately reduce damage or where no assistance is available, people have resorted to using chemical toxicants that are illegal for use on the intended target species. The illegal use of methods often results in loss of both target and non-target wildlife (White et al. 1989, USFWS 2001, FDA 2003). The use of illegal toxicants by those persons frustrated with the lack of assistance or assistance that inadequately reduces damage to an acceptable level can often result in the indiscriminate removal of wildlife species.

The ability to reduce negative effects caused by feral swine to wildlife species and their habitats, including T&E species, would be variable under this alternative. The ability to reduce risks would be based upon the skills and abilities of the person implementing damage management actions. It would be expected that this alternative would have a greater chance of reducing damage than Alternative 1

since WS would be available to provide information and advice on appropriately employing methods and reducing the risk of non-target removal.

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

The potential for adverse effects to non-targets occurs from the employment of methods to address feral swine damage. Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. The risks to non-targets from the use of non-lethal methods as part of an integrated direct operational assistance program would be similar to those risks to non-targets discussed in the other alternatives.

Personnel from WS would be experienced with managing wildlife damage and would be trained in the employment of methods, which would allow WS' employees to use the WS Decision Model to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. SOPs to prevent and reduce any potential adverse effects on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target exposure to methods during program activities, the potential for WS to disperse or lethally remove non-targets exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

Non-lethal methods have the potential to cause adverse effects to non-targets primarily through exclusion, harassment, and dispersal. Although non-lethal methods do not result in lethal removal of non-targets, the use of non-lethal methods can restrict or prevent access of non-targets to beneficial resources. Any exclusionary device erected to prevent access of target species also potentially excludes species that were not the primary reason for erecting the exclusion method; therefore, non-target species excluded from areas may potentially be adversely affected if the area excluded was large enough. Auditory and visual dispersal methods used to reduce damage or threats caused by feral swine would also likely disperse non-targets in the immediate area the methods were employed. Therefore, the use of non-lethal dispersal techniques may permanently disperse non-targets from an area. However, like target species, the potential impacts on non-target species would expect to be temporary with target and non-target species often returning after the cessation of dispersal methods.

Other non-lethal methods available for use under this alternative include live traps and immobilizing drugs. Live traps (*e.g.*, cage traps, walk-in traps, corral traps) and other live-capture methods (*e.g.*, foot snare, nets) restrain wildlife once captured and are considered live-capture methods. Live traps and other live-capture methods have the potential to live-capture non-target species. WS' personnel would handle any potential non-targets live-captured in such a manner as to ensure the survivability of the animal if released. Even though live-capture does occur from those methods, the potential for death of a target or non-target animal while being restrained or released does exist. Trap placement in areas where target species were active and the use of attractants as specific to the target species as possible would minimize the likelihood of capturing non-targets. If attended to appropriately, WS' personnel could release any non-targets live-captured on site unharmed.

WS' personnel would apply immobilizing drugs after live-capture occurs through injection or through direct application to target individuals from a dart gun, blowgun, or jabstick. Therefore, personnel would apply immobilizing drugs after identification of the target occurred prior to application. Personnel would administer immobilizing drugs in controlled situations where feral swine were

confined inside a live-trap, restrained using other live-capture methods, or other situations where after identification of the target animal occurs prior to application.

Potential impacts to non-targets from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. Non-targets would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal removal would occur. Non-lethal methods would be available under all the alternatives analyzed; however, the use of immobilizing drugs would be restricted to use by veterinarians and the SCDNR under Alternative 1 and Alternative 2. WS' involvement in the use of or recommendation of non-lethal methods would ensure the potential impacts to non-targets were considered under WS' Decision Model. Non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal methods would generally be regarded as having minimal impacts on overall populations of wildlife since individuals of those species are unharmed. Overall, potential impacts to non-targets from the use of non-lethal methods would not adversely affect populations since those methods would often be temporary and do not result in lethal removal. Potential impacts to non-targets under this alternative from the use of and/or the recommendation of non-lethal methods would likely be low.

WS could also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage, when those methods were deemed appropriate for use using the WS Decision Model. Lethal methods available for use to manage damage caused by feral swine under this alternative would include shooting (including shooting from aircraft), euthanasia chemicals (applied after live-capture), and the recommendation of hunting. Available methods and the application of those methods to resolve feral swine damage is further discussed in Appendix B.

The use of firearms would essentially be selective for target species since animals would be identified prior to application; therefore, no adverse effects would be anticipated from use of this method. Similarly, the use of euthanasia methods would not result in non-target removal since identification would occur prior to euthanizing an animal.

An issue that has arisen is the potential for low-level flights associated with using firearms from aircraft and surveillance could potentially disturb wildlife, including T&E species. Aerial operations would be an important method of damage management in South Carolina when used to address damage or threats associated with feral swine in remote areas where access is limited due to terrain and habitat. Aerial operations would only occur in those areas where a work initiation document allowing the use of aircraft had been signed between WS and the cooperating landowner or manager. Aerial operations would typically be conducted with aircraft between the months of December and April when the foliage has fallen; however, aircraft could be used at any time of year. The amount of time spent conducting aerial operations varies depending on the severity of damage, the size of the area where damage or threats were occurring, and the weather, as low-level aerial activities would be restricted to visual flight rules and would be impractical in high winds or at times when animals were not easily visible.

Aircraft play an important role in the management of various wildlife species for many agencies. Resource management agencies rely on low flying aircraft to monitor the status of many animal populations including large mammals (Lancia et al. 2000), birds of prey (Fuller and Mosher 1987), waterfowl (Bellrose 1976), and colonial waterbirds (Speich 1986). Low-level flights could also be required when aircraft are used to track animal movements by radio telemetry (Gilmer et al. 1981, Samuel and Fuller 1996).

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

The effects on wildlife from military-type aircraft have been studied extensively (Air National Guard 1997), and were found to have no expected adverse effects on wildlife. Examples of species or species groups that have been studied with regard to the issue of aircraft-generated disturbance are as follows:

***Waterbirds and Waterfowl*:** Low-level overflights of two to three minutes in duration by a fixed-wing airplane and a helicopter produced no "*drastic*" disturbance of tree-nesting colonial waterbirds, and, in 90% of the observations, the individual birds either showed no reaction or merely looked up (Kushlan 1979). Belanger and Bedard (1989, 1990) observed responses of greater snow geese (*Chen caerulescens atlantica*) to man-induced disturbance on a sanctuary area and estimated the energetic cost of such disturbance. Belanger and Bedard (1989, 1990) observed that disturbance rates exceeding two per hour reduced goose use of the sanctuary by 50% the following day. They also observed that about 40% of the disturbances caused interruptions in feeding that would require an estimated 32% increase in nighttime feeding to compensate for the energy lost. They concluded that overflights of sanctuary areas should be strictly regulated to avoid adverse effects. Conomy et al. (1998) quantified behavioral responses of wintering American black ducks (*Anas rubripes*), American wigeon (*A. americana*), gadwall (*A. strepera*), and American green-winged teal (*A. crecca carolinensis*) exposed to low-level military aircraft and found that only a small percentage (2%) of the birds reacted to the disturbance. They concluded that such disturbance was not adversely affecting the "*time-activity budgets*" of the species. Aerial operations conducted by WS would not be conducted over federal, State, or other governmental agency property without the concurrence of the managing entity. Those flights, if requested, would be conducted to reduce threats and damages occurring to natural resources and should not result in impacts to bird species. Thus, there is little to no potential for any adverse effects on waterbirds and waterfowl.

***Raptors*:** The Air National Guard (1997) analyzed and summarized the effects of overflight studies conducted by numerous federal and state government agencies and private organizations. Those studies determined that military aircraft noise initially startled raptors, but negative responses were brief and did not have an observed effect on productivity (see Ellis 1981, Fraser et al. 1985, Lamp 1989, United States Forest Service 1992 as cited in Air National Guard (1997)). A study conducted on the impacts of overflights to bald eagles (*Haliaeetus leucocephalus*) suggested that the eagles were not sensitive to this type of disturbance (Fraser et al. 1985). During the study, observations were made of more than 850 overflights of active eagle nests. Only two eagles rose out of either their incubation or brooding postures. This study also showed that perched adults were flushed only 10% of the time during aircraft overflights. Evidence also suggests that golden eagles (*Aquila chrysaetos*) are not highly sensitive to noise or other aircraft disturbances (Ellis 1981, Holthuijzen et al. 1990). Finally, one other study found that eagles were particularly resistant to being flushed from their nests (see Awbrey and Bowles 1990 as cited in Air National Guard (1997)). Therefore, there is considerable evidence that eagles would not be adversely affected by overflights during aerial operations.

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

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

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

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

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

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

do not hear noise from military aircraft as well as humans, which potentially indicates why they appeared not to be disturbed as much as previously thought.

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

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

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

Although many of those wildlife species discussed above are not present in South Carolina, the information was provided to demonstrate the relative tolerance most wildlife species have of overflights, even those that involve noise at high decibels, such as from military aircraft. In general, the greatest potential for impacts to occur would be expected to exist when overflights were frequent, such as hourly and over many days that could represent "*chronic*" exposure. Chronic exposure situations generally involve areas near commercial airports and military flight training facilities. Even then, many wildlife species become habituated to overflights, which appear to naturally minimize any potential adverse effects where such flights occur on a regular basis. Therefore, it is logical to conclude that the aircraft used to shoot feral swine should have far less potential to cause any disturbance to wildlife than military aircraft. Military aircraft produce much louder noise and are flown over certain training areas many more times per year, and yet, were found to have no expected adverse effects on wildlife (Air National Guard 1997).

The fact that WS would only conduct overflights on a very small percentage of the land area of the State indicates that most wildlife would not be exposed to overflights. In addition, such flights would occur infrequently throughout a year, which would further lessen the potential for any adverse effects.

While every precaution would be taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by feral swine, the use of such methods could result in the incidental lethal removal of unintended species. The unintentional removal and capture of wildlife species during damage management activities conducted under the proposed action alternative would primarily be associated with the use of live-traps. Those occurrences would be infrequent and should not affect the overall populations of any species under the proposed action. WS' removal of non-target species during activities to reduce

damage or threats to human safety associated with feral swine would be extremely low to non-existent.

Between FY 2009 and FY 2014, one raccoon was killed unintentionally in a corral trap during activities targeting feral swine when another raccoon triggered the door to the corral trap, which dropped on to the raccoon as it was entering into the trap. As discussed previously, the use of non-lethal methods to address damage or threats would generally be regarded as having no effect on a species' population since those individuals addressed using non-lethal methods would be unharmed and no actual reduction in the number of individuals in a species' population would occur. Similarly, the live-capture and release of non-targets would generally be regarded as having no adverse effects on a species' population since those individuals would be released unharmed and no actual reduction in the number of individuals in a population occurs. Therefore, the live-capture and subsequent releasing of non-targets during damage management activities conducted under the proposed action alternative would not result in declines in the number of individuals in a species' population.

WS would monitor the lethal removal of non-target species to ensure program activities or methodologies used in feral swine damage management would not adversely affect non-targets. Methods available to resolve and prevent damage or threats when employed by trained, knowledgeable personnel would be selective for target species. WS would report to the SCDNR any non-target removal to ensure lethal removal by WS was considered as part of management objectives established for those species by the SCDNR. The potential impacts to non-targets would be similar to the other alternatives and would be considered minimal to non-existent.

T&E Species Effects

WS would make special efforts to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. SOPs to avoid T&E effects are described in section 3.5 of this EA.

Federally Listed Species – Feral swine can occur statewide in South Carolina. Therefore, damage or threats of damage caused by feral swine could occur statewide wherever feral swine occur. However, WS would only conduct activities to alleviate or prevent damage when a landowner or manager requests such assistance and only on properties where WS and a cooperating entity sign a Memorandum of Understanding, work initiation document, or another comparable document. Therefore, WS has defined the action area as the State of South Carolina, which encompasses the known areas occupied by all of the T&E species listed within the State.

During the development of this EA, WS reviewed the current list of species designated as threatened or endangered in South Carolina as determined by the USFWS and the National Marine Fisheries Service. WS conducted a review of potential impacts of activities on each of the listed species. The evaluation took into consideration the direct and indirect effects of available methods. WS reviewed the status, critical habitats designations, and current known locations of all T&E species listed as threatened, endangered, or candidate species within South Carolina. In addition, WS reviewed the methods available to manage damage, the use patterns of those methods, and the areas where previous requests for assistance associated with feral swine have occurred within the State.

In some areas, feral swine can have adverse effects on threatened or endangered species and their habitats and are a factor in the continuing endangerment of multiple plant and animal species (Waithman et al. 1999, Gurevitch and Padilla 2004, Engeman et al. 2010). Feral swine can disturb large areas of vegetation and soils through rooting, and feral swine inhabiting coastal, upland, and wetland ecosystems can uproot, damage, and feed on rare native species of plants and animals. Feral

swine can disrupt natural vegetative communities, eliminate rare plants and animals, alter species composition within a forest, including both canopy and low growing species (Lipscomb 1989, Frost 1993), increase water turbidity in streams and wetlands (reducing water quality and impacting native fishes), and increase soil erosion and alter nutrient cycling (Singer et al. 1982, DeBenedetti 1986). Habitat damage by feral swine can be more pronounced in wet environments where plant communities and soils may be more sensitive to disturbance (Engeman et al. 2003, Engeman et al. 2004, West et al. 2009).

For several species listed within the State, WS has determined that the proposed activities "*may affect*" those species but those effects would be solely beneficial, insignificant, or discountable, which would warrant a "*not likely to adversely affect*" determination (see Table 4.1). In addition, WS has made a "*no effect*" determination for several species currently listed in the State based on those methods currently available and based on current life history information for those species (see Table 4.1). As part of the development of the EA, WS consulted with the USFWS under Section 7 of the ESA. The USFWS concurred with WS' determinations (T. McCoy, USFWS pers. comm. 2015).

Table 4.1 - List of threatened or endangered species in South Carolina and WS' determination

Common Name	Scientific Name	Status[†]	Determination[‡]
Animals			
Invertebrates			
Carolina Heelsplitter	*Lasmigona decorata*	E[*]	MANLAA
Reptiles			
Green Sea Turtle	*Chelonia mydas*	T	MANLAA
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	MANLAA
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	E	MANLAA
Leatherback Sea Turtle	*Dermochelys coriacea*	E	MANLAA
Loggerhead Sea Turtle	*Caretta caretta*	T[*]	MANLAA
Bog Turtle	*Clemmys muhlenbergii*	T/SA	MANLAA
Gopher Tortoise	*Gopherus polyphemus*	C	MANLAA
Amphibian			
Frosted Flatwoods Salamander	*Ambystoma cingulatum*	T[*]	MANLAA
Fish			
Shortnose Sturgeon	*Acipenser brevirostrum*	E	NE
Smalltooth Sawfish	*Pristis pectinata*	E	NE
Mammals			
West Indian Manatee	*Trichechus manatus*	E	NE
Finback Whale	*Balaenoptera physalus*	E	NE
Humpback Whale	*Megaptera novaeangliae*	E	NE
North Atlantic Right Whale	*Eubalaena glacialis*	E	NE
Red Wolf	*Canis rufus*	E	NE
Northern Long-eared Bat	*Myotis septentrionalis*	T	NE
Birds			
Piping Plover	*Charadrius melodus*	T[*]	NE
Bachman's Warbler	*Vermivora bachmanii*	E	NE
Red-cockaded Woodpecker	*Picoides borealis*	E	MANLAA
Kirtland's Warbler	*Setophaga kirtlandii*	E	NE
Wood Stork	*Mycteria americana*	T	MANLAA
Red Knot	*Calidris canutus rufa*	T	MANLAA
Roseate Tern	*Sterna dougallii dougallii*	T	NE

Plants			
American Chaffseed	*Schwalbea americana*	E	MANLAA
Bunched Arrowhead	*Sagittaria fasciculata*	E	MANLAA
Canby's Dropwort	*Oxypolis canbyi*	E	MANLAA
Pondberry	*Lindera melissifolia*	E	MANLAA
White Fringeless Orchid	*Platanthera integrilabia*	C	MANLAA
Dwarf-flowered Heartleaf	*Hexastylis naniflora*	T	MANLAA
Harperella	*Ptilimnium nodosum*	E	MANLAA
Little Ampianthus	*Amphianthus pusillus*	T	MANLAA
Miccosukee Gooseberry	*Ribes echinellum*	T	MANLAA
Michaux's sumac	*Rhus michauxii*	E	MANLAA
Mountain Sweet Pitcher-plant	*Sarracenia rubra jonesii*	E	MANLAA
Persistent Trillium	*Trillium persistens*	E	MANLAA
Relict Trillium	*Trillium reliquum*	E	MANLAA
Rough-leaved Loosestrife	*Lysimachia asperulaefolia*	E	MANLAA
Schweinitz's Sunflower	*Helianthus schweinitzii*	E	MANLAA
Seabeach Amaranth	*Amaranthus pumilus*	T	MANLAA
Small Whorled Pogonia	*Isotria medeoloides*	T	MANLAA
Smooth Coneflower	*Echinacea laevigata*	E	MANLAA
Swamp Pink	*Helonias bullata*	T	MANLAA
White Irisette	*Sisyrinchium dichotomum*	E	MANLAA
Black Spored Quillwort	*Isoetes melanospora*	E	MANLAA
Lichens			
Rock Gnome Lichen	*Gymnoderma lineare*	E	NE

†T=Threatened; E=Endangered; C=Candidate; P=Proposed; SA=Similarity of Appearance

‡NE=No effect; MANLAA=May affect, not likely to adversely affect

*Species with critical habitat designated within South Carolina

WS based the effects determination for each species on several considerations, including the use pattern of methods; the locations and habitats where WS was likely to use methods; and the known geographical extent of the species. The following discussion provides the rationale for WS' effects determination for each species.

Carolina Heelsplitter – This freshwater mussel species occurs in creeks, streams, and rivers along the slate-belt portion of the piedmont areas of North Carolina and South Carolina. In South Carolina, populations were only known to occur in small stretches of the Lynches River in Chesterfield, Lancaster, and Kershaw Counties; Flat Creek and Grills Creek in Lancaster County; Turkey Creek in Edgefield and McCormick Counties; Mountain Creek and Beaverdam Creek in Edgefield County; and Cuffytown creek in Greenwood and McCormick Counties (USFWS 1996). The USFWS (2012*a*) stated, "*Several small mammal species are known to feed on mussels including muskrat, otter, raccoon, mink…"* and "[w]*hile predation is not thought to be a significant threat to a healthy mussel population, it could limit the recovery of endangered mussel species or contribute to the local extirpation of mussel populations already depleted by other factors*". In addition, feral swine that wallow in and around creeks could negatively affect water quality by increasing erosion and water turbidity. Based on the use patterns of methods, the proposed activities would have no direct effect on the status of the heelsplitter. However, removing feral swine near areas where heelsplitters occur could provide some benefit by reducing predation and reducing the risks of feral swine adversely affecting water quality. In addition, the methods that would be available to resolve damage caused by feral swine do not result in major ground disturbances, siltation, pollution, or stream alterations;

therefore, the proposed action alternative would have no effect on any critical habitat designated for the heelsplitter in the State.

Green Sea Turtle - Like the other sea turtles, the green sea turtle is a marine species that could be found along the coastal waters of the State. Based on the use patterns of methods, the proposed activities would have no direct effect on the status of the green sea turtle. Nesting is not known to occur on coastal beaches of the continental United States; however, if nesting were to occur along the beaches in the State, removing feral swine near nesting areas could provide some benefit by reducing predation on eggs and young turtles.

Hawksbill Sea Turtle - The hawksbill sea turtle is another marine species that could occur along the coastal waters and could nest along the beach areas of the State. However, nesting is not known to occur along the coastal beaches of the State. Since methods and activities conducted under the proposed activities would not involve marine environments, the proposed activities would have no direct effect on the status of the Hawksbill sea turtle. If nesting were to occur along the beaches in the State, removing mammalian predators near nesting areas could provide some benefit by reducing predation on eggs and young turtles.

Kemp's Ridley Sea Turtle - This sea turtle is a marine species that could be found along the coastal waters of South Carolina. Based on the use patterns of methods available to alleviate feral swine damage, the proposed activities would have no direct effect on sea turtles. Predation of sea turtle nests by feral swine could occur if nesting occurs along the coastal beaches of the State. If nesting were to occur along the beaches in the State, removing feral swine near nesting areas could provide some benefit by reducing predation on eggs and young turtles.

Leatherback Sea Turtle - This marine species has been observed nesting along the gulf coast states from Texas to Georgia; however, the sea turtle currently only consistently nests along the Florida coast. Similar to the other sea turtles, the proposed activities would not directly affect the sea turtle; however, the removal of feral swine by WS could reduce predation on nests, which could benefit the species. Therefore, WS has concluded the proposed activities could benefit the species by reducing nest predation, which would warrant a not likely to adversely affect determination.

Loggerhead Sea Turtle - The loggerhead sea turtle is a marine species that could be found along the coastal areas of the State. The proposed activities would not result in any detrimental impacts to the status of the loggerhead sea turtle. The removal of feral swine in areas where sea turtles nest could result in reduced predation on eggs and young, which could be beneficial to the status of sea turtles. Therefore, WS has concluded the proposed activities may affect the loggerhead sea turtle but would have no adverse effect on the status of the species based on the potential for beneficial effects from the removal of feral swine from areas where nesting could occur in the State. In addition, the methods that would be available to resolve damage caused by feral swine do not result in major ground disturbances, pollution, or beach alterations; therefore, the proposed action alternative would have no effect on any critical habitat designated for the loggerhead sea turtle in the State.

Bog Turtle – The USFWS lists bog turtles found in the northern portion of their range as a threatened species. The USFWS lists those bog turtles in the southern portion of their range, including those turtles found in South Carolina, as threatened due to the similarity of appearance with the turtles from the northern portion of their range. In the southern portion of the their range, bog turtles occur in the Appalachian Mountains from southern Virginia to northern Georgia, with populations occurring in Greenville and Pickens Counties, South Carolina. The USFWS allows the incidental take of bog turtles in the southern portion of their range, including South Carolina, from otherwise lawful activities (see 62 FR 59605-59623; 50 CFR 17.42(f)). No incidental take of bog turtles has occurred

previously by WS in the State when targeting feral swine. WS does not expect incidental take to occur during activities to alleviate feral swine damage in the State given the limited range of the bog turtle in the State and the use patterns of methods available. Removing feral swine could reduce predation rates on bog turtles, which could provide some benefit to the species.

Gopher Tortoise - The gopher tortoise is an inhabitant of the southwestern portion of the State, including Aiken, Allendale, Barnwell, Hampton, and Jasper Counties. It inhabits well-drained sandy soils associated with an open pine over story and grassy groundcover. The gopher tortoise is a candidate species for listing by the USFWS. Removing feral swine could be beneficial to the status of the tortoise by reducing predation and habitat disturbance. None of the methods available to manage feral swine damage would cause major ground disturbances or result in loss of habitat; therefore, the methods would have no effect on any critical habitat designated for the gopher tortoise. If the gopher tortoise becomes a threatened or endangered species in the State, the removal of feral swine could benefit the species by reducing predation risks and habitat alteration.

Frosted Flatwoods Salamander – The frosted flatwoods salamander likely occurs in Beaufort, Berkeley, Charleston, Jasper, and Orangeburg Counties in the State. Flatwoods salamanders occur in longleaf pine-slash pine flatwoods with breeding occurring in isolated, seasonal ponds. The primary threat to the salamander is loss and degradation of both its terrestrial habitat and breeding habitat. In addition, fire suppression may be a primary reason for continued habitat degradation (see 74 FR 6700-6774). The proposed activities would not directly affect the frosted flatwoods salamander; however, the removal of feral swine by WS could reduce predation risks, which could benefit the species. In addition, the removal of feral swine in areas where seasonal ponds occur could prevent habitat degradation by removing swine that may root and wallow in those areas. Therefore, WS has concluded the proposed activities could benefit the species by reducing predation and by reducing habitat degradation, which would warrant a not likely to adversely affect determination. In addition, the proposed activities would not result in habitat destruction or draining of ponds; therefore, WS has determined the proposed activities would have no effect on critical habitat designated in the State.

Shortnose Sturgeon – The shortnose sturgeon is a fish species that occurs in large coastal rivers of eastern North America. Based on the use patterns of the methods available to address damage or threats of damage associated with feral swine, WS has determined the proposed action would have no effect on the status of the shortnose sturgeon.

Smalltooth Sawfish - The smalltooth sawfish historically has occurred in the shallow coastal waters of the Gulf of Mexico from Texas to Florida and the shallow coastal areas along the Atlantic Ocean from Florida to New York. WS' activities to resolve damage or threats associated with feral swine do not cause major disturbances to habitat or the introduction of pollutants into the waters where sawfish are known to occur. Current populations of smalltooth sawfish are only known to occur off the southern coasts of Florida (National Marine Fisheries Service 2009). Based on the current known range of the smalltooth sawfish being restricted to peninsular Florida, the proposed activities conducted pursuant to the EA would have no effect on the smalltooth sawfish.

West Indian Manatee - Manatees are an aquatic species occasionally found in larger drainages that empty into large saltwater bays and lakes or the Gulf of Mexico. WS does not conduct damage management activities in those types of environments; therefore, WS has determined that activities under the proposed action alternative would have no effect on this species, including any designated critical habitat.

Whales – The finback whale, the humpback whale, and the north Atlantic right whale are marine species that could occur along the coastal waters of South Carolina. WS would not conduct activities in marine environments; therefore, activities would have no effect on those whale species.

Red Wolf – The only wild red wolf population occurs in northeastern North Carolina along the Albemarle Peninsula, which the USFWS has designated as a non-essential experimental population. Based on the known range of the red wolf, WS had determined the proposed action alternative would have no effect on the status of the red wolf.

Northern Long-eared Bat – The northern long-eared bat occurs in 10 counties in South Carolina. During summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. It has also been found, rarely, roosting in structures like barns and sheds. The proposed activities would not result in modifications to any caves and would not disturb any snags or other large trees the bats would utilize. Therefore, WS has concluded that the proposed activities would have no effect on the status of the northern long-eared bat.

Piping Plover – The piping plover winters along the coast and prefers tidal flats for feeding and sandy beaches for roosting. Critical habitat for this plover includes the coastal areas of Beaufort, Charleston, Colleton, Georgetown, Horry, and Jasper Counties. The proposed activities would not directly affect the piping plover; however, the removal of feral swine by WS could reduce predation risks, which could benefit the species. Therefore, WS has concluded the proposed activities could benefit the species by reducing predation, which would warrant a not likely to adversely affect determination. In addition, the proposed activities would not result in habitat destruction; therefore, WS has determined the proposed activities would have no effect on critical habitat designated in the State.

Bachman's Warbler - The Bachman's warbler has not been officially documented in the United States since 1962 and was last documented on wintering grounds in Cuba in 1984 (USFWS 2007). Although unconfirmed reports of Bachman's warblers have occurred since 1962 in the United States and uncertainty on the status of the species remains, the species is likely extinct (USFWS 2007). Based on the rarity of occurrences and the preferred habitat of the Bachman's warbler being palustrine forested wetlands with a dense understory, WS' activities would have no effect on the Bachman's warbler in the State.

Red-cockaded Woodpecker - This species requires open stands of mature pine trees, primarily longleaf pine, for nest cavity construction. The proposed activities would not directly affect the red-cockaded woodpecker. The removal of feral swine to alleviate damage or threats of damage could also reduce habitat disturbance, thus providing positive benefits to the species; therefore, WS has determined that the proposed action could be beneficial and not likely to adversely affect the status of this species in the State.

Kirtland's Warbler – The Kirtland's warbler is an endangered species that nests in young jack pine stands in the Great Lakes region of the United States and Canada. During the migration periods, Kirtland's warbler may occur along the coastal areas of the southeastern United States as they move toward their wintering grounds in the Bahamas. Based on the use patterns of the methods available to alleviate damage and the areas where damage management activities could occur in relationship to areas where warblers are likely to occur during their migration, WS has concluded the proposed action would have no effect on the status of the Kirtland's warbler.

Wood Stork - Storks utilize freshwater and estuarine wetlands, primarily nesting in cypress or mangrove swamps. They feed in freshwater marshes, tidal creeks, and tidal pools. The proposed activities do not result in habitat destruction or modifications of habitat and WS does not anticipate any direct effects to wood storks from available methods. Based on the habitat preferences of wood storks and the activities where damage management activities could occur, WS has determined the removal of feral swine may affect but would not likely adversely affect wood storks by reducing habitat degradation in areas where storks may forage, which may benefit storks. The rooting and wallowing behavior of feral swine could degrade habitats where storks may feed.

Red Knot - The USFWS has listed the red knot as a threatened species. During the breeding season, red knots occur in the extreme northern artic region. Red knots winter primarily in intertidal marine habitats, especially near coastal inlets, estuaries, and bays. In South Carolina, red knots occur in marine habitats along the coast (Baker et al. 2013). Primary food sources include invertebrates, especially bivalves and crustaceans. Based on the use patterns of the methods available to alleviate damage and the areas where damage management activities could occur in relationship to areas where red knots are likely to occur, WS has concluded the proposed action could benefit the red knot by reducing competition for food sources. Removing feral swine from areas near where red knots forage could reduce competition for food sources.

Roseate Tern – Roseate terns present in the State would primarily occur during the migration periods as terns disperse from breeding areas to wintering areas. No known breeding colonies of terns occur in South Carolina. Terns primarily migrate far from land across the open ocean but are occasional observed along the coasts. Based on the migration patterns of terns, WS has determined the proposed action alternative would have no effect on the status of the roseate tern.

Plants – Based on the use patterns of the methods available and the current known locations of the plant species listed as endangered, threatened, or a candidate species in the State, WS has concluded the proposed action alternative would likely benefit plant species found in the State. Removing feral swine in areas of the state where those plant species occur could reduce the occurrence of feral swine foraging on those plant species and reducing habitat disturbance. For example, the white fringeless orchid is a candidate for listing in South Carolina. The orchid is only known to occur in one area of Greenville County on land owned by the State (USFWS 2012*b*). The fringeless orchid occurs in boggy areas at the head of streams and on slopes with water seepage (USFWS 2012*b*). Feral swine can damage orchids by uprooting the plant and disturbing critical habitats (USFWS 2012*b*). Therefore, the removal of feral swine could benefit the orchid and other plant species.

Rock Gnome Lichen – The rock gnome lichen is listed by the USFWS as an endangered species in the State. The lichen is endemic to cliffs at high elevation that are frequently bathed in fog or in deep river gorges at lower elevations where the humidity is high (USFWS 2013). This lichen species is only known to occur in Greenville County. Based on the known locations of this lichen species and the bare rock faces where the lichen occurs, WS had determined the proposed action would have no effect on the status of the lichen and any designated critical habitat.

State Listed Species - The list of T&E species designated by the State of South Carolina was also obtained during the development of this EA (see Appendix C). Based on the methods and scope of activities proposed under this alternative, activities conducted within the scope of analysis will not adversely affect any species listed as threatened and endangered in the State (E. Cope, SCDNR pers. comm. 2015).

Beneficial Effects on Non-target Species

Invasive species that are introduced into naïve environments often exploit resources and often compete with native plant and wildlife species. Competition for resources between invasive and native species has been well-documented (Pimentel et al. 2000). Of major concern to agencies are the potential effects invasive species have on T&E species. Pimentel et al. (2000) estimated 400 of the 958 species listed as threatened and endangered in the United States at the time of publication were negatively affected by invasive species, primarily from competition for resources and predation based on published reports by The Nature Conservancy (1996) and Wilcove et al. (1998). Worldwide, nearly 80% of wildlife populations at risk of extinction are threatened or negatively affected by invasive species (Pimentel et al. 2005). Thus, invasive species have been identified as the primary cause of endangerment of at least 40% of the species listed as threatened or endangered in the United States (Wilcove et al. 1998, Pimentel et al. 2000, Pimentel et al. 2005).

The adverse effects that feral swine can have on native flora and fauna are discussed in Chapter 1 of this EA. Any reduction in the invasive feral swine populations in the State could be viewed as benefiting native wildlife and habitats.

Under this alternative, WS' would be allowed to integrate methods to achieve the most effective approach to resolve and prevent damage to native flora and fauna in the State. An integrated approach allows the greatest amount of flexibility in the use of methods to ensure employment of methods either individual or in combination achieves the desired level of damage or threat reduction.

Issue 3 - Effects of Management Methods on Human Health and Safety

A common concern is the potential adverse effects methods available could have on human health and safety. The threats to human safety of methods available under the alternatives are evaluated below by each of the alternatives.

Alternative 1 - No Involvement by WS in Swine Damage Management

Under the no involvement in damage management by WS alternative, WS would not be involved in any aspect of managing damage associated with feral swine, including providing any technical assistance. Due to the lack of involvement in managing damage caused by feral swine, no impacts to human safety would occur directly from WS. This alternative would not prevent those entities experiencing threats or damage from feral swine from conducting damage management activities in the absence of WS' assistance. The direct burden of implementing permitted methods would be placed on those persons experiencing damage or require those persons to seek assistance from other entities.

Similar to the technical assistance only alternative, immobilizing drugs and euthanizing chemicals would not be available under this alternative to most persons experiencing damage or threats from feral swine. In addition, shooting from aircraft would not currently be available under this alternative. Since most methods available to resolve or prevent damage or threats would be available to anyone, the threats to human safety from the use of those methods would be similar between the alternatives. However, methods employed by those persons not experienced in the use of methods or by those persons that were not trained in their proper use, could increase threats to human safety. Overall, the methods available to the public, when applied correctly and appropriately, pose minimal risks to human safety.

Threats to human safety often occur due to interactions between people and feral swine where a

concern arises from transmission of zoonotic diseases, from physical interactions that result in injuries, and/or from threats of aircraft/vehicles striking feral swine. In the absence of an effective program to address human safety associated with feral swine, the risks associated with potential disease transmission and injuries would likely increase.

Under this alternative, no assistance would be provided by WS to those persons experiencing damage or threats associated with feral swine in South Carolina. In the absence of any assistance, those persons experiencing threats to human safety would be directly responsible for obtaining and employing the appropriate methods. Those persons employing methods could be at a higher risk of exposure to zoonotic diseases and injury since no guidance or recommendations would be made by WS. Therefore, the risks to human safety under this alternative would be variable and would be based on the knowledge and skills of those persons employing methods.

Alternative 2 – Addressing Requests for Assistance through Technical Assistance Only

Under this alternative, WS would be restricted to making recommendations of methods and the demonstration of methods only to resolve damage. WS would only provide technical assistance to those persons requesting assistance with feral swine damage and threats. The implementation of methods would be the sole responsibility of the requester. Although hazards to human safety from non-lethal methods exist, those methods are generally regarded as safe when used by trained individuals who are experienced in their use. Risks to human safety associated with non-chemical methods such as resource management methods (*e.g.*, limited habitat modification), exclusion devices, frightening devices, and cage traps would be considered low based on their use profile for alleviating damage associated with wildlife. Although some risk of fire and bodily harm exists from the use of pyrotechnics and propane cannons, when used appropriately and in consideration of those risks, they could be used with a high degree of safety.

Under a technical assistance only alternative, the use of immobilizing drugs and euthanasia chemicals would not be available to the public. Immobilizing drugs used in capturing and handling wildlife could be administered under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and other entities, such as the SCDNR. Without access to immobilizing drugs or euthanizing chemicals, those persons capturing feral swine using live-traps or other live-capture methods would be responsible for euthanizing or handling live-captured captive animals. Since immobilizing drugs and euthanizing chemicals would be unavailable under this alternative, a gunshot would likely be the primary method of euthanasia.

The recommendation of shooting with firearms as a method of direct lethal removal could occur under this alternative. Safety issues do arise related to misusing firearms and the potential human hazards associated with firearms use when employed to reduce damage and threats. When used appropriately and with consideration for human safety, risks associated with firearms would be minimal. If firearms were employed inappropriately or without regard to human safety, serious injuries could occur. Under this alternative, recommendations of the use of firearms by WS would include human safety considerations. Since the use of firearms to alleviate feral swine damage would be available under any of the alternatives and the use of firearms by those persons experiencing damage could occur whether WS was consulted or contacted, the risks to human safety from the use of firearms would be similar among all the alternatives.

If non-chemical methods were employed according to recommendations and as demonstrated by WS, the potential risks to human safety would be similar to the proposed action. If methods were employed without guidance from WS or applied inappropriately, the risks to human safety could increase. The extent of the increased risk would be unknown and variable. Non-chemical methods

inherently pose minimal risks to human safety given the design and the extent of the use of those methods. Since those non-chemical methods discussed in Appendix B would be similar across the alternatives, the risks to human safety under a technical assistance alternative would be similar to those discussed in the no involvement by WS alternative and the proposed action.

If resource owners felt the level of assistance available was inadequate to resolve damage or threats to an appropriate level, the illegal use of chemicals could increase. The illegal use of chemicals to resolve wildlife damage does occur and often has impacts to other wildlife species besides the targeted species (*e.g.*, see White et al. 1989, USFWS 2001, FDA 2003). The extent of the illegal use of chemicals, if only technical assistance was provided, is unknown though it would likely increase if affected resources owners were unable to resolve damage or threats adequately with methods recommended or legally available. An increase in the illegal use of chemicals could increase threats to human safety depending on the chemical used and the extent of the chemical use.

Threats to human safety under the technical assistance alternative could be resolved by those persons implementing methods recommended by WS. The effectiveness in reducing threats would be based on the knowledge of the person to implement the methods effectively and knowledge of the behavior of the target species that would increase the likelihood of resolving the threat. The ability to resolve threats to human safety by those persons requesting technical assistance would also be dependent upon the availability of methods and the effectiveness of those methods, and the ability of the requester to acquire those methods.

Given the expertise of WS in the behavior of the target species and the knowledge in the effective use of available methods, the potential threats to human safety under this alternative would likely be higher than the proposed action. Under this alternative, those persons requesting assistance would be responsible for implementing and using methods to resolve damage or threats, which places the requester at a high risk of exposure to disease and injury if not trained appropriately. The degree in which the risk is higher is unknown and is likely highly variable.

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

The cooperator requesting assistance would be made aware through a MOU, work initiation document, or a similar document that those methods agreed upon could potentially be used on property owned or managed by the cooperator. Therefore, the cooperator would be made aware of the possible use of those methods on property they own or manage through the signing of a MOU, work initiation document, or similar document, which would assist with identifying any risks to human safety associated with the use of those methods.

Under the proposed action, those methods discussed in Appendix B, could be integrated to resolve and prevent damage associated with feral swine in the State. WS would use the Decision Model to determine the appropriate method or methods that would effectively resolve the request for assistance. Those methods would be continually evaluated for effectiveness and if necessary, additional methods could be employed. Non-lethal and lethal methods could be used under the proposed action. WS would continue to provide technical assistance and/or direct operational assistance to those persons seeking assistance with managing damage or threats from feral swine. Risks to human safety from technical assistance conducted by WS would be similar to those risks addressed under Alternative 2. The use of non-lethal methods as part of an integrated approach to managing damage that could be employed as part of direct operational assistance by WS would be similar to those risks addressed in the other alternatives.

Lethal methods available under the proposed action would include the use of live-capture followed by euthanasia, shooting, and the recommendation of hunting. Those lethal methods available under the proposed action alternative would also be available under the other alternatives. None of the lethal methods available would be restricted to use by WS only, except for the use of aircraft. Euthanasia chemicals would not be available to the public but those feral swine live-captured could be killed using other methods.

WS' employees who conduct activities to manage damage caused by feral swine would be knowledgeable in the use of methods, feral swine behavior, and WS' directives. That knowledge would be incorporated into the decision-making process inherent with the WS' Decision Model that would be applied when addressing threats and damage caused by feral swine. When employing lethal methods, WS' employees consider risks to human safety when employing those methods based on location and method. For example, risks to human safety from the use of methods would likely be lower in rural areas that are less densely populated. Consideration would also be given to the location where damage management activities would be conducted based on property ownership. If locations where methods would be employed occur on private property in rural areas where access to the property was controlled and monitored, the risks to human safety from the use of methods would likely be less. If damage management activities occur at parks or near other public use areas, then risks of the public encountering damage management methods and the corresponding risk to human safety increases. Activities would generally be conducted when human activity was minimal (*e.g.*, early mornings, at night) or in areas where human activities were minimal (*e.g.*, in areas closed to the public).

The use of live-capture traps has been identified as a potential issue. Live-capture traps available for feral swine would typically be walk-in style traps where feral swine enter but are unable to exit. Live-traps would typically be set in situations where human activity was minimal to ensure public safety. Those methods rarely cause serious injury and would only be triggered through direct activation of the device. Therefore, human safety concerns associated with live-traps used to capture wildlife, including feral swine, would require direct contact to cause bodily harm. Therefore, if left undisturbed, risks to human safety would be minimal. Signs warning of the use of those tools in the area would be posted for public view at access points to increase awareness that those devices were being used and to avoid the area, especially pet owners.

Safety issues related to the misuse of firearms and the potential human hazards associated with firearms use were issues identified. To help ensure safe use and awareness, WS' employees who use firearms during official duties are required to attend an approved firearm safety-training course and to remain certified for firearm use must attend a safety-training course in accordance with WS Directive 2.615. As a condition of employment, WS' employees who carry and use firearms are subject to the Lautenberg Domestic Confiscation Law, which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence (18 USC § 922(g)(9)). A safety assessment based on site evaluations, coordination with cooperating and local agencies (if applicable), and consultation with cooperators would be conducted before firearms were deemed appropriate to alleviate or reduce damage and threats to human safety when conducting activities in the State. WS would work closely with cooperators requesting assistance to ensure all safety issues were considered before firearms would be deemed appropriate for use. The use of all methods, including firearms, would be agreed upon with the cooperator to ensure the safe use of those methods.

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use of chemical methods would include immobilizing drugs and euthanasia chemicals. Immobilization of live-

captured feral swine would occur to minimize stress and the likelihood of injury to the individual captured and for the safety of personnel handling the swine. Immobilizing drugs would be administered according to recommended methods and doses from published sources. Under this alternative, immobilizing drugs and euthanasia chemicals would be used infrequently. Immobilizing drugs would be limited to those requests where swine would be sedated to fit radio collars and/or to collect samples and then released. The use of immobilizing drugs would also be limited to those instances where euthanasia would occur from the use of euthanasia chemicals. When euthanasia chemicals were administered, immobilizing drugs would also be administered prior to the use of the euthanizing chemicals.

The use of immobilizing drugs would only be administered to feral swine that have been live-captured using other methods or administered through injection using a projectile (*e.g.*, dart gun). Immobilizing drugs used to sedate wildlife would be used to temporarily handle and transport animals to lessen the distress of the animal from the experience. Drug delivery to immobilize feral swine would be likely to occur on site with close monitoring of the animal to ensure proper care of the animal. Immobilizing drugs would be fully reversible with a full recovery of sedated animals occurring. A list and description of immobilizing drugs available for use under the identified alternatives can be found in Appendix B.

Euthanizing chemicals would be administered under similar circumstances to immobilizing drugs. Euthanizing chemicals would be administered to animals that were immobilized after being live-captured using other methods. Euthanized animals would be disposed of in accordance with WS Directives; therefore, would not be available for harvest and consumption. If feral swine were immobilized for sampling or to be fitted with a radio collar and released, risks could occur to human safety if harvest and consumption occurred. SOPs employed by WS to reduce risks are discussed in Chapter 3 and in Appendix B.

Drugs used in capturing, handling, and euthanizing wildlife include ketamine, a mixture of ketamine/Xylazine, sodium pentobarbital, potassium chloride, and Beuthanasia-D. Meeting the requirements of the AMDUCA should prevent any adverse effects on human health with regard to this issue (see Section 1.6). SOPs that would be part of the activities conducted 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 those veterinary authorities (as allowed by AMDUCA), wildlife hazard management programs may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to typical hunting seasons to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. Ear tagging or other marking of animals drugged and released to alert hunters and trappers that they should contact state officials before consuming the animal.
- Most feral swine administered drugs would be released well before typical hunting seasons, which would give the drug time to completely metabolize out of the animals' systems before they might be harvested and consumed by humans. 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.

By following those procedures in accordance with AMDUCA, wildlife management programs would avoid any adverse effects on human health with regard to this issue.

All WS' personnel who handle and administer chemical methods would be properly trained in the use of those methods. Training and adherence to agency directives (see WS Directive 2.430) would ensure the safety of employees applying chemical methods. Feral swine euthanized by WS or lethally removed using chemical methods would be disposed of in accordance with WS Directive 2.515. All euthanasia would occur in the absence of the public, whenever possible, which would minimize risks. SOPs are further described in Chapter 3 of this EA.

Consequences of Aerial Wildlife Operations Accidents

Aerial wildlife operations, like any other flying, may result in an accident. WS' pilots and crewmembers would be trained and experienced to recognize the circumstances that lead to accidents and have thousands of hours of flight time. The national WS Aviation Program has increased its emphasis on safety, including funding for additional training, the establishment of a WS Flight Training Center, and annual recurring training for all pilots. Still, accidents may occur and the environmental consequences should be evaluated.

***Major Ground or Wild/Forest Fires*:** Although fires could result from aircraft-related accidents, no such fires have occurred from aircraft incidents previously involving government aircraft and low-level flights.

Fuel Spills and Environmental Hazard from Aviation Accidents: A representative of the National Transportation Safety Board has stated previously that aviation fuel is extremely volatile and will evaporate within a few hours or less to the point that even its odor cannot be detected (USDA 2005). Helicopters used for aerial wildlife operations carry less fuel than fixed-wing aircraft with 30 gallons the maximum for most helicopters. In some cases, little or none of the fuel would be spilled if an accident occurs. Thus, there should be little environmental hazard from unignited fuel spills.

Oil and Other Fluid Spills: With the size of aircraft used by WS, the quantities of oil (*e.g.,* 3 to 5 quarts in helicopters) capable of being spilled in any accident would be small and insignificant with respect to the potential for environmental damage. The greatest potential amount of oil that could be spilled in one accident would be about eight quarts.

Petroleum products biodegrade through volatilization and bacterial action, particularly when exposed to oxygen (EPA 2000). Thus, small quantity oil spills on surface soils can be expected to biodegrade readily. Even in subsurface contamination situations involving underground storage facilities that would generally be expected to involve larger quantities than would ever be involved in a small aircraft accident, EPA guidelines provide for *"natural attenuation"* or volatilization and biodegradation in some situations to mitigate environmental hazards (EPA 2000). Thus, even where oil spills in small aircraft accidents were not cleaned up, the oil does not persist in the environment or persists in such small quantities that no adverse effects would be expected. In addition, WS' accidents generally would occur in remote areas away from human habitation and drinking water supplies. Thus, the risk to drinking water appears to be exceedingly low to nonexistent.

For these reasons, the risk of ground fires or fuel/oil pollution from aviation accidents could be considered low. In addition, based on the history and experience of the program in aircraft accidents, it appears the risk of significant environmental damage from such accidents is exceedingly low.

No adverse effects to human safety have occurred from WS' use of methods to alleviate feral swine damage in the State from FY 2009 through FY 2014. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, is considered low.

This alternative would allow personnel from WS to address threats to human safety associated with feral swine that were trained in the use of appropriate methodologies for addressing threats and were trained in the appropriate handling methods to ensure the safety of the handler and the public. The other alternatives would place the immediate burden of resolving threats to human safety on those persons requesting assistance, which would not likely be trained in the proper use of methods.

Issue 4 - Humaneness of Methods Available for Damage Management

As discussed previously, a common issue often raised is concerns about the humaneness of methods available under the alternatives for resolving feral swine damage and threats. The issues of method humaneness relating to the alternatives are discussed below.

Alternative 1 - No Involvement by WS in Swine Damage Management

Under this alternative, WS would not be involved in any aspect of feral swine damage management in South Carolina. Those persons experiencing damage or threats associated with feral swine could continue to use those methods legally available. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the public since methods are often labeled as inhumane by segments of society no matter the entity employing those methods.

The humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by WS under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to the public to use to resolve damage and threats caused by feral swine. Under Alternative 1, those persons employing methods would determine the methods used to euthanize or kill feral swine.

Alternative 2 – Addressing Requests for Assistance through Technical Assistance Only

The issue of humaneness of methods under this alternative would be similar to humaneness issues discussed under the proposed action, since WS could recommend methods that some persons may consider inhumane. WS would not be directly involved with damage management activities under this alternative. However, the recommendation of the use of methods would likely result in the requester employing those methods. Therefore, by recommending methods and thus a requester employing those methods, the issue of humaneness would be similar to the proposed action. Under Alternative 2, WS would recommend the use of euthanasia methods pursuant to WS Directive 2.505. However, the person requesting assistance would determine what methods to use to euthanize or kill a live-captured animal under Alternative 2.

WS would instruct and demonstrate the proper use and placement of methodologies to increase effectiveness in capturing feral swine and to ensure methods were used in such a way as to minimize pain and suffering. However, the efficacy of methods employed by a cooperator would be based on the skill and knowledge of the requester in resolving the threat to safety or damage situation despite WS' demonstration. Therefore, a lack of understanding of the behavior of feral swine or improperly identifying the damage caused by feral swine along with inadequate knowledge and skill in using methodologies to resolve the damage or threat could lead to incidents with a greater probability of

being perceived as inhumane. In those situations, the pain and suffering would likely be regarded as greater than those discussed in the proposed action.

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

Under the proposed action, WS would integrate methods using WS' Decision Model as part of technical assistance and direct operational assistance. Methods available under the proposed action could include non-lethal and lethal methods integrated into direct operational assistance conducted by WS. Under this alternative, non-lethal methods would be used by WS, which would generally be regarded as humane. Non-lethal methods would include resource management methods (*e.g.*, limited habitat modification), exclusion devices, frightening devices, cage traps, foot snares, and immobilizing drugs.

As discussed previously, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering.

Some individuals believe any use of lethal methods to resolve damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Others believe that certain lethal methods can lead to a humane death. Others believe most non-lethal methods of capturing wildlife to be humane because the animal is generally unharmed and alive. Still others believe that any disruption in the behavior of wildlife is inhumane. With the multitude of attitudes on the meaning of humaneness and the varying perspectives on the most effective way to address damage and threats in a humane manner, agencies are challenged with conducting activities and employing methods that are perceived to be humane while assisting those persons requesting assistance to manage damage and threats associated with wildlife. The goal of WS would be to use methods as humanely as possible to resolve requests for assistance to reduce damage and threats to human safety. WS would continue to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

Some methods have been stereotyped as "*humane*" or "*inhumane*". However, many "*humane*" methods can be inhumane if not used appropriately. For instance, a cage trap would generally be considered by most members of the public as "*humane*" since the animal would be live-captured unharmed. Yet, without proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately.

Therefore, the goal would be to address requests for assistance using methods in the most humane way possible that minimizes the stress and pain to the animal. Overall, the use of resource management methods, harassment methods, and exclusion devices would be regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals is likely temporary.

Although some issues of humaneness could occur from the use of resource management methods, exclusion devices, frightening devices, cage traps, and immobilizing drugs, those methods, when used appropriately and by trained personnel, would not result in the inhumane treatment of wildlife. Concerns from the use of those non-lethal methods would be from injuries to animals while those animals were restrained and from the stress of the animal while being restrained or during the application of the method. Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

If feral swine were to be live-captured by WS, capture devices would be checked in accordance with State laws and regulations to ensure feral swine captured were addressed in a timely manner and to prevent injury. Although stress could occur from being restrained, timely attention to live-captured wildlife would alleviate suffering; therefore, stress would likely be temporary. When live-capture methods were employed, WS would euthanize feral swine live-captured pursuant to WS Directive 2.505.

Under the proposed action, lethal methods could also be employed to resolve requests for assistance to alleviate or prevent feral swine damage and threats. Lethal methods would include shooting, euthanasia chemicals, and the recommendation of harvest during hunting seasons. In addition, target species live-captured using non-lethal methods could be euthanized by WS. WS' use of lethal control methods under the proposed action would follow those required by WS' directives (see WS Directive 2.505, WS Directive 2.430).

Research and development by WS has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods were used in situations where non-lethal damage management methods were not practical or effective. Personnel from WS would be experienced and professional in their use of management methods. Consequently, management methods would be implemented in the most humane manner possible. Many of those methods discussed in Appendix B to alleviate feral swine damage and/or threats in the State, could be used under any of the alternatives by those persons experiencing damage regardless of WS' direct involvement. The only methods that would not be available to those persons experiencing damage associated with feral swine would be immobilizing drugs, euthanasia chemicals, and shooting from an aircraft. Therefore, the issue of humaneness associated with methods would be similar across any of the alternatives since those methods could be employed by other entities in the absence of WS' involvement. Those persons who view a particular method as humane or inhumane would likely continue to view those methods as humane or inhumane under any of the alternatives. SOPs that would be incorporated into WS' activities to ensure methods were used by WS as humanely as possible are listed in Chapter 3.

4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

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.

Under Alternative 2 and Alternative 3, WS would address damage associated with feral swine either by providing technical assistance only (Alternative 2) or by providing technical assistance and direct operational assistance (Alternative 3) in the State. WS would be the primary agency conducting feral swine damage management in the State under Alternative 2 and Alternative 3. However, other federal, state, and private entities could also be conducting feral swine damage management in the State. Lethal removal of feral swine also occurs during the regulated harvest seasons in South Carolina.

WS does not normally conduct direct damage management activities in the same area concurrently with other entities that are conducting feral swine damage management, but could conduct damage management activities at adjacent sites within the same period. In addition, feral swine may be

lethally removed in South Carolina during regulated harvest seasons during periods when damage management activities could be occurring. Other federal, state, and private entities may also conduct damage management activities in the same area. The potential cumulative impacts analyzed below could occur because of WS' damage management program activities over time or because of the aggregate effects of those activities. Through ongoing coordination and collaboration between WS and the SCDNR, activities of each agency and the removal of feral swine would be available. Feral swine damage management activities in the State would be monitored to evaluate and analyze activities to ensure those activities remained within the scope of analysis of this EA.

Issue 1 - Effects on Feral Swine Populations in South Carolina

Evaluation of activities relative to target species indicated that program activities would likely have no cumulative adverse effects on feral swine populations in the State when targeting those feral swine responsible for causing damage or posing a threat of damage. WS' actions would be occurring simultaneously, over time, with other natural processes and human generated changes that are currently taking place. These activities include, but would not be limited to:

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

All those factors play a role in the dynamics of feral swine populations. In many circumstances, requests for assistance arise when some or all of those elements have contrived to elevate target species populations or place target species at a juncture to cause damage to resources. The actions taken to minimize or eliminate damage would be constrained as to scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the environment. WS would use the Decision Model to evaluate damage occurring, including other affected elements and the dynamics of the damaging species; to determine 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 effects on target species.

Feral swine are not native to South Carolina. Feral swine were likely introduced into the coastal areas of the State during the 1500s by European explorers that used swine as a food source. Historically, the distribution of feral swine was limited to the floodplains of the major river systems within the State. Introductions of feral swine into the mountainous regions of the States occurred in the early 1900s. The feral swine distribution in the State during the 1980s was limited to 26 counties, with the distribution resembling the historical range of swine throughout the State. In 2008, feral swine were found in all 46 counties of the State (SCDNR 2014*a*). Between 2003 and 2011, the estimated statewide population nearly doubled (South Carolina Wild Hog Task Force 2012). The South Carolina Wild Hog Task Force (2012) estimates the feral swine population would have to be reduced by 50 to 75% to stabilize or reduce the current statewide population. Based on the highest level of lethal removal that could occur by WS under the proposed action alternative and based on the annual harvest of feral swine that has occurred previously, the cumulative removal of feral swine would be below the levels required to stabilize or lower current statewide feral swine populations (see Section 4.1).

Historical outcomes of WS' damage management activities on wildlife

Damage management activities associated with feral swine would be conducted by WS only at the request of a cooperator to reduce damage that was occurring or to prevent damage from occurring and only after methods to be used were agreed upon by all parties involved. WS would monitor activities to ensure any potential impacts were identified and addressed. WS would work closely with state and federal resource agencies to ensure WS' activities were considered as part of management goals established by those agencies. Historically, WS' activities to manage feral swine have not reached a magnitude that would cause adverse effects to populations in the State.

SOPs built into the WS program

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

Issue 2 - Effects on Non-target Species, including Threatened and Endangered Species

Potential effects on non-target species from conducting feral swine damage management arise from the use of non-lethal and lethal methods to alleviate or prevent those damages. The use of non-lethal methods during activities to reduce or prevent damage caused by feral swine has the potential to exclude, disperse, or capture non-target wildlife. However, the effects of non-lethal methods would often be temporary and often do not involve the lethal removal of non-target wildlife species.

Using exclusion devices could prevent both target and non-target wildlife from accessing the resource being damaged. Since exclusion does not involve lethal removal, cumulative impacts on non-target species from the use of exclusionary devices would not occur but would likely disperse those individuals to other areas. Exclusionary methods can often require constant maintenance to ensure effectiveness. Therefore, the use of exclusionary devices would be somewhat limited to small, high-value resources. Exclusion methods would not exclude non-target animals from large areas to the extent that cumulatively affects would occur to a species' populations from the inability to access a resource, such as potential food sources.

People use auditory and visual stimuli to elicit a fright response from target animals, which disperses those animals from areas where damage or threats of damage are occurring. When employing those methods to disperse or harass target species, any non-targets near those methods when employed would also likely disperse from the area. The use of visual and auditory harassment and dispersion methods would generally be temporary with non-target species returning after the cessation of those activities. Dispersal and harassment do not involve the lethal removal of non-target species and, similar to exclusionary methods, people, including WS' personnel, would not use those methods to the extent or at a constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

Therefore, the persistent use of non-lethal methods would likely result in the dispersal or abandonment of those areas where non-lethal methods were employed by both target and non-target species. Any use of non-lethal methods would be similar to those results on both non-target and target species. Although non-lethal methods do not result in the lethal removal of non-targets, the use of non-lethal methods can restrict or prevent access of non-targets to beneficial resources.

The use of lethal methods or those methods used to live-capture target species followed by euthanasia also have the potential to affect non-target wildlife through the lethal removal or capture of non-target species. Capture methods used would often be methods that would be set to confine or restrain target wildlife after being triggered by a target individual. Capture methods would be employed in such a manner as to minimize the threat to non-target species by placement in those areas frequently used by target wildlife, using baits or lures that were as species specific as possible, and modification of individual methods to exclude non-targets from capture. Most methods described in Appendix B are methods that would be employed to confine or restrain wildlife that would be subsequently euthanized using humane methods. With all live-capture devices, non-target wildlife captured could be released on site if determined to be able to survive following release. SOPs are intended to ensure lethal removal of non-target wildlife would be minimal during the use of methods to capture target wildlife.

The use of firearms, immobilizing drugs, and euthanasia chemicals would essentially be selective for target species since identification of an individual would be made prior to the application of the method. Firearms require the identification of the target before application, which essentially is selective with minimal risks to non-targets. Euthanasia methods would be applied through direct application to target wildlife. Therefore, the use of those methods would not affect non-target species.

The methods described in Appendix B have a high level of selectivity and could be employed using SOPs to ensure minimal impacts to non-target species. Based on the methods available to resolve feral swine damage and/or threats, WS does not anticipate the number of non-targets lethally removed to reach a magnitude where declines in those species' populations would occur (see Section 4.1). Therefore, lethal removal under the proposed action of non-targets would not cumulatively affect non-target species. WS' has reviewed the T&E species listed by the SCDNR, the USFWS, and the National Marine Fisheries Service and has determined that damage management activities proposed by WS would not likely adversely affect T&E species. Cumulative impacts would be minimal on non-targets from any of the alternatives discussed.

Issue 3 - Effects of Management Methods on Human Health and Safety

Safety of Chemical Methods Employed

Chemical methods that would be available for use under the proposed action would be immobilizing drugs and euthanizing chemicals, which are described in Appendix B. Immobilizing drugs are administered to target individuals using devices or methods that ensure the identification of the target animal. The immobilizing drugs discussed in Appendix B require injection of the drug directly into an animal. Injection would occur through hand injection through a syringe, by jabstick, or by a pneumatically propelled dart that mechanically injects the drug into the animal upon impact. Immobilizing drugs temporarily sedate an animal to minimize stress of handling and reduces the risks to human safety. Immobilized animals may also be euthanized using a euthanizing chemical described in Appendix B. Euthanasia chemicals would only be administered after feral swine were properly restrained and immobilized and would occur through direct injection through a syringe. WS' personnel would be required to attend training courses and to be certified in the use of immobilizing drugs and euthanizing chemicals to ensure proper care and handling occurs, to ensure the proper doses were administered, and to ensure human safety.

Direct application of chemical methods to target species would ensure that there would be no cumulative impacts to human safety. All chemical methods would be tracked and recorded to ensure

that proper accounting of used and unused chemicals occurred. All chemicals would be stored and transported according to FDA and DEA regulations, including the directives of WS. The amount of chemicals used or stored by WS would be minimal to ensure human safety. All feral swine euthanized by euthanasia chemicals would be disposed of by deep burial or by incineration to ensure the safety of the public. Based on this information, the use of chemical methods as part of the proposed action by WS would not have cumulative impacts on human safety.

Safety of Non-Chemical Methods Employed

All non-chemical methods described in Appendix B would be used within a limited time frame, would not be residual, and do not possess properties capable of inducing cumulative adverse effects on human health and safety. All non-chemical methods would be used after careful consideration of the safety of those persons employing methods and to the public. All capture methods would be employed in areas where human activity was minimal and warnings signs would be placed in conspicuous areas, when appropriate, to ensure the safety of the public. Capture methods would also require direct contact to trigger, which would ensure that those methods, when left undisturbed, would have no effect on human safety. All methods would be agreed upon by the requesting entities, which would be made aware of the safety issues of those methods when entering into a MOU, work initiation document, or another comparable document with WS. SOPs would also ensure the safety of the public from those methods used to capture or remove wildlife. Firearms used to alleviate or prevent damage, though hazards do exist, would be employed to ensure the safety of employees and the public. Based on the use of non-chemical methods, those methods would not cumulatively affect human safety.

Issue 4 - Humaneness of Methods Available for Damage Management

WS continues to seek new methods and ways to improve current technology and to improve the humaneness of methods used to manage damage caused by wildlife. Cooperation with individuals and organizations involved in animal welfare continues to be an agency priority for the purpose of evaluating strategies and defining research aimed at developing humane methods.

As discussed in Chapter 2 and Chapter 4, the perception of humaneness and welfare varies among people. Generally, non-lethal methods involving habitat modification, harassment, and exclusion would be considered humane methods since wildlife would be displaced to other areas and would generally be unharmed. Restraining methods that result in live-capture are often viewed as inhumane when wildlife are held for long periods of time that can often lead to pain, stress, and ultimately, distress of the animal. Restraining devices used for the capture of feral swine (*e.g.*, corral traps, cage traps, foot snares) all require supervision of the methods, which allows for those feral swine captured to be addressed in a timely manner, which reduces the amount of time those individuals would be held. Trap monitoring devices could also be used, when appropriate, that indicate when traps have been triggered, which would allow for traps in remote location to be monitored daily and any wildlife captured to be addressed quickly. By limiting the amount of time wildlife were held in restraining devices and by timely addressing those animal captured in restraining devices, the pain, suffering, and distress of the animal can be minimized.

Immobilizing drugs could be used to sedate and anesthetize feral swine restrained inside a live-trap through injection either by hand, jab stick, or pneumatic dart gun. Applicators would be present on site during application, which ensures those swine would be addressed in a timely manner. The effects of immobilizing drugs would be temporary with a full recovery occurring after drug was metabolized fully. If euthanasia chemicals were used, feral swine captured would be euthanized while anesthetized which renders the swine unconscious and unresponsive. Therefore, euthanasia can

occur with no pain or suffering.

Humaneness and animal welfare concerns can also arise from the use of euthanasia methods. The guidelines for euthanasia provided by the AVMA lists barbiturates and potassium chloride in conjunction with general anesthesia as acceptable methods of euthanasia for swine (AVMA 2013). Euthanasia by gunshot is a conditionally acceptable form of euthanasia (AVMA 2013). WS' personnel would be trained in the proper use of firearms to minimize pain and suffering of feral swine removed by this method.

WS employs methods as humanely as possible by applying measures to minimize pain and that allow wildlife captured to be addressed in a timely manner to minimize distress. Through the establishment of SOPs that guide WS in the use of methods to address damage and threats associated with feral swine, the cumulative impacts on the issue of method humaneness would be minimal. All methods would be evaluated during review of the EA to ensure SOPs were adequate, which would ensure those methods continue to be used to minimize suffering and that wildlife captured were addressed in a timely manner to minimize distress.

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED

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APPENDIX A
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APPENDIX B
FERAL SWINE DAMAGE MANAGEMENT METHODS

The most effective approach to resolving wildlife damage problems would be to integrate the use of several methods, either simultaneously or sequentially. An adaptive plan would integrate and apply practical methods of prevention and reduce damage by feral swine while minimizing effects of damage reduction measures on humans, other species, and the environment. An adaptive plan may incorporate resource management, physical exclusion, deterrents, and localized removal of target species, or any combination of these, depending on the characteristics of specific damage problems.

In selecting damage management techniques for specific damage situations, consideration would be given to the magnitude, geographic extent, duration and frequency, and likelihood of feral swine damage. Consideration would also be given to the status of feral swine, local environmental conditions and impacts, social and legal aspects, and relative costs of damage reduction options. The cost of damage reduction may sometimes be a secondary concern because of the overriding environmental, legal, and animal welfare considerations. Those factors would be evaluated in formulating damage management strategies that incorporate the application of one or more techniques.

A variety of methods would potentially be available to the WS program in South Carolina relative to the management or reduction of damage from feral swine. Various federal, state, and local statutes and regulations and WS directives would govern WS' use of damage management methods. WS would develop and recommend or implement strategies based on resource management, physical exclusion, and wildlife management approaches. Within each approach there may be available a number of specific methods or techniques. The following methods could be recommended or used by the WS program. Many of the methods described would also be available to other entities in the absence of any involvement by WS.

Non-chemical Wildlife Damage Management Methods

Non-chemical management methods consist primarily of tools or devices used to repel, capture, or kill a particular animal or a local group of animals to alleviate damage and conflicts. Methods may be non-lethal (*e.g.*, fencing, frightening devices) or lethal (*e.g.*, firearms). If WS' personnel applied those methods, a MOU, work initiation document, or other similar document would be signed by the landowner or administrator authorizing the use of each damage management method. Non-chemical methods that could be used or recommended by WS include:

Exclusion pertains to preventing access to resources through fencing or other barriers. Fencing of small critical areas can sometimes prevent animals that cannot climb from entering areas of protected resources. Fencing installed with an underground skirt can prevent access to areas for feral swine that can root underneath fencing. Areas such as airports, yards, or hay meadows may be fenced. Electric fences of various constructions could be used effectively to reduce damage to various crops.

Exclusion fences constructed of woven wire or multiple strands of electrified wire can be effective for feral swine in some areas. Electric fences were not completely effective in excluding swine but, in rangeland tests, 2-strand electric fences reduced incursions to bait stations 49% and resulted in a 64% drop in damage to sorghum crops when compared to unfenced areas (Reidy et al. 2008). Some fences inadvertently trap, catch, or affect the movement of non-target wildlife. Physical exclusion methods impede the use of areas by many wildlife species, so use of those methods must be considered with care.

Cultural Methods and Habitat Management includes the application of practices that seek to minimize exposure of the protected resource to damaging animals through processes other than exclusion. They may include animal husbandry practices such as employing guard dogs, herders, shed lambing, carcass removal, or pasture selection. Strategies may also include minimizing cover where feral swine might hide, manipulating the surrounding environment through barriers or fences to deter animals from entering a protected area, or planting lure crops on fringes of protected crops.

Feral swine in urban environments can be attracted to homes by the presence of garbage or pet food left outside and unprotected. Removal or sealing of garbage in tight trash receptacles, and elimination of all pet foods from outside areas can reduce the presence of unwanted feral swine. In addition, cleaning up spilled grain at agricultural facilities could reduce the attraction to the area by feral swine.

Supplemental feeding is sometimes used to reduce damage by wildlife, such as lure crops. Food would be provided so that the animal causing damage would consume it rather than the resource being protected. In feeding programs, target wildlife would be offered an alternative food source with a higher appeal with the intention of luring them from feeding on affected resources.

Animal behavior modification refers to tactics that deter or repel damaging feral swine and thus, reduce damage to the protected resource. Those techniques are usually aimed at causing target animals to respond by fleeing from the site or remaining at a distance. They usually employ aversive noise or visual stimuli. Unfortunately, many of these techniques are only effective for a short time before wildlife habituate to them (Conover 1982). Devices used to modify behavior in animals include electronic guards (siren strobe-light devices), propane exploders, pyrotechnics, laser lights, human effigies, and the noise associated with the discharge of a firearm.

Propane exploders operate on propane gas and produce loud explosions at controllable intervals. They are strategically located (*e.g.*, elevated above the vegetation) in areas of high feral swine use to frighten them from the problem site. Because animals are known to habituate to sounds, exploders must be moved frequently and used in conjunction with other scare devices. Exploders can be left in an area after dispersal is complete to discourage animals from returning.

Pyrotechnics, shell-crackers, and scare cartridges, are commonly used to repel wildlife. Shell-crackers are 12 gauge shotgun shells containing firecrackers that are projected up to 75 yards in the air before exploding. They can be used to frighten feral swine and are most often used for scaring them to prevent crop depredations. The purpose is to produce an explosion between feral swine and their objective, the crop. Noise bombs, whistle bombs, racket bombs, and rocket bombs are fired from 15-millimeter flare pistols. They are used similarly to shell-crackers but are projected for shorter distances. Noise bombs are firecrackers that travel about 75 feet before exploding. Whistle bombs are similar to noise bombs, but whistle in flight but do not explode. They produce a noticeable response because of the trail of smoke and fire, as well as the whistling sound. Rocket bombs make a screaming noise in flight and do not explode. Rocket bombs are similar to noise bombs but may travel up to 150 yards before exploding.

Lights, such as strobe, barricade, and revolving units, are used with mixed results to frighten wildlife. Brilliant lights, similar to those used on aircraft, are most effective in frightening night feeding mammals. These extremely bright-flashing lights have a blinding effect, causing confusion that reduces the animal's ability to locate it food or roosting spot. However, most animals rapidly become accustomed to such lights and their long-term effectiveness is questionable. In general, the type of light, the number of units, and their location are determined by the size of the area to be protected and by the power source available.

Other scaring devices are available to scare wildlife. The Electronic Guard (siren strobe-light device), a battery-powered, portable unit that houses a strobe light and siren has been developed by the NWRC. The device activates automatically at nightfall and is programmed to discharge periodically throughout the night. Efficacy of strobe-sirens is highly variable, but in certain situations, this device has been used successfully to reduce coyote and bear depredation on sheep. The technique has proven most successful when used at "*bedding grounds*" where sheep gather to sleep for the night. The device, however, is a short-term tool used to deter predation until livestock can be moved to another pasture, brought to market, or other damage management methods are implemented. The effectiveness of Electronic Guards to dispersal feral swine is unknown.

Dakpa et al. (2009) developed a device that used noise and light to reduce swine damage to crops in Bhutan. Methods that use light and sound, such as pyrotechnics and propane cannons, are often of limited efficacy because the animals eventually become accustomed to the stimulus and cease to respond to the device. In a study aimed at identifying deterrents for wild boar, Vassant and Boisaubert (1984) tested acoustic scarers, such as cannon firing at random, electronic sound generators, and wild boar alarm calls. The results showed that wild boar became habituated to all repellents within a few days.

Trapping can utilize a number of cage-type traps. Those techniques are implemented by WS' personnel because of the technical training required to use such devices.

Cage traps come in a variety of styles to live-capture animals. The most commonly known cage traps are box traps and corral traps. Box traps are usually rectangular and are made from various materials, including metal, wire mesh, and wood. These traps are well suited for use in residential areas and work best when baited with foods attractive to the target animal. Box traps can be portable and easy to set-up.

Corral traps for feral swine are generally large circular traps consisting of panels anchored to the ground using steel posts with a door allowing entrance and an open top. As with cage traps, bait is used to draw the swine into the trap. Side panels are typically woven metal fencing referred to as hog panels or cow panels. The entrances into the traps generally consist of a door that allows entry into the trap but prevents exit. The doors are often designed to allow swine to continually enter the trap that allows for the possibility of capturing multiple swine.

The disadvantages of using cage traps are: 1) some individual target animals may avoid cage traps (Saunders et al. 1993); 2) some non-target animals may associate the traps with available food and purposely get captured to eat the bait, making the trap unavailable to catch target animals; 3) cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions; 4) some animals will fight to escape and may become injured; and 5) expense of purchasing traps. Disadvantages associated with corral traps include: 1) the expense of purchasing the materials to construct trap, 2) once constructed, corral traps are not moveable until disassembled and transported, and 3) in remote areas, getting all the required equipment to the location can be difficult.

Trap monitors are devices that send a radio signal to a receiver if a set trap is disturbed and alerts field personnel that an animal may be captured. Trap monitors can be attached directly to the trap or attached to a string or wire and then placed away from the trap in a tree or shrub. When the monitor is hung above the ground, it can be detected from several miles away, depending on the terrain in the area. There are many benefits to using trap monitors, such as saving considerable time when checking traps, decreasing fuel usage, prioritizing trap checks, and decreasing the need for human presence in the area.

Trap monitoring devices would be employed, when applicable, that indicate when a trap has been activated. Trap monitoring devices would allow personnel to prioritize trap checks and decrease the amount of time required to check traps, which decreases the amount of time captured target or non-targets would be restrained. By reducing the amount of time targets and non-targets are restrained, pain and stress can be minimized and captured wildlife can be addressed in a timely manner, which could allow non-targets to be released unharmed. Trap monitoring devices could be employed where applicable to facilitate monitoring of the status of traps in remote locations to ensure any captured wildlife was removed promptly to minimize distress and to increase the likelihood non-targets could be released unharmed.

Cage traps may also be monitored and activated from remote sites using video systems. Camera systems at the location of the trap send images to off-site devices. Users of the system can monitor activity in the project area to obtain information on the number of feral swine in the area, and the extent to which animals are entering the trap area. Some live trap systems have remote-activated triggers that can be activated by a remote user when the desired numbers of animals enter into a trap. Remote observation and activation of triggers also substantially reduces or eliminates risks of trapping non-target species. However, use of remote monitored and activated systems is limited by the expense of the systems.

Recent variations on corral traps include a method that elevates the trap, which allows pigs to enter and exit the project area to access bait without encountering trap doors or walls, similar to using a drop net. This can reduce problems with trap-wary behavior (Gaskamp and Biermacher 2013). The trap is "*dropped*" when the trigger mechanism is activated by an individual observing the site electronically from a remote location. This helps eliminate the risk of capturing non-target species in the trap.

Drop nets are large nets set over a baited area to capture vulnerable target species. Drop nets have been used for other ungulate species, such as deer, for many years. Until recently, drop nets had not been evaluated for feral swine. Gaskamp and Gee (2011) published a study comparing the effectiveness and efficiency of a drop net and a traditional corral trap for trapping feral swine. A mark and recapture analysis showed more swine were removed with drop nets (93%) than with corral traps (55%). Efficiency estimates for the average time per capture were 1.9 hours for drop nets and 2.3 hours for corral traps. Feral swine did not appear to exhibit trap shyness around drop nets, which often allowed the researchers to capture entire family units (sounders) in a single drop. The use of drop nets also eliminated the capture of non-target species because the device can be activated remotely by a person who can see the target area. Results of this study indicate that drop nets can be an effective tool for capturing feral swine. Disadvantages of drop nets are that an observer must be nearby to monitor the net and then euthanize the hogs before they escape from the nets.

Catchpoles can be used to capture or safely handle problem animals. This device consists of a hollow pipe with an internal cable or rope that forms an adjustable noose at one end. The free end of the cable or rope extends through a locking mechanism on the end opposite of the noose. By pulling on the free end of the cable or rope, the size of the noose is reduced sufficiently to hold an animal. Catchpoles are used primarily to remove live animals from traps without danger to or from the captured animal.

Cable Restraints or snares are typically made of wire or cable, and can be set to capture an animal by the neck, body, or foot. Cable restraints may be used as either lethal or live-capture devices depending on how or where they are set. Cable restraints set to capture an animal by the neck are usually lethal but stops can be attached to the cable to increase the probability of a live capture

depending on the trap check interval. Snares positioned to capture the animal around the body can be a useful live-capture device, but are more often used as a lethal control technique. Snares can incorporate a breakaway feature to release non-target wildlife and livestock where the target animal is smaller than potential non-targets (Phillips 1996). Snares can be effectively used wherever a target animal moves through a restricted travel lane (*e.g.*, under fences or trails through vegetation). When an animal moves forward into the loop formed by the cable, the noose tightens and the animal is held. Snares must be set in locations where the likelihood of capturing non-target animals is minimized.

The foot or leg snare can be set as a spring-powered non-lethal device, activated when an animal places its foot on the trigger or pan. Foot snares consist of a cable loop and a locking mechanism and are set to capture feral swine by the foot or leg. Foot snares employ a spring-loaded mechanism to elevate the snare and close it around the foot of the target animal. Foot snares can be selective for a certain weight of target animal using pan tension to increase the weight of the animal triggering the snare. Several types of foot snare are available commercially. In some situations, using snares to capture wildlife is impractical due to the behavior or morphology of the animal, or the location of many wildlife conflicts. Cable restraints would not be available to other entities to alleviate damage.

Hunting refers to the capture and removal of feral swine by the public, primarily for recreation or food. WS sometimes recommends that resource owners consider legal hunting as an option for reducing feral swine damage. Although legal hunting/trapping is impractical and/or prohibited in many urban-suburban areas, it can be used to reduce some populations of feral swine.

Dogs could be used to locate or pursue target swine. Training and maintaining suitable dogs requires considerable skill, effort, and expense. Dogs are commonly used to track and target wildlife species. Different breeds of hounds such as blue tick, red-bone, and Walker are commonly used. They become familiar with the scent of the animal they are to track, and will strike (howl) when they smell them. Tracking dogs are trained to follow the scent of target species. If the track of the target species is not too old, the dogs can follow the trail and the animal, which will usually seek refuge in a thicket on the ground at bay, or in a hole. The dogs stay with the animal until the WS' employee arrives and dispatches, tranquilizes, or releases the "*bayed*" species, depending on the situation. A possibility exists that dogs would switch to a fresher trail of a non-target species while pursuing the target species. This sometimes occurs if the hounds being used are less experienced but running less-experienced hounds with more-experienced hounds reduces the likelihood of this occurrence.

Ground Shooting with firearms is very selective for the target species and would be conducted with rifles, handguns, and shotguns. Methods and approaches used by WS may include use of vehicles or aircraft, illuminating devices, bait, firearm suppressors, night vision/thermal equipment, and elevated platforms. Shooting is an effective method in some circumstances, and can often provide immediate relief from the problem. Shooting may at times be one of the only methods available to effectively and efficiently resolve a wildlife problem.

Ground shooting is sometimes used as the primary method to alleviate damage or threats of damage. Shooting is limited to locations where it is legal and safe to discharge a weapon. A shooting program, especially conducted alone, can be expensive because it often requires many staff hours to complete.

Shooting can also be used in conjunction with an illumination device at night, which is especially useful for nocturnal mammals, such as feral swine. Spotlights may or may not be covered with a red lens, which nocturnal animals may not be able to see, making it easier to locate them undisturbed. Night shooting may be conducted in sensitive areas that have high public use or other activity during the day, which would make daytime shooting unsafe. The use of night vision and Forward Looking Infrared (FLIR) devices can also be used to detect and shoot feral swine at night, and is often the

preferred equipment due to the ability to detect and identify animals in complete darkness. Night vision and FLIR equipment aid in locating wildlife at night when wildlife may be more active. Night vision and FLIR equipment could be used during surveys and in combination with shooting to remove target feral swine at night. WS' personnel most often use this technology to target feral swine in the act of causing damage or likely responsible for causing damage. Those methods aid in the use of other methods or allow other methods to be applied more selectively and efficiently. Night vision and FLIR equipment allow for the identification of target species during night activities, which reduces the risks to non-targets and reduces human safety risks. Night vision equipment and FLIR devices only aid in the identification of wildlife and are not actual methods of removal. The use of FLIR and night vision equipment to remove target feral swine would increase the selectivity of direct management activities by targeting those feral swine most likely responsible for causing damage or posing threats.

Aerial Shooting or aerial hunting (*i.e.*, shooting from an aircraft) is a commonly used feral swine damage management method. Aerial shooting is one of the preferred damage management methods for reducing feral swine damage as well, in that local swine populations can quickly be removed when weather and habitat conditions are favorable. Aerial hunting is mostly species-selective (there is a slight potential for misidentification) and can be used for immediate control to reduce damage if weather, terrain, and cover conditions are favorable. Fixed-wing aircraft are most frequently used in flat and gently rolling terrain whereas helicopters with better maneuverability have greater utility and are safer over rugged terrain and timbered areas.

In broken timber or deciduous cover, aerial hunting is more effective in winter when snow cover improves visibility and leaves have fallen. The WS program aircraft-use policy helps ensure that aerial hunting is conducted in a safe and environmentally sound manner, in accordance with federal and state laws. Pilots and aircraft must be certified under established WS program procedures and only properly trained WS' employees are approved as gunners. Ground crews are often used with aerial operations for safety reasons and to assist locating and recovering target animals, as necessary.

Aircraft overflights have created concerns about disturbing wildlife. The National Park Service (1995) reviewed studies on the effects of aircraft overflights on wildlife. Their report revealed that a number of studies documented responses by certain wildlife species that could suggest adverse impacts may occur. Few, if any studies, have proven that aircraft overflights cause significant adverse impacts to wildlife populations, although the report stated it is possible to draw the conclusion that affects to populations could occur. It appears that some species will frequently, or at least occasionally, show adverse responses to even minor overflight occurrences. In general, it appears that the more serious potential impacts occur when overflights are frequent, such as hourly, and over long periods of time, which represents chronic exposure. Chronic exposure situations generally occur in areas near commercial airports and military flight training facilities. WS spends relatively little time over any one area.

WS has used fixed-wing aircraft and helicopters for aerial hunting in areas inhabited by wildlife for years. WS conducts aerial activities on areas only under signed agreement and concentrates efforts during certain times of the year and to specific areas. WS' Predator Damage Management Environmental Assessments (*e.g.*, see USDA 2005) that have looked at the issue of aerial hunting overflights on wildlife have found that WS has annually flown less than 10 min/mi^2 on properties under agreements. WS flies very little over any one property under agreement in any given year. As a result, no known problems to date have occurred with WS' aerial hunting overflights on wildlife, nor are they anticipated in the future.

Aerial Surveying is a commonly used tool for evaluating and monitoring damage and establishing population estimates and locations of various species of wildlife. WS uses aerial surveying throughout the United States to monitor damages and/or populations of coyotes, fox, wolves, feral swine, feral goats, feral dogs, bobcats, mountain lions, white-tailed deer, pronghorn antelope, elk, big-horn sheep, and wild horses but any wildlife species big enough to see from a moving aircraft could be surveyed using this method. As with aerial shooting, the WS program aircraft-use policy helps ensure that aerial surveys are conducted in a safe and environmentally sound manner, in accordance with Federal and State laws. Pilots and aircraft must also be certified under established WS program procedures and policies.

Aerial Telemetry is used in research projects studying the movements of various wildlife species. Biologists will frequently place radio-transmitting collars on selected individuals of a species and then monitor their movements over a specified period. Whenever possible, the biologist attempts to locate the research subject using a hand-held antennae and radio receiver, however, occasionally animals will make large movements that prevent biologists from locating the animal from the ground. In these situations, WS can utilize either fixed wing aircraft or helicopters and elevation to conduct aerial telemetry and locate the specific animal wherever it has moved to. As with any aerial operations, the WS program aircraft-use policy helps ensure that aerial surveys would be conducted in a safe and environmentally sound manner, in accordance with Federal and State laws.

Radio collaring is a technique where a radio-collar is affixed to live-captured feral swine. Once affixed to the swine, the animal is released into an area and, after a sufficient period, allowed to join with other feral swine. The radio-collared animal is monitored and located to using radio telemetry equipment from aircraft, vehicles, or hand-held units. Swine are often radio collared and allowed to rejoin other swine to monitor movements and to locate swine when employing damage manage methods.

Chemical Wildlife Damage Management Methods

Pharmaceutical drugs, including those used in wildlife capture and handling, are administrated by FDA and/or the DEA. The following chemical methods could be available under the alternatives. However, euthanasia chemicals are not currently available for use by WS in South Carolina but are discussed here in anticipation of those products being available in the future.

Ketamine (Ketamine HCl) is a dissociative anesthetic that is used to capture wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calm fears, and allay anxiety. Ketamine is possibly the most versatile drug for chemical capture, and it has a wide safety margin (Johnson et al. 2001). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs, such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety.

Telazol (tiletamine) is another anesthetic used in wildlife capture. It is 2.5 to 5 times more potent than ketamine; therefore, it generally works faster and lasts longer. Currently, tiletamine can only be purchased as Telazol, which is a mixture of two drugs: tiletamine and zolazepam (a tranquilizer). Muscle tension varies with species. Telazol produces extensive muscle tension in dogs, but produces a more relaxed anesthesia in coyotes, wolves, and bears. It is often the drug of choice for those wild species (Johnson et al. 2001). This drug is sold in a powder form and must be reconstituted with sterile water before use. Once mixed with sterile water, the shelf life is four days at room temperature and 14 days if refrigerated.

Xylazine is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with ketamine to produce a relaxed anesthesia. It can also be used alone to facilitate physical restraint. Because xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel should be even more attentive to minimizing sight, sound, and touch. When using ketamine/xylazine combinations, xylazine will usually overcome the tension produced by ketamine, resulting in a relaxed, anesthetized animal (Johnson et al. 2001). This reduces heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions.

Sodium Pentobarbital is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. There are DEA restrictions on who can possess and administer this drug. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Certified WS personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with DEA and state regulations. All animals euthanized using sodium pentobarbital and all of its dilutions (*e.g.*, Beuthanasia-D, Fatal-Plus) are disposed of immediately through incineration or deep burial to prevent secondary poisoning of scavenging animals and introduction of these chemicals to non-target animals.

Potassium Chloride used in conjunction with prior general anesthesia is used as a euthanasia agent for animals, and is considered acceptable and humane by the AVMA (2013). Animals that have been euthanized with this chemical experience cardiac arrest followed by death, and are not toxic to predators or scavengers.

Beuthanasia®-D combines pentobarbital with another substance to hasten cardiac arrest. Intravenous (IV) and intracardiac (IC) are the only acceptable routes of injection. As with pure sodium pentobarbital, IC injections with Beuthanasia®-D are only acceptable for animals that are unconscious or deeply anesthetized. With other injection routes, there are concerns that the cardiotoxic properties may cause cardiac arrest before the animal is fully unconscious. It is a Schedule III drug, which means it can be obtained directly from the manufacturer by anyone with a DEA registration. However, Schedule III drugs are subject to the same security and record-keeping requirements as Schedule II drugs.

Fatal-Plus® combines pentobarbital other substances to hasten cardiac arrest. IV is the preferred route of injection; however, IC is acceptable as part of the two-step procedure used by WS. Animals are first anesthetized and sedated using a combination of ketamine/xylazine and once completely unresponsive to stimuli and thoroughly sedated, Fatal-Plus® is administered. Like Beuthanasia®-D, it is a Schedule III drug requiring a DEA registration for purchase and is subject to the security and record-keeping requirements of Schedule II drugs.

APPENDIX C
STATE LISTED THREATENED AND ENDANGERED SPECIES

The following species of resident wildlife are designated as state-listed endangered species:

Animals

Scientific Name	Common Name	Status
Acipenser brevirostrum	Shortnose Sturgeon	SE-Endangered
Ambystoma cingulatum	Flatwoods Salamander	SE-Endangered
Caretta caretta	Loggerhead	ST-Threatened
Charadrius wilsonia	Wilson's Plover	ST-Threatened
Clemmys guttata	Spotted Turtle	ST-Threatened
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	SE-Endangered
Elanoides forficatus	American Swallow-tailed Kite	SE-Endangered
Elassoma boehlkei	Carolina Pygmy Sunfish	ST-Threatened
Eumeces anthracinus pluvialis	Southern Coal Skink	ST-Threatened
Falco peregrinus anatum	American Peregrine Falcon	ST-Threatened
Glyptemys muhlenbergii	Bog Turtle	ST-Threatened
Gopherus polyphemus	Gopher Tortoise	SE-Endangered
Haliaeetus leucocephalus	Bald Eagle	ST-Threatened
Hyla andersonii	Pine Barrens Treefrog	ST-Threatened
Mycteria Americana	Wood Stork	SE-Endangered
Myotis leibii	Eastern Small-footed Myotis	ST-Threatened
Myotis sodalist	Indiana Myotis	SE-Endangered
Picoides borealis	Red-cockaded Woodpecker	SE-Endangered
Plethodon websteri	Webster's Salamander	SE-Endangered
Pseudobranchus striatus	Dwarf Siren	ST-Threatened
Puma concolor couguar	Eastern Cougar	SE-Endangered
Rana capito	Gopher Frog	SE-Endangered
Sterna antillarum	Least Tern	ST-Threatened
Thryomanes bewickii	Bewick's Wren	ST-Threatened
Trichechus manatus	Florida Manatee	SE-Endangered
Vermivora bachmanii	Bachman's Warbler	SE-Endangered
Lasmigona decorate	Carolina Heelsplitter	SE-Endangered

SCDNR – March 2015